The National Center for Women & Information Technology is helping institutions and businesses increase the number of women in computing majors and the tech workforce.

**DEFINING THE PROBLEM**

Women make up 51 percent of the adult population and account for 57 percent of both college students and working professionals in the US. Yet the percentage of women earning undergraduate degrees in computer or information sciences (CIS) declined to only 19 percent in 2012, from almost 30 percent a decade earlier. Indeed, as Figure 1 shows, the percentage of women earning CIS degrees, though not declining at all levels, remains low. It’s perhaps not surprising, then, that only 26 percent of US workers in computing occupations are women, a rate lower than that of most other science professions.

This underrepresentation in post-secondary education and industry is disturbing given that we know girls and women have the ability to perform as well in mathematics and science as boys and men do. In fact, research shows that despite their relatively limited numbers, women have been active contributors both to the computing knowledge base and to technological innovation through their publications and patents (www.ncwit.org/scorecard). So what can we do?

**WORKING TOGETHER TO INCREASE WOMEN’S REPRESENTATION IN COMPUTING**

The National Center for Women & Information Technology (NCWIT; www.ncwit.org) was founded in 2004 to increase the meaningful participation of women in computing. A growing coalition of over 575 US-based corporations and startups, academic institutions, government agencies, and nonprofits, it both develops and facilitates efforts to diversify computing. NCWIT focuses on creating community, educational materials, and awareness to strengthen the computing workforce and advance technology innovation through women’s full participation.

NCWIT’s social scientists publish research- and evidence-based educational materials that can help anyone involved in computing further these goals, including

- practical tips for recruiting and retaining women undergraduates;
• ideas and activities for K–12 outreach;
• specific techniques for recruiting, retaining, and advancing women in the technical workplace;
• recorded interviews with women entrepreneurs; and
• statistics that highlight girls’ and women’s presence and participation in technology at all levels.

Following are some research-based practices that can be implemented in two critical areas: helping computing educators attract and retain women at the undergraduate level, and helping businesses encourage women already in the technical workforce to remain in the field.

ENGAGING WOMEN IN COMPUTING EDUCATION
Undergraduate education is a key building block for creating future technologists. Educators can pursue various evidence-based strategies to encourage and retain women, as well as other underrepresented students.

Create inclusive pedagogical approaches and environments
In both introductory and follow-on courses, it’s important to select curricula that will interest students who are new to computing. Game design, digital media, and other socially relevant assignments offer promising ways to engage such students. Many faculty have had success using the Alice programming environment for 3D animations, the Scratch environment for games, and other user-friendly programs that enable students to learn difficult computer science concepts before they’re introduced to formal coding.

Equally important is ensuring that lessons and teaching environments are welcoming to all students. Are homework and test examples relevant to people with different life experiences? Does the language used by instructors and teaching assistants both in class and on assignments avoid assuming that most students are male? Is the physical décor in department labs and classrooms inviting to many people, or just to stereotypical “computer nerds”? Considering questions like these may provide insight into ways the teaching environment can be improved for all students.

Encourage students equally
Simple written and verbal comments can make a big difference as students decide whether or not to take another computing class or stay in the major. Students are more likely to engage in tasks they believe they can perform successfully, so encouragement should focus on student progress, persistence, and effort rather than just on being “smart” or demonstrating prior computing experience.

Provide clear messages
Students need to hear balanced, accurate messages about working in technology. The recent barrage of media stories reporting a “bro culture” in computing and low diversity numbers in major tech companies could easily discourage young women from pursuing a career in the field. However, research shows that girls and women choose careers for various reasons, so despite these negative images computing can be attractive to women if they have the facts. Here are some persuasive talking points to use in favor of computing:

• Our society is increasingly IT-dependent, so having an IT job means career security.
• Computing has seen consistently low unemployment and high profitability relative to other industries, even in the midst of the last decade’s recession.
• Working in tech provides many opportunities for creativity, problem solving, and making a difference in the world.
• Computing has the second highest median annual wage of all occupational categories tracked by the Bureau of Labor Statistics. Salary data from the US Census and from Dice.com...
suggested that the infamous wage gap between men and women is actually smaller in the computing industry than across the professional occupation sector generally.

