

Women in Computer Science Are Making Strides

Computer science is still not a level playing field for those women who majored in it and choose to pursue it as a career.

AS A SENIOR majoring in computer science at Vanderbilt University, Lina Drechsler is looking forward to a bright future. Drechsler has secured a job as a software engineer at Microsoft when she graduates, and has had a good academic experience in a field traditionally dominated by men.

“Vanderbilt actually does a great job of striving for gender balance in their engineering school,” observes Drechsler, noting that for the current freshman engineering class, for the first time the ratio is “49.9% male and 50.1% female.” Most of Drechsler’s classes have an even gender split, she says, although she adds, “I have had classes where I am one of only two females.”

Her experience does not necessarily reflect the state of women in computer science at a macro level. When it comes to the science technology engineering math (STEM) workforce, women remain underrepresented, with the greatest disparities occurring in engineering and the computer sciences, according to the National Girls Collaborative Project (NGCP). Women earn 50% of bachelor’s degrees in science and engineering, but comprise just 34% of the STEM workforce, the NGCP says.

While strides have certainly been made, it is still not a level playing field for women who major in computer science and related fields and choose it for a career. Computer science still does not attract a lot of girls and women, and experts say there remains a stubbornly persistent view it is not something in which women will excel.

“Bias against women in STEM is persistent at all levels of education and in most community institutions,” says Bettina Bair, chair of the ACM-W organization, a global organization that advocates for women in computing.



At Arizona State University, assistant professor of computer science Carole-Jeane Wu (standing, center) said female students comprise only 15% of the university’s 1,900-plus computer science majors.

“Girls will be exposed to these attitudes more and more frequently as they move through school and extracurricular programs. They will hear that math skills are fixed, and that boys have natural abilities in math.”

A girl who demonstrates skill in math will be told she will always have to work harder than the boys, and her serious demeanor and competence makes her unlikeable, Bair says. “Girls will hear that being unlikeable will limit their chance of success.”

This will lead many girls to look for another option where they feel more comfortable and more likely to succeed, she says. By the time they are college age, only 5% of women, compared to 20% of men, will apply for a degree in an engineering, physical science, or computing field.

Further, women comprise a smaller number of computing students at the outset, so the loss of women from these majors is especially concerning, Bair says. “In college, women students

are about 20% of computing students; they are a minority and a novelty in the classroom.”

Genius or Girlfriend

As a result, they feel pressure to fit into one of two stereotypical roles offered: genius or girlfriend. The genius girl is highly sought after by her male classmates for group projects with the expectation that she will be the organizer and leader and ensure her male teammates get a good grade.

Often, instructors have higher expectations of genius girls to be able to answer all in-class questions and rescue any boys who need a tutor, Bair notes.

Like Bair, Leigh Ann DeLyser says certain perceptions of women in computer science start young. “Throughout the education process, there are multiple points of reinforcing feedback that [computer science] is not for girls,” says DeLyser, executive director of CSforALL, an organization that seeks to make computer science an integral part of K–12 ed-

education and support pathways to college and careers in the field.

DeLyser, who has a Ph.D. in computer science from Carnegie Mellon University, says there is “the expectation that you’re up all night in the lab in order to do your problem sets, which is often a lab full of guys who aren’t nice to girls, so they’re excluded from the social network that helps them excel through collaborative action in their classes.”

She also maintains there is a media narrative around who computer science is for, so girls “may hear from friends and parents and relatives and others, ‘Why do you want to do that?’ It’s death by a thousand cuts.”

DeLyser also cites the controversial Google manifesto written by an unnamed male engineer at the search engine giant that slammed the company’s diversity initiatives as contributing to the problem. The manifesto argued women in tech are underrepresented—not because of bias and discrimination in the workplace, but because of the psychological differences between men and women.

“We should never take one of those moments as an isolated incident,” DeLyser says. Young women find it difficult to get a job in the field because even if they make it to the interview stage, interviews are very subjective, “and there’s this question of ‘fit’. And we don’t fit with the ‘bro culture,’” she says.

