Designing for Diversity (Case Study 2)

Recruiting Women through Inclusive Pedagogy

Undergraduate

The undergraduate computer science (CS) program at the University of Virginia took several successful steps to improve the recruitment of women from their introductory course into the CS major. The department instituted multiple entry paths that tracked experienced and inexperienced students into different sections and incorporated structured laboratories into the "lecture" portion of the inexperienced section. The instructor repeatedly and explicitly encouraged students to choose a computer science major, used examples and assignments that appeal to diverse student groups, and deliberately established a class culture that extended beyond the course. These actions, together with smaller class size, markedly increased the yield of CS majors, and particularly, women and minority CS majors.

All first-year engineering students at UVA are required to earn credit for CS101, the introductory computer science course. Because it is a service course, the school requires an introduction to programming rather than a survey of computing and its grand challenges. To meet the needs of inexperienced students, a higher proportion of whom are women and ethnic or racial minorities, two special sections, CS101E and CS101X, are offered in addition to a regular CS101. All sections cover comparable content, but the prerequisites differ. CS101E is for students with prior classroom experience with variables and control constructs. CS101E students complete their lab assignments at times of their own choosing in open laboratories. CS101X enrolls students who are unfamiliar with programming. This section integrates lecture with guided, in-class experience in an environment free from the potentially intimidating comparison with more advanced classmates. CS101 is available to any student.

Enrolling only inexperienced students affects course demographics. The Student Demographics table (see top right) compares the population of incoming engineering students in 2005 with the population of CS101X. The course was almost half women, and Black students were over-represented — highly unusual demographics for computing or engineering classes. Also unusual for a UVA introductory computing course was the number of students enrolled in CS101X. Space restrictions limited enrollment to 43 students. During the same semester, CS101 enrolled 356 students and CS101E enrolled 91 students.

Student Demographics

Category	Incoming Students	CS101X
White Men	49%	26%
Asian Men	10%	7%
Hispanic/Other Men	9%	5%
Black Students	6%	23%
Women Students	26%	49%

Because of overlap, the percentages do not sum up to 100%.

Surveys identified applications and examples of interest to students. Based on survey results, and research indicating that female and minority students are particularly interested in applications with obvious benefits to society, CS101X emphasizes examples and assignments related to language translation, psychological testing, health, medical diagnosis, and games.

Other pedagogical practices are also designed to be inclusive and attractive to female and minority students. The instructor brings women professionals to discuss their careers. The instructor also routinely expounds on the breadth of options, advantages, and rewards in a computing career. Classroom discussion is routine and offers opportunities for students to learn each others' interests and activities.

CS Major Yields From Underrepresented Groups

Category	CS101X	CS101E	CS101
Minority	49%	26%	3%
Women	10%	7%	5%

The results from the CS101X initiative are student grades comparable to previous CS101 grades, but with more students, more women, and more minority students choosing a CS major. From the beginning to the end of the semester, CS101X increased the number of its students intending a CS major from one to eight. The CS Major Yields table shows striking differences in course success in attracting underrepresented students to a computing major.

RESOURCES

For more information contact Jim Cohoon at cohoon@virginia.edu.

NCWIT offers practices for increasing and benefiting from gender diversity in IT at the K-12, undergraduate, graduate, and career levels.

This case study describes a research-inspired practice that may need further evaluation. Try it, and let us know your results.

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How Do You Recruit or Retain Women through Inclusive Pedagogy?
with Case Study 2

Undergraduate

Physiology is important, but learning occurs within social environments, and it is mediated by the communication norms of those environments. As educational researchers Margaret Eisenhart and Elizabeth Finkel wrote, learning develops when one "changes from novice to expert, newcomer to old-timer, or naïve to mature practitioners in a social practice such as the activities of a science curriculum or an engineering workplace" (p. 8).

Decreased confidence among women is a frequently recurring theme in STEM and IT research. Women are more likely than men to lose confidence in their ability to complete the tasks required for earning acceptable grades, even when their performance is equal to males'. This loss of confidence can result from the suggestion that women do not fit the image of "scientist" or "engineer." We know that students and professors maintain mental models of the types of people who belong and what they can or should contribute. For example, two studies in engineering showed that despite entering their engineering majors with stronger academic preparation than their male peers, women were often considered less capable academically, or even described as "not the real engineering type." Not surprisingly, women in these studies eventually came to view themselves in the same way, resulting in either dropping out or practicing on the margins in their project groups. With repeated (and often subtle) messages that one is not like the other students— not as smart, not interested in the same activities, not a "real" computing major— it becomes difficult to imagine oneself developing the identity of a computer scientist.

Classroom opportunities for holding intellectual conversations can help to alleviate the loss of confidence among women, while allowing them to develop support groups and networks of intellectual support. Hearing other students talk about what they are learning gives women better information for making judgments about whether they in fact do belong there. And, other students hearing women's intellectual talk forces them to recognize that women are competent contributors to the intellectual enterprise.

WHERE WE LEARN SHAPES OUR LEARNING

Both the physical and the social aspects of a learning environment influence student participation and satisfaction, as well as learning itself. For example, when students' seats are bolted to the floor facing a lectern, student collaboration can be inhibited.

An important aspect of a classroom learning environment is the communication climate. When instruction is mainly lecture-based with few or no opportunities for interaction, students have little expectation that they will, can, or should learn from each other. Under these circumstances students may resist different teaching methods such as student-led discussion or small group-work. Studies show, however, that with effective teaching, small group-discussion enables students to effectively internalize and apply interpretive procedures. Hearing other students talk about the concepts being taught has many benefits. Especially important in this process are the supportive relationships and the network of learning partners students can develop. So, despite the years of socialization and expectations that students (and instructors) bring with them, new routines can quickly develop into new norms.

Despite the years of socialization and expectations that students (and instructors) bring with them, new routines can quickly develop into new norms.

RESOURCES

Eisenhart, M. & Finkel, E. (1998). *Women's science: Learning and succeeding from the margins*. Chicago, IL: University of Chicago Press.

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