

Where have all the women gone?



Ada Lovelace,
The 1st Programmer



Grace Hopper,
Creator of Cobol



Katie A. Moor
PhD Student
Indiana University

Ada Lovelace was the first programmer. We learned about her during last night's documentary, *To Dream Tomorrow* (<http://www.mith.umd.edu/flare/lovelace/>).

Admiral Grace Hopper (Navy) is a famous computer scientist who created Cobol to allow people to program in "plain English." She also found the first computer "bug" (she found a dead moth in the Mark II).

Who will be next? Could you or one of your students be one of the famous women in computing?

Problem?

Recruitment

Retention

What can we do?

I will first discuss what is the problem? Where have all the women gone? Why is it important to have women in computing?

 <p>Problem?</p>	 <p>Recruitment</p>
 <p>Retention</p>	 <p>What can we do?</p>

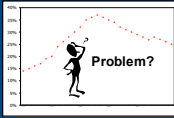
Next, I will discuss recruitment – how to get women interested in computing. We cannot drag women into our classrooms, so how can we get interest.

<p>Problem?</p>	<p>Recruitment</p>
<p>Retention</p>	<p>What can we do?</p>

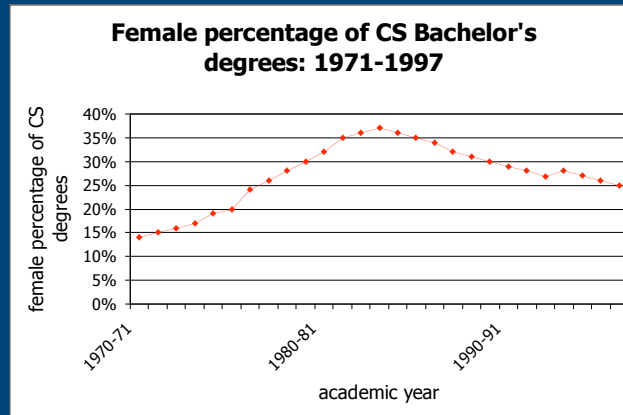
Once we have women interested in computing, how do we keep women in computing?

<p>Problem?</p>	<p>Recruitment</p>
<p>Retention</p>	<p>What can we do?</p>

Finally, I will discuss what we can do right now to help women in computing.



Where have all the women gone?

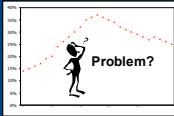


Cohoon, J. McGrath. "Toward Improving Female Retention in the Computer Science Major" in Communications of the ACM: May 2001.

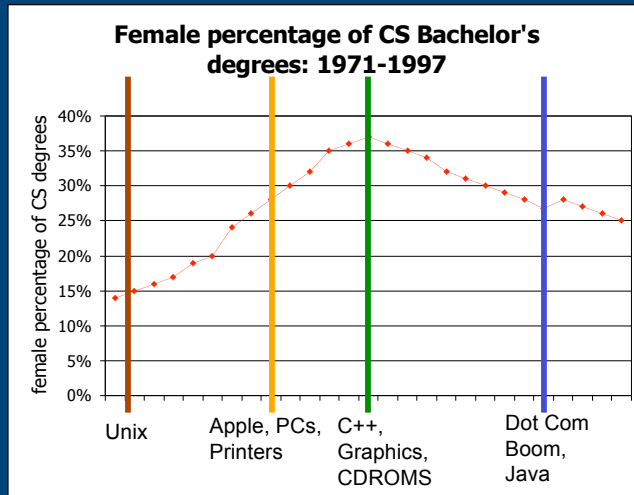
Here is a graph from Dr. Cohoon's research. It shows the percentage of CS Bachelor's degrees. The y-axis is the percentages of degrees. The x-axis is the academic years.

We can see there is a peak in 1983 at 37%. There have been lots of ideas about why women BS degrees peaked in 1983. When Dr. Cohoon presented her work at a talk I attended, a professor gave his idea of why it peaked. Around the time of 1983, everyone wanted to get involved in computers. Universities were running out of resources, so they made courses a lot more competitive. Courses were designed to "weed out" students – if you weren't in a certain percentage, you could not move onto the next course. The professor saw a lot of women leave the discipline because they did not like the "cut throat" culture resulting from the weed-out courses. Why deal with the culture if you can make the same amount of money in a different field?