DeLyser says she sees some of that changing, given the current intense focus on diversity, equity, and inclusion (DEI). “I think there’s a desire for di-

The Google manifesto argued women in tech are underrepresented because of the psychological differences between men and women.

verse voices and fresh air in the hiring process—but I’m not sure that that’s filtered all the way through to the team of individuals who are part of the interview process.”

The challenge of women finding jobs in computer science isn’t as much an issue with the level they are at in their career as it is the industry and the maturity of the company, DeLyser believes.

However, Paula Bratcher Ratliff, president and CEO of Women Impact Tech, a for-profit, woman-owned business that helps women in technology network, says the problems of women both finding jobs and advancing are systemic and across the board.

Even though most companies have DEI initiatives, they are unable to retain talent because they have not created the right culture and environments in which women can grow and flourish, Bratcher Ratliff says.

“You’ve got many women due to either imposter syndrome or issues with children or parental care [who] feel they’re already asking for flexibility that their male counterparts are not,” so they don’t feel comfortable asking for a raise or discussing career advancement, she says.

“This perpetuates the problem of them being underpaid and not asking for career advancement ... they stay quiet and they’re not having their voices heard or being at the table or driving strategy in their divisions, which then perpetuates the problem of ‘bro culture’ in terms of elevation,” Bratcher Ratliff says.

If women do speak up, they often are seen as troublemakers, particularly if the company has not developed a framework through which women may advance via sponsorship/coaching and general “career pathing,” she adds.

Even Drechsler, who forged a path for herself while studying computer science at Vanderbilt, says she has noticed she is “typically the last person to be consulted for help by some of my male peers, and there is sometimes a competitive one-upmanship around assignments and tests.” Drechsler says she learned to ask teaching assistants for help early on, and to absorb difficult concepts gradually so that they stick.

“The way I approach my computer science work is quite different from some of my hypercompetitive peers,” Drechsler says, “and this has potentially caused them to view me as less apt at the subject.”

That said, overall, Drechsler said she

Tech Brief

ACM’s Remote Proctoring Software Guidelines

ACM’s U.S. Technology Policy Committee (USTPC) released a **Statement on Principles for the Development and Deployment of Equitable, Private, and Secure Remote Proctoring Systems** (<https://bit.ly/3KY7dPk>) that provides a framework to guide those developing and deploying such systems to ensure they are private, secure, fair, and accessible to all, among other important features.

The USTPC authors note that, as remote proctoring technologies emerge as a pervasive component of online

education, institutions, and technology vendors at minimum must address major issues of equity, privacy, security, accessibility, and efficacy. Key recommendations outlined in the statement include:

- ▶ **Privacy:** Remote proctoring technologies should incorporate end-to-end encryption for all test-taking data.
- ▶ **Mitigating AI bias:** Providers must work to assure and demonstrate that their systems do not discriminate against students.
- ▶ **Access:** These technologies should accommodate students

with disabilities, those who are homeless, and students with limited broadband access, as well as others.

▶ **Uniform certifications:** Educators, researchers, and technology providers should develop benchmarks and certification procedures to assess and document the comparative effectiveness of remote proctoring systems.

“During the COVID-19 pandemic, teachers and students experienced an abrupt shift to online teaching and learning, including the use of remote

proctoring tools,” explained Christopher Kang, a Ph.D. student at the University of Chicago and lead author of the USTPC Statement. “We hope our framework helps educators, students, and e-proctoring developers better design and deploy these systems.”

Added USTPC Chair Jeremy Epstein, “A common theme with all our policy products is to guide the development of new computing technologies so that they serve the broader society in a beneficial, not adverse, way.”

has never encountered pushback from professors or in the professional environment. “It is mostly the competitive nature of my peers that occasionally makes me feel less valuable in scenarios where quick thinking is praised, and where people make bold statements,” Drechsler says. “I’ve learned that I perform better and do my best work in positive-reinforcement environments.”

There are some actions that companies—and tech companies in particular—can take to change the culture. According to the Act Report, released in 2021 by a coalition of 29 DEI experts from academia, these steps include “disrupting everyday biases that subtly, but repeatedly, harm people from underrepresented groups.”

