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**Improving Diversity in Computer Science**

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In an age where technology is constantly discarding old ideas and promoting new ones, a vital field like computer science always needs a diverse workforce to be able to constantly generate new and diverse ideas. In this article, “diversity” is described as differences in race, gender, and economic sector, factors that can create limitless ideas to meet the ever-changing needs of technology. According to the National Center for Women & Information Technology (NCWIT), as of their 2022 report, women represent only 26% of computing-related jobs, while Black and Hispanic employees comprise just 9% and 7%, respectively. These figures have raised an alarming situation about the lack of diversity in the computer science workforce, especially women, and those from economically disadvantaged areas. This article will examine the barriers such as limited access to education, cultural biases, financial barriers, and lack of role models. It will also propose possible solutions, including coding bootcamps, scholarships, mentorships, industry partnerships, and curriculum updates, to increase diversity in computer science.

First, in computer science, limited access to early computer science education is one of the biggest challenges. In low-income areas, schools often lack the resources to provide young people with early access to technology, making it difficult for these students to develop technology skills and passion for technology careers from an early age. In a 2021 Code.org article, it stated that only 47% of high schools in the United States offer computer science courses, raising concerns about the disparity in education between urban and rural areas. Additionally, Code.org highlights that schools with limited funding and resources are less likely to provide these programs, resulting in a persistent gap in access to foundational tech education.

Next, long-held cultural stereotypes are also a significant deterrent for underrepresented groups, especially women. A 2018 study by Ehrlinger et al. found that gender stereotypes contribute to the underrepresentation of women in STEM, especially in roles considered “male-dominated.” Their research shows that women in technology are often criticized and unfairly judged for their technical skills. They are often compared to men in terms of technical knowledge and are often perceived as inferior because of the religiously segregated professions for men and women. This can lead women to choose less competitive careers over those considered “male-dominated.” With only 18% of computer science degrees awarded to women as of 2022, according to data from NCWIT from 2022, the impact of such stereotypes on educational and career paths is clear and alarming.

In addition, finance is also one of the main reasons for the imbalance in the number of students studying computer science between rural and urban areas or between developing and developed countries. According to the National Center for Education Statistics (NCES), the average tuition for a computer science program can exceed $33,606 per year in the United States, compared to the average tuition for finance programs at $25,000 per year. This is a very expensive expense for many low-income students and a major challenge for middle-income households in the United States. It also makes access to this profession more difficult for students living in rural areas or developing countries. Without significant financial assistance, such as scholarships or grants, students from these regions and economic backgrounds face immense challenges in pursuing computer science careers, which further exacerbates the gap in representation and opportunity within the field.

Finally, a seemingly innocuous factor that can exacerbate the imbalance in the computer science workforce is the shortage of diverse role models. McHugh, author of a 2020 paper, reports that despite some progress, the proportion of computer science graduates from underrepresented groups remains low, with black students making up just 9% of graduates and Hispanic students making up 11%. This can dissuade future generations from pursuing the profession, as they are unable to witness the success or achievements of their peers in their community. Role models not only motivate future generations to pursue computer science, but also help them envision future success more clearly. Therefore, the lack of diverse role models may not convince students from different races to pursue this type of education.

**However, despite all of those obstacles, actionable solutions exist to mitigate those problems. First,** partnering with underserved schools to establish coding bootcamps allows students to expose themselves with computer science at an early age. In the article from Code.org in 2021, the report indicates that introducing coding programs at the elementary and high school levels significantly boosts their interest in computer science. The data shows that schools with bootcamps report up to a 40% increase in student interest in tech careers, demonstrating the potential of early exposure to close the diversity gap.

Solving the problem of female underrepresentation in the industry is a difficult one because it is rooted in cultural and human perceptions that have been around for ages. However, organizing hackathons or coding competitions for women with attractive prizes can encourage women’s passion for this profession. Research from Girls Who Code has shown that this approach is feasible because these competitions led to a 25% increase in women’s enrollment in computer science courses at the college level. Additionally, educating younger generations from an early age about gender equality can help eliminate long-standing stereotypes about “male-dominated” jobs. This can help women later have a healthier working environment, where their achievements are recognized for their work capacity, not their gender. And what's more, a healthy environment where women have a voice will help generate more diverse and innovative ideas.

Furthermore, providing programs such as scholarships, mentorships, and internships are increasingly becoming the most optimal solutions in increasing diversity in technology fields. Research by Smith and Mendoza (2018) revealed that financial aid and mentorship programs significantly improve retention rates among minority students in STEM fields, with scholarships boosting graduation rates by 28% and mentorship increasing student persistence by 15%. By addressing financial needs and support, these programs create more pathways for students with financial barriers to develop computer science careers. In addition, internships and career exposure opportunities offered by tech companies, as noted by Code.org (2021) can increase the competitiveness of students in college when attractive scholarships or internships at famous companies are offered, which will encourage students to continue to study. From there, the emergence of talent from diverse skin colors and living areas will no longer be an impossible thing.

Lastly, collaboration with tech companies to offer internships and job-shadowing programs is also an important solution to address the lack of role models in tech. These programs provide students from communities that typically follow careers that their predecessors have successfully filled with computer science. Connecting them with students from other communities at workshops can help spark their curiosity and interest in pursuing computer science. Additionally, working with mentors from similar backgrounds or accomplished professionals can help motivate them to pursue this career, allowing students to envision themselves in similar roles and thereby fostering their confidence and ambition.

In summary, the above solutions will partly help to address the worrying situation of diversity imbalance for human resources in the computer science industry. Having a diverse workforce will help the industry to constantly develop with new initiatives. Especially in the era of technology 4.0, industries such as computer science need constant creativity and innovation to serve the increasingly advanced needs of human life. Therefore, having the participation of the workforce from different races, different genders or different regions is indispensable. Groups with different backgrounds can bring unique perspectives, creating comprehensive solutions to complex technological challenges. Data from the Bureau of Labor Statistics in 2024 shows that the demand for skilled technology professionals across demographic groups is very high, emphasizing that diversity is not only beneficial but also necessary to meet the industry's growth forecasts, when the demand for skilled technology professionals is projected to grow by 15% by 2030. A diverse team allows them to create products that meet a variety of needs, making them invaluable assets to technology companies and contributors to society.

Increasing diversity in computer science is important for both social equity and the future growth of the industry. Barriers to diversity, such as limited access to education, cultural biases, financial challenges, and lack of role models, prevent many talented individuals from entering the field. Therefore, a proposal for solutions to these problems, such as coding bootcamps, scholarships, mentorships, internships, and inclusive curricula, can make computer science more accessible and welcoming to everyone in the world. By supporting these initiatives, schools, companies, and policymakers can help build a technology industry that reflects and benefits all members of society by including all aspects of the product, ensuring a diverse workforce with more innovative and adaptable ideas for the future. Diversity allows computers to develop faster, helping to fully meet human needs in a period of continuous technological development. Society should support this idea of ​​diversity and industries should pay attention to promoting the preservation of diversity in the workforce.

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