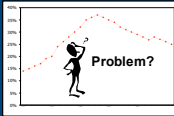
In the mid-90s we can see there is another little peak from the dot com boom.



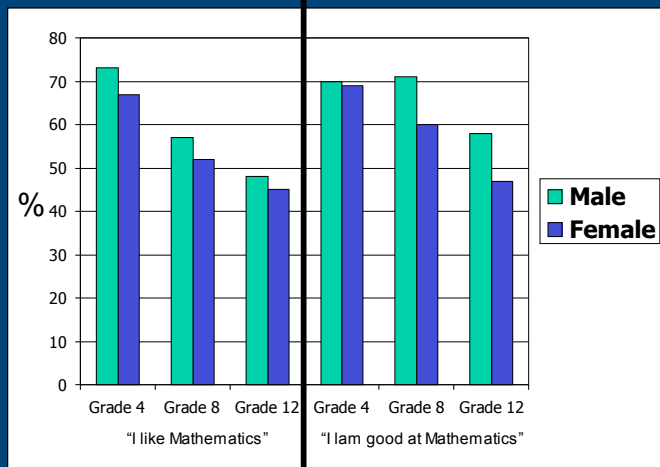
Where have all the women gone?



Here I added a rough computer history timeline to Dr. Cohoon's work to see what was going on during that time. Some research talks about how more women migrate to computing for the art/design aspect. I don't want to bolster any stereotypes, but it is interesting that Apple introduced one of the first graphics applications in the early 80s around the time of the peak.

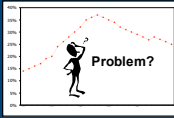


Dispelling some rumors...

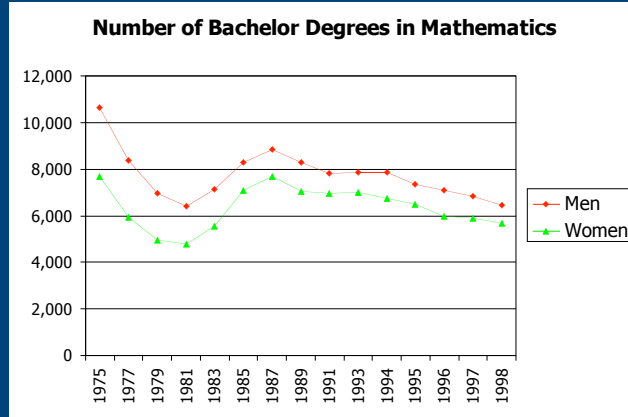


National Science Foundation. Women, Minorities, and Persons with Disabilities in Science and Engineering: 2002. July 2003.

I'd like to briefly dispel some rumors... One rumor I hear a lot is women do not go into computing because they do not like or are not good at math. Here is a study from 2000. They interviewed a random group of students in 4th, 8th, and 12th grade asking them if they think they like mathematics or think they are good at mathematics. We see that girls do not quite like math as good as boys...but they do think they are good at math (even if they don't like it) at higher rates. This shows us that they have confidence in their math skills...they just need some encouragement and the right classes to hone their skills and get them interested in other areas to apply their knowledge. Maybe then they could enjoy math more.

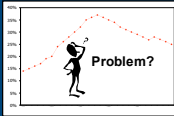


Women can do math



Association of Women in Science. Statistics:
http://awis.org/statistics/r_statisticsmain.html

Here again we see that women are getting mathematics degrees. Interesting enough, women have the same peaks as men – not the case in computer science degrees.



Why do we need women in computing?

