

Sociology a Game Changer in Computer Science Programs

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Abstract—This full paper of innovative practice addresses how Computer Science programs in the United States continue to struggle with diversity, not only in their faculty and student body, but also with their curriculum. The lack of diversity in these programs affects the programs themselves, their students, but also society. This paper looks at alternative approaches to solving this problem by proposing a theoretical model that has Computer Science programs recruiting an Applied Sociologist that specializes in inequalities and engages local communities. The paper provides relevant discussion and examples of how an Applied Sociologist would affect diversity by being a liaison to the community and contributing to the curriculum. This unconventional concept is expressed through a case study that uses Seattle and the University of Washington to discuss the multi-faceted layers of equalities brought on by history and current social practices.

Keywords— *Diversity, Computer Science, Sociology, Faculty*

I. INTRODUCTION

Computer Science programs in the United States continue to lack diversity across gender, racial/ethnic, socio-economic and other lines. The homogeneity of Computer Science programs resonates throughout their faculty, student body and their curriculum. Though some colleges around the country are attempting to resolve some of these shortcomings with various tactics such as creating summer programs and reaching out to local schools, this paper introduces an alternative approach to solving this problem based on previous applications of Sociology and science that has shown to be successful. To fully understand why the sociological approach has the potential to help resolve the computer science quandary, this paper uses sociological insight to help explain the impact on society when diversity measures are disregarded. The sociological lens also is applied by using Seattle, Washington, as a case study, to help understand the societal challenges of deep-rooted, historical and contemporary discriminatory practices. This paper provides tangible content to help highlight the need for innovative approaches to resolve the growing digital divide. As Artificial Intelligence and Machine Learning begin to unveil the next technological evolution, there appears to be signs of a growing division across race, class, gender and sexuality as software developers design algorithms and use data that could potentially reinforce stereotyping. In order to address these potential inequalities, Computer Science programs should consider alternative approaches to recruiting, hiring and developing curriculum, such as infusing other disciplines and instructors into their programs.

II. SEATTLE: A BOOMING PARADOX

This paper cannot begin to fully uncover the roots of racism that can be traced back to colonialism, social differentiation by Francois Bernier, the coining of the “Races of Man Kind” by Immanuel Kant, and the introduction of Johann Blumenbach’s influential typology that laid the foundation for the stratification of races that placed “Caucasians” on the top [1]. Rather, this paper provides a snapshot of the mounting barriers facing African Americans and other underrepresented minorities (URMs), such as Latinos and Indigenous Peoples of the Americas.

African Americans and Latinos continue to trail behind Whites and Asians in education. Whites and Asians are more likely to attain a College Degree with Asian Americans at the top. Though African American high school completion rates have improved, Latinos continue to lag. Consequently, the lack of education has led to higher gaps in income. Whites and Asians make nearly \$30,000 more per year than African Americans and Latinos [2].

African Americans and other underrepresented minorities (URMs) face racism and discrimination across the United States, but to better understand how racism and discrimination continue to perpetuate inequalities, taking a closer look at a local community like Seattle can provide insight to the depths of the problem. How does a booming economy negatively impact local marginalized populations? How do practices in the public schools deter URMs from participating in STEM education? How do segregationists’ policies and practices continue to perpetuate inequities?

Seattle, a gray city surrounded by bodies of waters and mountains, is an outdoor paradise for biking, hiking, and skiing enthusiasts. Seattle is located in King County, considered the most liberal and progressive county in the State of Washington. Seattle saw its first significant spike in population in the early 1900’s with the gold rush and again in 2011 [3]. Since 2010, Seattle metropolitan area has added about 1,000 people each week [4], which is not surprising with Seattle’s booming tech economy, housing two of the world’s largest tech companies Amazon and Microsoft. Seattle also continues to lead the nation with the hottest housing market 15 months in a row [5]. The average home in Seattle was about \$725,000 in 2017, up about \$200,000 in about two years [6][5]. What has this growth meant for marginalized communities that once were segregated, such as the African Americans in Seattle’s Central District?