Individuals should also personally interact on an ongoing basis with employees from underrepresented groups, and leaders should support flexible work arrangements, leave, and work-life balance, the report advises.

Kathryn Kun, director of information security at digital trust platform Forter, credits having sponsors throughout their career as important to women’s success. Kun, who identifies as non-binary, says they are “shaped like a woman and they treat me like one.”

Kun recalls being in an executive meeting with their boss and CEO, and they brought a cake in to celebrate the successful conclusion of a project. “This was not my role, but I brought the cake into the meeting, and it turned into ‘let’s compliment Kathryn on her baking,’” Kun says. “My boss turned to his boss after the meeting and said, ‘Kathryn never touches food in front of an executive again.’ He wanted to be very clear that my image could not be the baker and food-fetcher; it needed to be as a professional.”

That, said Kun, was “such a display of solidarity from my management that they wanted me to be seen as a professional. Now I eat the cake, but don’t serve it. It’s important for women to find and surround themselves and stick with the people who will defend their image like that.”

Women are also often called argumentative when they give an opinion, and Kun says women need to leave jobs where they will not be defended. Such situations often are due to a lack of investment in training people in management skills, they said.

“There is an attitude among computer scientists that the closer you are to hardware and electronics, the more masculine the field of study is.”

Companies should also cast a wider net for diverse candidates for computer science jobs. “I usually work with recruiters and say I need to see a diverse pool, so I set the expectations,” Kun says. However, they add, “More than once, I’ve walked up to my recruiters and handed them back resumés and said, ‘I can’t hire from this pool, it’s all White dudes’.”

Drechsler says that in joining organizations like Women in Computer Science, Theta Tau (a co-ed engineering fraternity), and the Society of Women Engineers, “I have found a great community that ensures I never feel alone in the major.”

She recommends women computer science students build a strong network, with women in particular, as well as joining groups that serve as support systems for women in STEM. She also advises them to ask for help. “Use tutoring services, your peers, professors, and office hours as much as possible. Become someone who is okay with not knowing, but not okay with not learning.”

Bair says it an interesting paradox that even though there’s a well-documented shortage of tech and computer science professionals, women still find it a challenge to find jobs in the field. “It’s a complicated problem, and unfortunately, there are a number of contributing factors that make it hard to fix.”

The biggest issue, according to Bair, is “institutionalized sexism at every step of the pathway to those jobs. So while girls and boys have an equal interest and ability in STEM until the age of 11 or so, girls suffer a continuous series of social and institutional obstacles as they progress,” she says. “By the time they reach college graduation, the origi-

nal cohort of STEM-interested girls has been significantly reduced and eroded by all the implicit bias and barriers they have encountered.”

So the number of women who make it through those barriers to get a degree is a small fraction of the girls who had an interest in STEM at age 12, Bair says. However, she stresses that the women who do get degrees in computing majors will be offered jobs.

Yet most women will encounter sexism, and unethical, illegal, and unfriendly employment practices for the rest of their careers because of implicit bias, according to Bair. “There is an attitude among computer scientists that the closer you are to hardware and electronics, the more masculine the field of study is,” she says. Similarly, the further a person gets from hardware, the softer, or less masculine, it is.

“Women students may be subtly encouraged away from gadgets, robots, and circuits,” Bair says. “They may be reminded that women have better communication skills and that they would be more successful in a role that has more client interaction, like systems analysis.” **C**

Further Reading

Speak Up 2022: Women’s voices in the tech workplace. Ensono.

<https://www.ensonono.com/resources/blog/speak-up-2022/>

Women in Computer Science: Getting Involved in STEM. Computer Science.org, December 2022.

<https://www.computerscience.org/resources/women-in-computer-science/>

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2019. Why so Few Women in Computer Science? A Look into Stereotyping & College Curriculum. Bit.ly/3QSymEm

The ACT Report’s DEI Initiative
<https://actreport.com/>

ACM-W
<https://women.acm.org>

Association for Women in Science
<https://awis.org>

Million Women Mentors
<https://mwm.stemconnector.com>

National Girls Collaborative Project:
<https://bit.ly/4Op4za6>

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