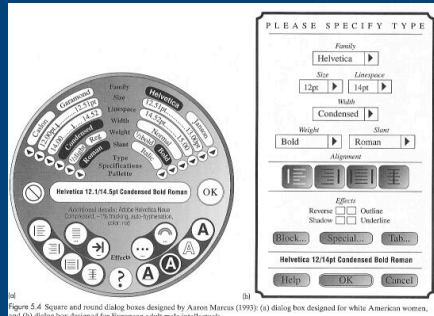


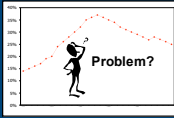
Figure 5.4. Square and round dialog boxes designed by Aaron Marcus (1993): (a) dialog box designed for white American women, and (b) dialog box designed for European adult male intellectuals.

- Program design is improved when designers better understand users.
- Having designers from a diversity of gender and ethnic backgrounds will improve designs.

DESIGN: Marcus, A (1993) Human communication issues in advanced UIs. Communications of the ACM, 101-109.

USER STUDY: Teasley, B., Leventhal, L., Blumenthal, B., Instone, K., and Stone, D. (1994) Cultural diversity in user interface design. SIGCHI Bulletin, 26(1), 36-40.

Is Diversity in Computing a Moral Matter? In Inroads, by Deborah G. Johnson & Keith W. Miller



Give women the opportunity to succeed in computing



- Over half of male students who have a computer at home have the computer in **their room**
- Only 17% of women received a computer early in their education (40% of male students reported having computers early on)

Unlocking the Clubhouse: Women in Computing.
Jane Margolis and Allan Fisher



Where do we start?



- At **all ages**, boys spend more times playing video games
 - Age 8, twice as much time gaming than girls
 - Over age 14, over 50% more gaming than girls
- Gaming = confidence in computing

Unlocking the Clubhouse: Women in Computing.
Jane Margolis and Allan Fisher



Recruitment

High School is Important



- Boys typically make decisions about computing early on from gaming
- Girls “try things out” in high school

Unlocking the Clubhouse: Women in Computing.
Jane Margolis and Alan Fisher

How do we get women interested in computing?

Recruitment

Women in Grad School...
WOMEN of VALOR
Piled Higher & Deeper by Jorge Cham

Women in Grad School...
WOMEN of VALOR
SUPPORT your local female GEEK

Piled Higher & Deeper by Jorge Cham
<http://www.phdcomics.com>

How do we get women interested in computing? We cannot drag them into the classrooms!

It would be nice if we could hang up some signs and get women interested in computing like we see here on the left. Here is a sign made by Jorge Cham, a recent PhD who makes comics for graduate students. Unfortunately, look at this last line, "SUPPORT your local female GEEK." Some girls do not want to be associated with "geeks."



Recruitment

Dispel the geek stereotype

- CMU Roadshow
- Invite guest speakers
- Be a positive role model






CMU Roadshow: <http://women.cs.cmu.edu/What/Outreach/Roadshow/>

However, not all computer scientists are geeks. How do we dispel the geek stereotype? How do we tell students not all computer scientists are dilberts?

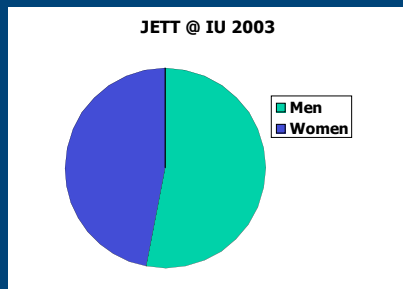
The CMU Women in Computing group created the “Roadshow.” The women gathered pictures from themselves, friends, and professors from when they were young and doing activities they enjoy. Then, they composed a powerpoint presentation describing to the students how they got involved in computer science. The presentation also discussed what is computer science (not just Programming, Programming, PROGRAMMING!). The students were shown pictures of people doing activities they enjoyed doing as shown on the pictures to our left and asked the children, “Do you think he/she is a computer scientist?” Well...do you? All three people are computer scientists. The ended the presentation by describing interdisciplinary work available to computer scientists. They presented the “Roadshow” at elementary, middle, and high schools in the Pittsburgh area.

Also, invite guest speakers from industry and/or academia – male or female. Show students not all computer scientists look like Bill Gates.

Finally, be a positive role model yourself.