Though inequity appears to have been driven in the past 10 years by the growing tech giants, African Americans had before

and continue to face enormous obstacles from segregation policies to being prevented from accessing quality education. In the early 20th century, Seattle like so many other cities around the country participated in restrictive covenants that prevented African Americans from purchasing homes North of the Ship Canal and in some exclusive neighborhoods like Queen Anne, Magnolia, Madison Park and Capitol Hill [7]. These practices were later sanctioned by the Home Owners' Loan Corporation (HOLC), a federal agency that provided banks with lending guidelines, which led to the practice of "red lining" [8]. African Americans were prevented from receiving loans and their homes were deemed not valuable, leaving African Americans trapped.

In the 1960's, African Americans made up 70 percent of the Central District. Today, only about 20 percent of the community remains [9]. Between 2000 and 2013, African Americans home ownership dropped by 50 percent [9]. Furthermore, African Americans in Seattle saw their incomes drop from \$32,000 in 2000 to \$25,700 in 2013 [9]. Meanwhile, Whites in Seattle saw their incomes rise from \$45,700 to \$70,200, which was a consequence of the changing demographic [9]. White and Asian employees from the tech industries have higher salaries and can afford higher prices for homes, which meant long-time residents and families were pushed from their homes, making way for housing developers to purchase African American homes, tear them down and rebuild townhouses and apartments in their place. African Americans were forced to move south to more affordable housing and others who were not so lucky took to the streets. Today, African Americans in Seattle make up a disproportionate number of the homeless [9] [10].

African Americans not only were segregated in their communities and later succumbed to gentrification, but also were prevented from participating in quality academic programs. According to a news report, African Americans make up one percent of Seattle Public School's gifted program. Latinos, Pacific Islanders and Indigenous Peoples of the Americas also are grossly underrepresented [11]. While White children make up around 70 percent, the next majority are Asian American children [12]. Though Seattle Public Schools did attempt to integrate their schools, a group of parents formed a non-profit organization, called Parents Involved in Community Schools, and sued the District. In 2007, the Supreme Court ruled in favor of the non-profit organization, curtailing integration and sanctioning segregation [13].

African American children not only received unfair treatment from the school district through court sanctioned segregation and restrictive access to gifted programs, but also through disciplinary practices. In a featured story by Claudia Rowe, in the *Seattle Times*, Rowe provided ample evidence of discipline disparities between Whites and URMs in Washington State with a special focus on Seattle Public Schools [14]. For example, African Americans were suspended or expelled 268.2 percent as much as White students, making them the most targeted group. The second most targeted group was Hispanics who were suspended or expelled 141 percent as much as Whites. Not only were Blacks and Hispanics more likely to be targeted for discipline but were more likely to receive harsher disciplinary actions. In 2013, the federal government probed the Seattle Public School District for their harsher treatment of URMs, such as African Americans [15].

Why did these practices occur? Taking a closer look at who makes up the teachers and administrators can help explain some of the unfair practices. In the state of Washington, White Administrators make up about 88.6%, Asian American Administrators make up about 1.96%, Latino Administrators make up about 3.94%, African American Administrators make up about 2.85% and Indigenous Peoples of the Americas and Pacific Islanders make up less than one percent of all administrators. Meanwhile, White teachers make up 89.79% and Asian Americans make up 2.55% of all teachers in the State of Washington. Latinos make up 4% of teachers, African Americans make up 1.27%, and Indigenous Peoples of the Americas and Pacific Islanders make up less than one percent of all teachers in the state of Washington even after you combine their numbers. These figures are severely disproportionate to the students being represented across the state. Whites only make up about 54.4% of all students, Asian Americans 7.6%, African Americans 4.3%, Indigenous Peoples of the Americas 1.4% and Latinos make up the largest minority group at 23.1% [16] [17]. In Seattle, African Americans make up a larger percentage of students of color, accounting for 15 percent in the Elementary Schools alone [14].