- Having a computing degree opens doors in many other fields such as healthcare, finance, and design.

The job criteria important to women, according to much social science research, align very closely with a career in computing, making it an excellent option for women.

NCWIT’s “Top 10 Ways to Engage Underrepresented Students in Computing” (www.ncwit.org/top10engagestudents) offers additional suggestions for attracting and retaining women in computing courses and majors.

ENCOURAGING WOMEN IN INDUSTRY TO STAY IN THE COMPUTING FIELD

According to a study by the Center for Work-Life Policy, 74 percent of women in technology report “loving their work,” yet about 56 percent of women leave their science and technology jobs at midcareer. Contrary to popular perception, most of these women don’t leave the workforce entirely. Half of women who leave the private workforce continue to use their training, just not for the company they left or even in the private sector. Research suggests that most leave because of toxic environments or difficulties with supervisors (www.ncwit.org/thefacts).

The supervisory relationship is important, in part, because it influences so many aspects of an employee’s work life. Consequently, supervisors have the power to exacerbate or remedy many barriers women in technology face. Research also shows that women’s high attrition rates can be attributed to a lack of role models, mentors, and sponsors; inequities in performance and promotion procedures; and inflexible work-life policies.

Companies can foster various approaches to ensure that valuable midcareer employees, particularly women, don’t leave.

Provide equal opportunities for employees to demonstrate technical abilities

Women employees should receive explicit responsibility for technical assignments with defined deliverables and expectations. This enables them to demonstrate their technical abilities clearly—something research suggests can be more difficult when one is a minority on a team.

In fact, more than 350 studies report that being a minority in a particular environment significantly reduces confidence and risk taking. Simple encouragement to take on specific roles and challenges can be a big help in this regard—whether by a colleague, supervisor, or mentor. It’s important not to underestimate the power of simply saying, “You should take on this role or apply for this position” or “You did well on this project.”

Examine task assignments for patterns that subtly disadvantage women

Women are often assigned, or feel compelled to take on, less visible assignments or to assume execution roles rather than creative ones. Supervisors should carefully monitor which employees get which tasks. If patterns emerge, ask whether they’re based on actual ability or rather on unconscious gender assumptions.

Promote sponsorship for junior women

Many companies have had success with formal sponsorships, advocating for women employees and showcasing their work in the right places and with the right people. Research shows that women with sponsors are four times more likely to remain with a company than those without a sponsor. Senior male and female employees can strategically help make junior women’s accomplishments visible within a company.

Ensure that performance evaluations are results-based to avoid unconscious biases

Written rubrics and concrete examples should be used to support all evaluative statements on performance reviews. For example, promotion and resource allocation policies sometimes unfairly penalize employees who use flextime or take advantage of work-from-home policies. Written job-based performance criteria and attention to work results can help attenuate unconscious biases like these.

HOW NCWIT CAN HELP YOU

NCWIT can count many successes over its 10 years, including a study showing that members of its Academic Alliance (www.ncwit.org/alliances/aa) who worked on change by participating in the reform community and implementing evidence-based practices saw increasing numbers of young women pursuing undergraduate computing majors at their institutions. Another success is the Aspirations...
in Computing program (www.aspirations.org). Through it, NCWIT has identified a large population of historically underrepresented girls who show not only aptitude but also an abiding interest by pursuing computing as undergraduates. NCWIT member organizations help support these talented young women through regional Aspirations in Computing Awards, as well as scholarships and internships.

NCWIT membership is open to all degree-granting undergraduate institutions and all private and public companies, and we strive to make the evidence-based practices we have developed as easy to use as possible. You can request hard-copy versions of NCWIT resources through info@ncwit.org to distribute at conferences or in your own organization. The materials are also available to download for free from www.ncwit.org. A new phone app, PockIT Facts, even puts some of the most popular statistics and research at your fingertips when you’re on the go.

Despite ongoing successes, the journey toward gender parity in computing remains challenging. As any participant in social-reform movements can attest, identifying and moving key lever points simultaneously is a difficult undertaking. In this case, we’ve identified the most critical changes that must be made at the secondary, postsecondary, and industry levels.

But actually moving these levers and making these changes will require individuals to act within their own organizations. What can you do tomorrow to shift the status quo?

References

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