

ADVICE

5 Ways to Welcome Women to Computer Science

By Janet Davis | NOVEMBER 18, 2019



Dave Cutler for The Chronicle

In 1999, at the height of the dot-com revolution, I was the only woman to graduate from Harvey Mudd College with a degree in computer science. The secret to my success? Supportive professors and classmates, sure — but also a willful obliviousness to my difference.

In some classes, I would sit in the front row with my best (male) buddies, pretending no one else was there. As far as I was concerned, this was between me, my friends, and the professor. In other classes, I kept to myself and receded into the background.

Only occasionally was my difference called out, most memorably when a professor started class by announcing, "Now, gentlemen, settle down — and Janet, too." Of course, I was minding my own business, not making a sound.

Twenty years later, I am now founding chair of Whitman College's new computer-science department. Obliviousness is not a strategy I can justify teaching my women students today — especially not when we have all become painfully aware of the persistent underrepresentation of women in tech. Nor should students have to create the conditions they need to succeed. It is the responsibility of instructors and departments to foster an inclusive learning environment.

Back at my alma mater, enrollment of women in computer science is approaching parity thanks to a major effort led by the president, Maria Klawe. While I appreciate all that the college has done to increase the representation of women there, not enough has been said about how other institutions should welcome women into the field. Harvey Mudd calls itself a "liberal-arts college of science and engineering," but most institutions don't have that singular science focus.

At a college like Whitman — where women are a majority of the students but only a minority of STEM majors — we face a different challenge. Many of our students don't see themselves as "tech people." We have to kindle their interest in solving problems via technology, an interest that women might not know

they have.

What follows are the five strategies I've found most effective in bringing more women into computer science:

Make computing social. A common stereotype is that programmers are solitary creatures, working their magic late at night in dimly lit basements. Even if there was once a kernel of truth to that cliché, today programming is a team sport.

In industry, much attention is given to agile software development, emphasizing close communication and collaboration over written specifications. One particular agile practice, pair programming, has been adopted at many colleges, including Whitman. Research has shown that pair programming — in which two programmers work side by side to solve a problem together — increases retention of women.

Our students report that pair programming makes work more enjoyable, helps them use their time more effectively, and provides opportunities to learn from peers. In exit interviews, our seniors have pointed to pair programming and team projects as among the things they liked best about the computer-science major.

Bridge the confidence gap. In the classroom as elsewhere, blustery men can seem to know more than they do, while less-confident women question their abilities to the point that even success can make them feel like imposters. That our culture almost always envisions programmers as male only serves to amplify the confidence gap.

To mitigate that, we identify the most experienced and self-confident programmers among our incoming students so that we can track them directly into an intermediate-level course. That means our introductory course is reserved for the true beginners and those who need more practice to build confidence.

When students ask a question that seems designed to show off their prior knowledge (usually, though not always, it's a male student), I redirect them to my office hours rather than starting a one-on-one conversation in class that might be intimidating to others.

One advantage of our small class sizes at Whitman is that I can pay attention not just to gender but to personality when forming pairs and teams. The first time I assign pairs in the introductory computer-science course, I group women with other women in the hope that they find mutual support. As I learn more about the students, I pair those with similar abilities. I try to pair less-confident women with classmates of any gender who are patient and considerate.

Likewise in the department's upper-division courses, faculty members try to avoid placing a woman on a team of mostly men — both to make sure the women are not isolated and to foster teams with gender-equitable communication styles.

Welcome late bloomers to the field. The same stereotypes that undermine girls' confidence at an early age can push them away from computing altogether in their teen years. While this is beginning to change with earlier, problem-driven exposure to computing (such as middle-school robotics competitions), young women are still less likely to start college with prior programming experience.

That is a serious barrier at universities where students must begin taking courses in their major during their first semester, or worse, where students must apply to the computer-science major prior to even graduating from high school.

At Whitman, we have designed the major to offer as many entry points as possible — even as late as sophomore year. This works. My research assistant Buyaki Nyatichi, an international student from Kenya, worried about her late arrival to computer science after realizing that engineering was not going to work for her. She's not only on track to graduate on time, but has also been able to study abroad and pursue a second major.

In addition, our department reserves seats in the intro class for sophomores, juniors, and seniors so that even those who might be too late to major in the field are able to pursue a minor, or at least take a few courses that fit their schedule.

Make computing relevant to the student. Some female and minority students are more likely to pursue a computer-science degree if they see computing not purely as a toy, but as a tool for solving problems that matter. The computing curricula that I learned as a student in the 1990s used examples and problems from business and the sciences, the two application areas in which computing has the longest history. (Back then, the most engaging assignments, by far, were making video games.)

Today, we want to engage students from across the entire college. So beyond traditional problems like compound interest, projectile trajectories, and DNA analysis, we add problems such as "distant reading" of novels and simulating human social behavior. In the future, I hope to add assignments like one developed by Evan Peck at Bucknell University, in which students consider the ethical consequences of algorithms for self-driving cars.

In my own courses, I try to avoid examples from gendered domains such as football, as well as ones like video games that reinforce the geek stereotype about our field. Many of my students still choose to do final projects in which they write programs modeling aspects of sports or video games. But the sports

projects have focused on modeling ski-trail connectivity, Olympic swimming records, and softball-team statistics, while other projects have involved naming constellations, answering questions about U.S. presidents, and representing musical notation.

The goal is to encourage final projects that allow students to apply computing in ways that they find personally meaningful.

Provide diverse role models. When I declared my computer-science major more than 20 years ago, all of the department's faculty members were white or Asian men. I felt an immediate connection to Harvey Mudd's first female professor of computer science, hired when I was a student. While I hadn't given much thought at that point to my own career plans, I began to see myself in her position.

So I'm well aware of the symbolic value of having a woman as the senior member and chair of a computer-science department. Since my first child was born almost two years ago, I proudly display photos on my desk and office door. And when they ask, I talk frankly with students about my experience as a woman in the field:

- I tell them about working with graduate advisers. Some of those relationships were easy and some weren't, including one that led me to see a counselor.
- I share my mixed feelings about changing my research area in graduate school from computer networks — a "hard" subfield in which there are few women — to the "soft" subfield of human-computer interaction where women were well-represented. On the one hand, the change let me pursue a more genuine interest (I realized I was more of a maker and a humanist than a scientist) and find a more supportive adviser and research group. On the other hand, I felt like I was letting future women down.
- Most recently, I reflect on the joys and challenges of returning to faculty work after becoming a mother.

But this isn't just about me. As a department we've taken a variety of steps to offer students diverse mentors. For example, we try to hire a diverse pool of students as class mentors and lab aides. Among a pool of candidates with similar grades and communication skills, we favor women and students belonging to other underrepresented groups in order to provide their classmates with a range of role models.

There's always more we could be doing, and there are some things we just can't do. We lack the funding to regularly take students to the Grace Hopper Celebration of Women in Computing like some colleges do. We may never be big enough to form a student chapter of the Association for Computing Machinery's Council on Women in Computing. Yet we're seeing some success.

We're still a very new department. Last spring, in the class of 2019 — the first class who could declare a computer-science major in their sophomore year — we graduated only one woman out of 15 majors: Melissa Kohl, a CS-physics double major who has since been hired at Google.

Thanks to the strategies I outlined above — along with some key help from Melissa encouraging students at Whitman to pursue the major — a quarter of the department's graduating class of 2020 (five out of 19 majors) are women. Despite being the only woman in the major, Melissa tells me that she was never the only woman in any of her computer-science classes. I hope that no Whitman student will have to be the "only woman" again.

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