Meanwhile, in higher education, the University of Washington (UW), also shows signs of favoring Asian and International students, in addition to White students. These three groups combined make up over 80 percent of its student population. African Americans make up 2.7 and Indigenous Peoples of the Americas and Pacific Islanders make up less than one percent. Latinos make up around 7 percent [18]. The numbers drop further when looking at technical fields like engineering. In the College of Engineering, URMs are 7 percent of the BS recipients, even though URMs make up about 12 percent of the total student population at UW [19].

UW's faculty, like the public-school system, also faces disparities. Over 75 percent of all faculty at the Washington University are White, and African American faculty make up less than 2 percent [20]. In UW's school of Computer Science and Engineering, the diversity among faculty is even less. Of the full-time faculty, there are no African American Professors, Indigenous Peoples of the Americas, or Latino-American (Latino's born in the United States) Professors. Just to provide a comparative snapshot, in the United States, Whites (non-Hispanic) constitute about 61.3 of the United States population, African Americans about 13.3 percent and Latinos almost 18 percent. Asians consist only of 5.7 percent of the population [21].

Unfortunately, the University of Washington is reflective of most universities around the country, but the problem is not that of the universities alone. Students who take computer science in high school in the United States has dropped from 25% to 19%. The effect is even greater for African Americans. According to a study conducted by Gallup and Google, African American students in seventh through 12th are less likely to be exposed to computer science in school [22]. Part of the overall decline in computer sciences can be attributed to the fact that college computer science goals and objectives do not align with those of primary and middle schools. This is especially evident in K-12 curriculum, which usually advances soft skills like typing and using Microsoft Office.

“Currently about 14 states in the U.S. have adopted educational standards for computer science instruction, and nine states allow computer science courses to count towards science or mathematics required hours. One of the reasons why it is so difficult to fit computer science into K-12 curriculum is because each state defines its own academic standards” [23].

An example of this can be seen in Washington State’s Educational Technology and Learning Standards, which were not updated for 8 years. In December of 2016, Washington State finally adopted standards developed by the National Computer Science Teachers Association. The new standards still do not do enough to lower the learning gap [24] [25].

“...second-graders will know how to use a computer app to draw a picture. Middle-school students will understand different file formats, and high-school seniors will recognize the issues that affect computer network speeds.” [25]

These are antiquated requirements, of little relevance to most jobs in technology. The American school systems still do not require students to learn algorithm thinking; despite studies suggesting that math skills are like a language and require early exposure. Without early exposure to algorithms, students risk falling behind. The only way to circumvent this educational shortfall is to either place political pressure for states to adopt curriculum that promotes computer science principles and algorithmic thinking or to rely more heavily on the private sector or Computer Science programs to develop educational software, such as MIT’s Scratch and HackerRank, which came out of Stanford. The problem with pushing public schools to keep up with the demand is that even if they changed the requirements, they do not have the instructors, curriculum and financial backing to support such a massive infrastructure change. Thus, to support the growing demand for more workers to help build society’s technical infrastructure and meet the need for more instructors, University Computer Science programs must continue to grow and support a diverse student population and curriculum with the assistance of private donors and government alike.

III. INSIDE UW’S PAUL ALLEN SCHOOL OF COMPUTER SCIENCE & ENGINEERING

Currently, UW’s Paul Allen School of Computer Science and Engineering (PASCSE) faces major challenges from historical and societal discriminatory practices in the United States and more specifically, Seattle. In order to understand UW’s PASCSE current diversity circumstances within the context of their college, several points of data were collected, which included statistical data, which was discussed earlier, review of their course catalog, degree requirements, full-time faculty profiles and an interview with a recent graduate, administrator and faculty member. Upon review of the curriculum, two classes stood out that reflected potential social constructs within the United States. These courses were (1) CSE 491 *Data Science & Society Seminar* (2) CSE 482 *Capstone Software Design to Empower Underserved Populations*. According to a faculty member, these courses are not required. They later stated that CSE 491 will no longer be offered, but explained:

“...We have partnered with the Sociology department to have them offer a 3-credit course that subsumes CSE 491 in additional depth.” [26]

They also elaborated on CSE 482.

