WOMEN/MINORITIES IN COMPUTER SCIENCE: WHERE ARE THEY?

NO ATTENTION NO RETENTION

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ABSTRACT

Lack of women (and other minorities) has been a long-standing situation in the sciences. Socialization and "the shrinking pipeline" are contributory factors. Both of those factors need long-term solutions. In the meantime, there are some solutions that can immediately be implemented that are not terribly costly. For example, supplying escort services so that women can safely come to and from labs and classes is relatively inexpensive. Tighter security benefits all students and faculty. A more difficult solution is for the academic administration to value the time faculty spends with students as highly as the administration values grants and papers. If you don't give the students attention, you won't get retention.
INTRODUCTION

Lack of women (and other minorities) in the sciences has been a long-standing situation. Many factors contribute to women not attempting a career in the sciences. Socialization from birth through high school plays a role in that:

1- males are usually more mechanically oriented. Males are given erector sets; females are given dolls.

2- most role models are male, including in computer ads.

3- females, with the same level of intelligence and higher grades, perceive themselves to be less intelligent than males perceive themselves. Females tend to have lower self-esteem.

4- Software themes (war, blowing things up) tend to appeal to males, not to females.

"The Shrinking Pipeline" exacerbates the retention of females from high school to college, undergraduate school to graduate school. As college professors, we cannot effect change on all levels. But, we can implement some changes that should increase the retention of females (and other minorities) in computer science. The basic premise of all the following suggestions is "If you don't give them attention, you won't get retention."

SUGGESTIONS

1. Administrative support is key. Most of the suggestions that follow require time. As we all know, with teaching a full-load and the increased pressure to publish and obtain grants, we simply do not have the time to spend with students. Last year, at our university, the department had 45 NSF scholarships for students in CS, GIS, Math and Engineering Technology. At the time, one of the authors was teaching all sections of our CS1 class. Despite her strong encouragement, students were hesitant to apply as they did not know how. So, she scheduled individual appointments with all interested students. Her day began at 9:00 a.m. and ended at 8:30 p.m. for over two weeks. All the students, with whom she worked, successfully obtained a scholarship. Over 90% of these students are under-represented and/or first-generation. All of these students said that they would not have applied if she had not pushed them to do so.

2. Special efforts need to be made to encourage females to participate in programming classes and computer science clubs. For example, hold a Saturday "computer brunch" for females, and invite women engineers and programmers into the classroom. [DI]

3. Safe access to classrooms, labs and offices must be provided. Students as well as faculty often need to work late hours in order to succeed in the field. Women are particularly vulnerable in early morning hours and evening hours. Short routes to parked vehicles, well-lit parking lots and walkways, escort services and adequate surveillance and security are needed. [PA]
4. Professors and staff need training to provide feedback that builds self-esteem and eliminates discrimination. "Provide personal encouragement: Be aware that women will be more likely than men to perceive their performance as less satisfactory..." [BU]

   In addition, "Increased awareness on the part of faculty of their differential treatment of male and female students will help". [LN] Professors must ensure that the female students do not become invisible. Many times the same remark made by a man is acknowledged and praised, whereas it is ignored when made by a female. So, professors need to make a conscious effort to afford all students equal attention. [PA]

   "Videotapes of classroom interaction have found the following unconscious biases:
   - Women are interrupted more than men
   - Faculty members make eye contact with male students more often that with female students.
   - Faculty members are more likely to know and use the names of their male students than of female students.
   - Women are often asked fewer or easier questions than men." [SE]

5. Classroom examples need to be non-gender specific. A topic that is a poor choice for a classroom example is one involving automotive terminology. We tend to create examples that pertain to our lives. At one point one of the authors was purchasing a new vehicle. So, on a test for a 3-dimensional array problem, she used the model, make and vehicle type. Although she included a description, one of her non-traditional female students could not understand the problem.

6. Patronizing and demeaning comments need to cease. [PA] For example, one of author's ex-students came to her with a complaint. In her GIS class, the instructor gave examples of building things. After giving the example, he would say, "Now, I know you girls do not understand that, so let me explain that to you."

7. Shift to a cooperative rather than a competitive model. Encourage student participation. To facilitate this, change the "normal" seating arrangement to a U-shape or small tables. Encourage study groups. Have students work in groups. Have times that students meet outside the class. For example, one of the authors holds extra review sessions for interested students before each exam. [BU]

8. Change the grading system. Along with the cooperative environment, the use of a curve needs to be eliminated. Discuss the grading system. Explain to students that one poor lab grade will not cause them to do poorly in the class. As a matter of fact, the authors explain to students that they can do extra-credit to replace a lab grade. [BU]

   Make students aware of the services available to them on campus such as:
   - Computer Science Lab Assistants
   - The Tutoring and Learning Center
   - The Counseling Center for test anxiety, study and test-taking skills.
Office for Students with Disabilities. Some of my students for whom English is a second language, have done well using the reading machines.

In CS1, the authors have their students go on a "Treasure Hunt". Students are required to visit the above offices, the degree coordinator, their faculty advisor and all labs on campus.

9. Mentors [LN] and role models need to be provided. The real solution is to increase the number of females so that role models and mentors are highly visible. In the meantime, one method is to pair undergraduates with graduates; junior faculty with senior faculty. [PA] Make women more visible. Invite alumni and speakers from industry. [CS]

10. Make yourself accessible. Require each student to come to your office during office hours. Tell students that they are to introduce themselves, tell in what class they are registered, and discuss their background. Keep your door open during office hours. Use email to field student communication. At the beginning of each semester, the authors set up an address book for each class. When changes are made in due dates or assignments, we simply email the entire class. Students also know that they can email us any time and we will respond within 24-hours, (usually in a few hours.) [BU]

SUMMARY

The majority of the solutions above, require additional time of faculty. Mentoring, providing encouragement verbally and written, being accessible to students, replying promptly to email, all require faculty to make an extensive time commitment. Until these activities are valued by administrators, these changes will not occur. Faculty simply do not have the time to make this commitment given the demands for papers and grants. When the administrators finally realize, "without attention, you won't get retention", and give release time to those faculty who want to effect these changes, we'll be first in line.

REFERENCES


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