Educate yourself, teachers, counselors, and parents



- Recommend home computers be placed in centralized locations
- If your classes are not 50-50, notify administrators
- Talk to parents and counselors to help encourage women
- Create a technology club

Really cool stat about this JETT workshop....lots of women are teaching AP CS. When women see other women teaching computer science, it shows them that women can succeed in this field. An idea of “if she can do it, I can do it...”

How many of you have a 50-50 class ratio? If you do not have a 50-50 class ratio, I encourage you to notify your administrators and tell them why it is important to have women in computing. Administrators could help find funding, talk to counselors and bring up these issues.

Please, please talk to parents and counselors to encourage women in computing. Studies have shown counselors shy away from recommending computing to girls and certain boys. Everyone has their biases... Researchers have reported that counselors have an idea of the “computer type” (usually male), thus they do not recommend higher math and/or CS to women. Let counselors know that all kinds of students are needed.

Encouragement starts at home..make sure parents know that women can be computer scientists and to encourage their daughters to at least tinker with computers.



Create opportunities for interdisciplinary work

- Over 40% of women wanted to do interdisciplinary work (art, medicine, education, etc.).
- Women design applications for communication and collaboration. Men design applications as an “extension of power.”



Unlocking the Clubhouse: Women in Computing.
Jane Margolis and Allan Fisher

Honey et al. (1991) Bank Street College Center for Children and Technology.

We understand that the AP curriculum is jammed pack. It is difficult enough to teach the students everything in the curriculum in preparation for the exam...and now I'm asking you to create opportunities for interdisciplinary work. However, to improve retention we must show students that once we have the background knowledge, we can apply our knowledge to other fields. 40% of women want to do interdisciplinary work (whereas only 13% of men showed an interest). One way to create interdisciplinary opportunities is to start a club.

On the right is a picture of a website an elementary student created. While at Notre Dame, I showed elementary school girls how to create webpages. Webpages encourage girls to use computers, use the internet, apply some logical thought, and practice writing. We used the free Netscape composer and uploaded it to a local Notre Dame site. One mention of warning if you want to do this – create a subset of images the girls can select from (searching the web can lead to unsuitable material very quickly) and make sure girls put limited amounts of persona information on their website (no addresses, school name, etc.).

Another project I was involved in was teaching high school students how to use Lego MindStorms. I showed students how to build machines and program them...but I didn't tell the students what to build. On their own, the two girls in the group worked together and the boys broke up into groups of their own. The girls made a “secret note passer” – they laid a track in the room, dropped their note into the little car. pushed a button. and the car zoomed



Provide a safe, positive lab environment



- Computer labs allow students to get a break
- Limit harassment and lewd conduct
- Lab set-up influences how students work

Geeks don't want to be in the hub-bub of athletes...we have to make sure all students have a place to work, hang out, and enjoy computers. Having rows of computers may make other students uncomfortable when the "geeks" are there. There have been studies that made "computer clusters" within a room. This allowed the "geeks" to hang out in their cluster, girls to hang out in another cluster, and other students to hang out various clusters. The clustering of computers lead to more variety in the students who used the lab and helped mix the groups. When students needed help, they looked to the "geek cluster" allowing everyone to begin mixing together.

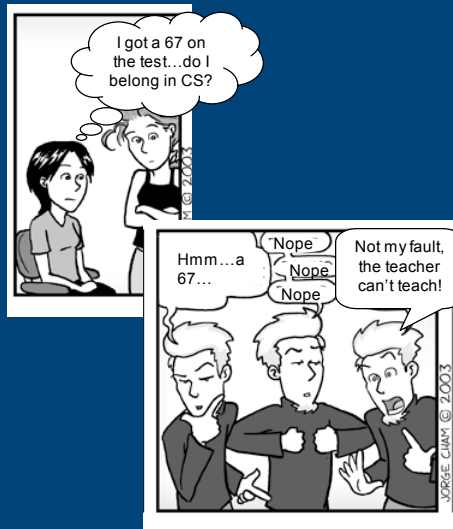
Remember...students have not been in "the real world" yet. They may not be aware of professional behavior. Thus, it is our responsibility to teach professional behavior. For instance, make sure there are no naked pictures or scantily clad pictures used as screen savers, backgrounds, etc. This can make others feel uncomfortable. Also, monitor behavior and language that may be offensive.