“CSE 482 is for capstone design courses that meet the university’s diversity requirement. We have had one on accessible technology in the recent past and will continue to offer that one. Next year I expect to add one on technology for the developing world.” [26]

During the interview with the administrator, they revealed that their efforts to increase gender diversity have been successful, including hiring more faculty, but that their efforts to increase URMs has been a more recent effort in the past two years. They stated and recognized that this was a current weakness in their program, but also across the United States. Some of their current efforts included the “Flip Alliance.” This program partners with other graduate Computer Science programs. The purpose of the “Flip Alliance” is to increase diversity among faculty by recommending potential candidates to avoid hiring their own graduate students, which is often frowned upon in academia. Another initiative included shifting from an upper division acceptance to taking more freshman directly into their program. They also offered a summer skills program for students. Another program, where they are able to attract a few students is from UW’s STARS (Washington State Academic Redshirt) Program. The STARS program recruits students who have an economic need and come from diverse high schools [27].

“STARS is a two-year program with specialized curriculum designed to build learning skills and strengthen academic preparation for core math and science prerequisites. STARS students who maintain a cumulative GPA of 3.00 or higher and fulfill first- and second-year program requirements are guaranteed admission to an engineering or computer science major.”

Other efforts by the Computer Science and Engineering program included establishing a diversity committee, hiring an administrator for diversity, and through their diversity office, offering unconscious bias workshops. They also have received a million-dollar grant from a private donor to be distributed over the next three years to help increase diversity. One of the programs that has emerged from the support of the grant is their K-12 research demos and scratch workshops, which is delivered by PASCSE ambassador students, many whom are under-represented minority (URM) students themselves. Previously, the demos and works were conducted by request, but that they have started to do more outreach to underserved communities.

Despite efforts, the administrator admits to some daunting challenges that are out of their control, such as the deep-seated historical and contemporary discrimination that URMs face in their own communities, and poor academic preparation, making

recruiting these students more challenging. They also discussed how there is a range of what faculty members are willing to concede or do to ensure diversity, raising the question of potential bias among faculty members, which suggests that some may believe that allowing unprepared students to enter the program could lower the quality of the program.

“...One of the things that limits us is the lack of understanding. Most of our faculty members, especially senior faculty members, are old White men who’ve only ever studied in Computer Science. Their social circle, their perspective, is pretty narrow, even if they want to know more, so I think this lack of understanding is really limiting...” [28]

Incidentally, the aforementioned statement was made by the administrator before an opinion piece by Computer Science Principal Lecturer, Stuart Reges, was published in an international magazine. In Reges’ opinion piece, he admonished Google’s firing of James Damore, a Google employee who sent a memo questioning women’s relevance in the tech industry and even suggesting intellectual and emotional differences. Though Reges did not go as far as Damore, he did suggest that women had a greater aptitude for reading over math, but those who applied themselves in Computer Science were still capable. He made the case that women were not in Computer Science programs because of barriers, but rather, it was their choice, insisting that impediments no longer existed for women. He later encouraged “closet Damores” to come out of the woodworks and let their opinions be heard [29]. Thus, the opinion piece is reflective of the current environment facing industry and Computer Science programs. It is a central reminder of how alienated Computer Science programs and industry are from understanding structural and cultural inequalities, reinforcing the White, male power dynamic that further alienates women and people of color.

