Increasing the number of women majoring in CS: what works?

Maria M. Klawe
Dean of Engineering and Applied Science, Princeton University
Chair, Board of Trustees, ABI
Past President of ACM
Why it matters
Why the numbers are low (myths, opinions and facts)
What works
Why getting more women to be CS majors matters?

- 1990: Equity
- 1995: Demand for IT skills in workforce
- 2000: Benefits of workforce diversity on IT creation and application
- 2005: Health of CS in academia and industry
Percent of students interested in majoring in Computer Science

<table>
<thead>
<tr>
<th>Year</th>
<th>Interest (%)</th>
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<tbody>
<tr>
<td>1995</td>
<td>2.1</td>
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<td>1996</td>
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<td>2000</td>
<td>3.7</td>
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<td>2001</td>
<td>3.3</td>
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<td>2002</td>
<td>2.2</td>
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<td>2003</td>
<td>1.7</td>
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<td>2004</td>
<td>1.4</td>
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</tbody>
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HERI's American Freshman results (the best survey of incoming freshmen).
Why do fewer females

- Play computer and video games?
- Take computer science courses?
- Major in computer science?
- Go into computing careers?
Some often-heard answers...

- Computers are a boy thing
  - Teenage girls spend more time on the internet than boys
- [Girls, women] can’t do math
  - Girls outperform boys in high school math
- You have to program 24/7 and …
- Programming is boring
- Computer people have no life
- To succeed you need to be born with the computer gene
- Computing jobs are all gone now
True or false?

- Some of these “answers” were [are] partially true at some point
- Where true or false, they persist in influencing students, teachers, parents, media
Some “truths”

- Boys spend more time playing video and computer games than girls
- Boys and girls like different things in video and computer games
- Most games are designed for boys and men
- Most boys who learn to program early do so in order to create a computer game
- Boys monopolize access to computers at school and at home
Some “truths”

- Under-prepared high school CS teachers rely on boy hackers in class
- Males taking intro CS courses are more prepared and act more confident
- Assignments focus on CS rather than applications
- Software, assignments often buggy
More truths

- In N.A. gender differences appear early and are sustained into adulthood
  - Using computers by age 7-10
    - getting access
    - choice of activities
    - style of use
    - confidence
  - Interest in courses/careers by age 10-14
K-12 SWIFT Career Interest Survey
1998-1999

- 7300 Vancouver students in grades 8, 10, 12
- participation decided by English class teacher
  (60% participation) but results from entire schools analogous
- interest in subjects, ability in subjects, career influences
- participation, interest, ability in IT activities
- perception of different kinds of careers
Interest in taking a course
Expected performance

![Bar chart showing expected performance across different subjects for male and female students.](image)
Career influences

![Bar chart showing career influences](image)

- Make World Better
- Career and Family
- Flexible Hours
- Challenge
- Financial Rewards
- Personal Abilities
- Personal Interests
- Job Opportunities
- Job Image
- Teachers/Counselors
- Parents
- Friends

**Gender**
- Male
- Female
Issue 1

- Choice of careers follows interest and perceived ability
- Most females think that computing is less interesting than other options and that they won’t be as good at it
Issue 2

- Females often have the “impostor syndrome” to a higher degree than males
  - [lack of confidence, lack of sense of belonging]
- this causes many females to leave computing courses and careers
- Imposter syndrome occurs at all ages, career points, and levels of achievement
solutions

- Increasing interest in computing
- Increasing confidence
- Increasing sense of belonging
Increasing interest

- Change the image
  - media, games, contests, workshops, speakers, programming in math curriculum
  - The Oprah project
- Emphasize applications
- Create joint majors, e.g. computer science and...
  - psychology, biology, art, music, languages, statistics, math, chemistry, theatre, business
- Provide work experience (coop terms)
- Include team work, users, communication, volunteer opportunities
- Research opportunities (DMP, REU, independent work)
Increasing confidence

- How we teach
  - Pairs programming, assignments in labs
- Send students to Hopper (San Diego 2006)
- Unfailing encouragement, positive feedback
- Role models and mentors
- Peer cheer-leading groups
- Comfy home base, OK to cry
- Learning how to become strong in an area of weakness
Increasing sense of belonging

- Achieving critical mass
- Creating environments supportive of personal lives
- Ensuring inclusive language, images, examples
- Suppressing jerky behavior
- Treasuring difference of opinion, difference of experience
- Hearing female voices
Everyone can contribute

- Encourage
- Provide role models
- Work on the image
- Help high school CS teachers (JETT project)
- Use pairs programming in intro classes
- Make your environment PL-friendly
  - photos, kid presence, part-time, flex-time
- Hear female voices
- Join ACM
The contribution of Larry Summers?
Remembering Anita Borg
www.abi.org
references

- One Hundred Ideas for “Women in Computing” groups, Gloria Townsend, Stephanie Ball, Laura Kuh
- Female Computer Science Students Who Pair Program Persist, Linda L. Werner, Brian Hanks and Charlie McDowell, preprint (submitted to JERIC)
- Special Issue of JERIC