Groups work well for girls

Girls help others when they are done...boys keep playing



Create a community for all students



Piled Higher & Deeper by Jorge Cham
<http://www.phdcomics.com>

- Why aren't there Men in Education or Men in Psychology groups?
- Create a support structure for female students
- Keep in mind how people think

Create a community for **all** students.

I asked my friends in education and psychology why there aren't Men in Education or Men in Psychology groups like there are Women in Computing and Women in Mathematics groups. My friends were not sure... but mentioned that when a man enters their field, they embrace him. They are excited that he is interested in education/psychology and tell him what a great role model he will be and understand what he can offer to the field. As a woman in computing, I can tell you we do not get a warm reception like that. When a woman enters computer science, she must prove herself. Some men do not think women can necessarily do what they can ... so it is up to women to prove themselves. This is a tiring process that would be nice if we could one day not have to constantly prove ourselves to the masses.

Create support structures for female students. A lot of universities have women in computing groups. This support structure is very important to let women know they are not alone. In computer science, we currently have a "geek culture" where you'll hear guys say, "You're not a real computer scientist unless you've read book X." In the geek culture, posturing is okay... you'll here guys talk about the "latest and greatest" chip...but sometimes they don't know what they are talking about...they are just talking about nothing. Also, there is a lot of bragging...either someone pulled an "all nighter" to create an application that was not an assignment or someone will finish the assignment in no time flat. Having a women's group helps create another culture where it is okay if you did not read "book X" or stay up programming all night for



Encourage women!

- Be aware of your voice, gestures, and body language
- Do not “talk down to girls”
- Ask high-order, open ended questions to all students
- Put girls in touch with female scientists
- Encourage questioning and exploration for all students

North Central Regional Education Laboratory


Encourage women! Encourage all of your students equally.

I know you are all sitting there saying I do that, I do that...but I'm asking you to really concentrate on your actions. A woman who had read about how teachers make more eye contact with boys, call on boys more, etc. even found herself doing these exact things. Sometimes it is so easy to call on the guy who is confident and “has all the answers”...but I encourage you to call on students who don't have the answers all the time.

Do not talk down to girls... When I was in high school, a math teacher told me, “It's okay if you don't get this..you're a girl.” Of course, this really motivated me...gave me an “I'll show you attitude.” However, the comment wasn't made to motivate me...and it doesn't motivate everyone. So, please be mindful of this.



(bullets)

Encourage questioning and exploration for all students. Boys see computers as toys...toys imply play...and play implies tinkering. So, if something isn't working how they would like, they will tinker with it to make the application work. Girls see computers as tools (I.e. communication and collaboration research)...tools imply work...and work implies if something is not working you look at the manual, directions, or ask the teacher. Try to get girls to tinker do not answer questions immediately



Get Involved!

- ACM-W High School Chapters
- Systems
- Computer Girl
- Regional Grace Hopper Conference

Finally get involved!

The Association of Computing Machinery (ACM) is a professional society for people in computing. The ACM has sponsored a committee to foster a community for women in computing. The ACM-W has created high school chapters to foster a community with girls in computing and encourage them to continue their studies. Being associated with ACM-W can put you in touch with other women in the field (guest speaker opportunity), perhaps some funding for clubs, outings, etc. and gives you a more official presence at your school.

Systems is an e-mail community. There is a systems email group for professional women, women in academia, graduate school, undergraduate, and high school. I am on the systems email list and have only posted to it once. I was the only woman taking the PhD qualifier exam. I did not have a study group and was not sure how to go about studying for the qualifier. I posted the question to the group (how to study for the “qual”) and received 15 responses from women at really good schools. Not only that, but five of the 15 continued emailing me to see how I was doing in my studying and encouraged me to keep working.

Computer Girl is a website (there are many websites on the Session 6 webpage (<http://www.cs.indiana.edu/~jett/schedule.html>) specifically for girls in high school interested in computing. The website has links to mentoring,