An example of how barriers affect diversity enrollment in UW Computer Science program according to the administrator is their “elite” reputation, which potentially deters students from applying. Another factor is that once URM students arrive, they may be one or two in their classes, and they may feel isolated. The lack of URMs also was reverberated by recent graduating senior, Robert Marver:

“...I don’t see a black person and I find it shocking” [30]

Mr. Marver discussed that most of his access to diversity in his program revolved around gender, but that there was a lack of other forms of diversity. His only access to diversity in his curriculum was through courses that were offered outside his major program. He took *Environmental Ethics* and *Emerging Nations in Literature*, focusing on Gender and Islamic Studies. He did not take the CSE 491 or 482 because his specialization did not align with these courses. He did share that his study abroad experience in Switzerland provided him with the best overall experience in regards to his exposure to diversity. He

said that he met students from around the world, including Latin America and African Nations.

“...It was super cool to meet people from everywhere” [30]

This experience had a profound impact of how he saw diversity, and its value. Mr. Marver emphasized that diversity was important across gender, cultural, racial, ethnic and socioeconomic lines. He expressed that without exposure to diversity that he could not bring products that would accurately serve or reflect peoples’ outside his educational bubble.

“...Diversity is really important, in order to get the best experience for everyone...Create products that are best for everyone ...” [30]

IV. HOW SOCIOLOGISTS CAN BE A GAME CHANGER INSIDE A COMPUTER SCIENCE PROGRAM: PERSPECTIVE

In National Public Radio’s *Invisibilia*, they highlighted an effort by Princeton Sociologist, Matthew Salganik, who after seeing *Neflix* hold a competition to help them better predict movie preferences, decided to use the same principles by hosting his own version of the competition, but to predict human outcomes in academia, using a large longitudinal data set of over 5,000 children. An estimated 400 teams were given information about the children from age birth until age 9 and were instructed to create computer models to predict the children’s grades and some other outcomes at age 15. What Salganik discovered was that none of the computer modules created by these technical teams could accurately predict future outcomes [31]. Though this large failure could be interpreted as “humans are unpredictable”, another plausible explanation is that these teams lacked the necessary diversity to understand the variability of outcomes.

An Applied Sociologist, specializing in community outreach and inequalities, could provide a bridge to marginalized communities, help widen the sociological lens among Computer Science students and build awareness and stewardship. An example of this can be seen through my work. I am an Applied Environmental Sociologist, woman of color and twenty-year veteran in the classroom and in the field. I use my sociological lens and experiential learning pedagogy to engage students in their local community. As an Environmental Sociologists, I had to fuse science and Sociology into my classroom and research, working across disciplines from Ecology, Forest Resources, Atmospheric Science, Permaculture to Hydrology. I took students into the field, conducted interviews with community members, participated in relevant local research. We visited K-8 classrooms, met writers, researchers and engaged in meaningful discussions about our community. These same principles can be applied to Computer Science.

Having an Applied Sociologist in a Computer Science program can help infuse sociological principles into the curriculum, which can assist students to understand the effects of diversity. An Applied Sociologist also can be an intermediary between academia and the community. This is crucial to Computer Science programs because community engagement serves several goals: 1) create awareness and applicable skills

among students, which are necessary to engage communities 2) provide marginalized communities with services that otherwise may not be afforded to them 3) serve as a conduit to recruit future students into technical fields, by providing mentorship 4) provide opportunities and interests to marginalized groups that may encourage their future participation in more technical fields, which is reflective in the type of careers they tend to gravitate towards. An Applied Sociologist also can use their time to build community relationships, help dispel stereotypes and promote STEM education, especially in Computer Science.

The following are a few examples from my classroom experiences that demonstrate the aforementioned impact Applied Sociologists can have on their communities and programs.

In the Spring of 2016, I taught *Introduction to Sociology*. I enrolled my students into a code.org class, and then used "Inequalities in Computer Sciences and Its Impact on Society" as our themed platform. I assigned the students a group project that required them to team up with a web development course. The instructor of the technical course was African American. I raise his race/ethnicity because when I sought to work with other instructors in a similar fashion, there was no interest to collaborate. As part of the process, his students interviewed my students and together they collaborated to build their webpage with sociological content.

In the Fall of 2016, I revamped my *Introduction to Sociology* course to completely focus on Society and the Digital Age. I introduced them to various subtopics from the subjugation of less privileged peoples filtering our videos and facing trauma from disturbing footage to how families are affected by technology. This class also attempted to make a video go viral. We peaked at a little over 16,000 views.

The idea of Sociologists having value in Computer Science programs is emerging across the United States, from Princeton to UW. As previously mentioned, UW has released its CSE 491 *Data Science & Society Seminar* to the Sociology Department. The problem arises in that some programs do not require these courses, but instead include them as potential options.

Another example of Sociology as a game changer is that Applied Sociologists can be liaisons between Computer Science programs and their community. In my academic career, I have engaged many communities, such as exploring the viability of Biomass in Northern Maine, which was funded through a National Science Foundation Grant (NSF). One of my best examples of community engagement in the Seattle area took place in the Fall of 2015. My class worked with two stakeholders from Washington Middle School, and my students were tasked with building four workshops for almost 300 eighth grade students about social sustainability and gentrification. My college students received direct feedback on their workshops from their stakeholders, and many were asked to revise them. Though they found this frustrating because they had to go back and redo their work, they also appreciated the real-world experience.

Working with the community had a profound effect on both the eighth graders and the college students. The following is a

written testimonial from a college student who participated in the class [32].

"Personally, I would like to thank you for the seed you planted in my heart this quarter. I learned how important is Social Sustainability to the success of economic sustainability, and how strongly are connected. Before I started this quarter, I thought little about Social Inequalities, social justice and important pillars they are to sustainability. Now I even consider pursuing a career in social sustainability. Thank you again for your hard work to bring awareness of social issues to our class."

The following are statements from the middle-school participants, which were provided by the stakeholders [33]:

"I finally understand why none of our (my mom's) friends (including old neighbors) live in the area anymore"

"I like the games, and how they taught us about gentrification"

"I like being w/different students and seeing there perspective on something"

"I liked that the presenters knew what they were talking about and weren't reading from a script"

"Talking to College People"

Having real-world experiences not only resonated with my students, but also with the UW Computer Science student that was previously interviewed for this paper. Mr. Marver reiterated that his travel abroad experience was the most impactful because he was exposed to applicable experiences in the classroom.

"it was hard...projects were fun" [30]

As an Applied Sociologist that works in the field, I often build community relationships, help dispel stereotypes and promote education. I am especially interested in promoting STEM education because as a Sociologist who studies and teaches inequalities, I am concerned with the growing digital divide, but also the reproduction of stereotypes, discrimination and racism within technology. In an effort to address these issues, I volunteer in the community. I also serve as the President of a local start-up company, Wild Noodle Corp that offers free coding software. The program is called Herbert, which was created by Princeton graduate, Brian Conte. The program has its own language, called "H" and players must use it to write algorithms to solve puzzles. The Herbert program was used in Microsoft's Imagine Cup's algorithm competition for four years. College students from around the world competed in solving the puzzles. This software was later made available to the public through a web app created by Mr. Conte. I helped Mr. Conte beta test this educational program in schools with students in elementary, middle school and high school.

Through my volunteer and networking efforts, I have made connections with administrators, teachers, children, industry and non-profit organizations. These valuable relationships can be

used to build programs between the community and the college. Similar efforts are being practiced at the UW School of Computer Science, with their K-12 workshops and demos, but it is limited to 12 ambassadors. UW does not offer enough required curriculum and/or projects that can benefit the Computer Science students. This lack of scope in their curriculum places the students at risk of creating graduates that may perpetuate inequalities in the emerging technical infrastructure.

V. SOCIOLOGY AND COMPUTER SCIENCE: THE EMERGING MODEL

The aforementioned discusses factors that make incorporating Sociology into a Computer Science programs worth considering, but the following introduces how that theoretical model could possibly look like and function.

First when hiring an Applied Sociologist, Computer Science programs should also find a Sociologist that specializes in community engagement and inequalities/stratification. Also, before hiring a Sociologist for a Computer Science program, the program may consider two potential models. The first would be hiring a full-time Sociologist that works exclusively with a Computer Science program, allowing them to teach classes about society and computer science, inequalities in computer science, field courses in community engagement, research methods, and work with students on capstone projects. If this model is used, there will be times when co-teaching would be advantageous, such as in capstone work and research methods. Sociologists can help with data analysis and interpretation from a sociological perspective. A full-time Sociologist could also engage students with their research. Finally, a Sociologist would be an asset in grant writing endeavors because of their ability to use a sociological lens, which includes diversity.

Another model to consider, would be a joint position between Sociology and Computer Science. This type of model would allow for the professor to actually collaborate across programs with two sets of students with very different backgrounds and interests. This could help both groups participate in field work, using different skills. The Sociology professor could also teach a course to Computer Science students about inequalities as it relates to computer science and technology. In some respects, UW appears to be moving towards this model.

The downside of the second model is that the program risks alienating the faculty member from the Computer Science program and their participation and contribution may not be seen as a key element of the program. Also dividing the Sociologists across two programs, creates additional work by requiring them to attend two different faculty meetings and adhere to two different departmental missions and expectations. This may affect long-term retention of the faculty member and make it more difficult for them to achieve tenure.

The second model would be helpful initially to address diversity as it is a more immediate response to the problem because more diverse students are in the social sciences, but the first model 1) provides the groundwork to emphasize the importance of a diverse faculty to prepare future students to work with diverse populations, 2) dispels stereotyping and

racism in students' work by using a sociological lens to understand the diversity of gathering and interpreting of data 3) helps create a community bridge that can serve the community needs, but also assist with future recruiting 4) builds faculty and mentors that will make Computer Science programs and their research more relevant to diverse students.

VI. WHY DOES IT MATTER?

Why and how does this all matter? Understanding the difficult historical and societal circumstances can assist with understanding the effect on future Computer Science programs, their graduates and ultimately society. For example, the lack of diversity may manifest itself and play a role in stereotyping, which could affect decision making processes, which was evident in the disciplinary actions taken by the Seattle Public Schools. Research has shown that perceived beliefs about certain URM's can affect decision-making processes. For example, in a study that used mock jurors, when the jurors were given the name of a defendant with a Latino surname, they were more likely to find them guilty [34]. This phenomenon is reflective of several studies that reinforce the notion that "people can develop the sense that their stereotypes are quite accurate and feel confident in relying on their stereotypes" to make decisions even when they are incorrect [34]. Further impacting the decision-making practices; complex decisions, being busy or distracted are factors that will more likely elicit the use of stereotypes [34].

Machine learning and Artificial Intelligence (AI) are upcoming and emerging technologies, but despite the nature of their logic, they are not immune to the social biases reflective in our society. Computer scientists developing Artificial Intelligence programs and machine learning algorithms may be using data that is reflective of racist practices. For example, a U.S. court is purported to have been using a computer program for risk assessment that reflected social biases. "The program, Correctional Offender Management Profiling for Alternative Sanctions" was more likely to flag African American defendants as potential reoffenders at 45% compared to 24% for White defendants [35]. In another program developed for police to help patrol (PredPol), San Francisco researchers found that PredPol was at a higher risk to create feedback loops that would encourage increased policing of African American and Latino neighborhoods. PredPol would use data inputted to determine where crime hot spots would be more likely to occur, sending police to these areas, which would in turn continue to feed those same areas into the computer program, causing a perpetual loop that unfairly targets marginalized communities [35]. Though the argument can be made that pure data is used and the program is not racist or biased, but that fails to consider that the process and conditions in which those data points were accessed. Thus, computer scientists need to be familiar with the sociological implications in order to stop perpetuating racist practices that unfairly target URM's and find ways to correct for the social discrepancies.

Thus, if Computer Science programs in the United States continue to enroll predominantly White and Asian students, they risk creating a cultural echo chamber that excludes diversity and perpetuates social prejudices. These practices could transcend into the workforce. For example, when giant tech companies

were inventoried through self-reporting, regarding their diversity, most of them reported that African Americans made up about 2 percent or less in their technical fields with the exception of Apple, which had reported 6 percent. When these numbers were further divided by gender, the number dropped even further for African American women [36]. Though the number of African Americans graduating from Computer Science programs is far lower than Whites and Asians, those who do receive a degree often face multiple obstacles. Some graduates opt to go into business settings avoiding the more technical fields because of the lack of diversity in those organizations, and sometimes companies hiring are not looking in the right places like historically black colleges [37].

Though Computer Science programs can serve to help with the transition process through recruiting more students and providing more mentoring, this task is more complicated because of the lack of opportunities and educational infrastructure. Yet Computer Science programs, should consider incorporating Sociologists into their faculty because they bring the social and human aspect to technology. Many African Americans and Latinos often turn to these disciplines because they resonate with their experiences. According to Georgetown University's Center on Education and the Workforce 2016 report on African Americans College Majors and Earnings, African Americans were less likely to pursue careers in STEM fields, but instead were highly represented in the following low-earning careers: Twenty-one percent were represented in Health and Medical Administration; twenty percent in Human Services and Community Organization, nineteen percent in Social Work, seventeen percent in Public Administration, fifteen percent in Criminal Justice and Fire Protection, and fourteen percent in Sociology [38]. All the aforementioned fields gravitate towards community stewardship. Thus, bringing Sociologists into a Computer Science program could help build that bridge and not only attract diversity, but also serve in the development of curriculum that can help shape a better understanding of society. Sociologists are trained in data gathering, analysis, policy implementation and understanding the complexities of social interactions, including social inequalities.

VII. PARTING THOUGHTS

Finally, why does diversity matter? First, because of the moral imperative to stop injustices, but second, because of the potential benefits to individuals, academia and society. For example, research has shown that companies with racial and ethnic diversity are "35 percent more likely to have financial returns above their respective national industry medians" [39]. Several studies have highlighted the benefits of having diversity, but also the consequences of neglecting it. In a study by Richard Freeman and Wei Huang, they uncovered through their analysis that papers authored by individuals of the same cultural and racial background were less likely to be cited by other researchers compared to papers that had multiple authors from various cultural and ethnic backgrounds [40]. Another study by Frederic C. Godart et. al., captured the importance of having immersive experiences outside one's own cultural narrative in that the more individuals were highly engaged in new experiences, adapting to other environments and building their diverse networks, the greater an individual's creativity output

[41]. This outcome was reflected in the interview with the UW Computer Science Graduate, Mr. Marver, where he emphasized the relevance of diversity in applying his knowledge to his career. He also cited that his study abroad experience where he had made deep connections with students from around the world had a significant impact on his learning and growth as a student [30].

Thus, having an Applied Sociologist can serve to help introduce a diverse mindset in the curriculum, but also engage students in local communities, often serving marginalized populations. Computer Science students learn about diversity and its value, gain real-world experiences, but also their impact on these communities can help address needs and recruit potential students. The greatest obstacle facing Computer Science programs is changing the mindset of the senior faculty that may have a limited view and understanding or lack of interest to change their pedagogy and curriculum, which was reverberated in Reges' opinion piece [29]. Furthermore, if Computer Science programs recruit Applied Sociologists to help build curriculum that exposes students to authentic and meaningful experiences, these classes need to be required for all students in their program. Diversity should not be something a student picks up casually as a requirement. As the aforementioned research has alluded, students need diverse, immersive experiences for their own growth, but also because their future contributions will greatly benefit their own work and society [40] [41].

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