national center for women & INFORMATION TECHNOLOGY
Revolutionizing the Face of Technology

RESEARCH ON ATTRACTING GIRLS INTO COMPUTING

Lecia Barker
Senior Research Scientist, NCWIT

TAG Organizers Meeting
February 12, 2011

Strategic Partners: Microsoft Bank of America

Investment Partners: AVAYA Pfizer MERCK

Overview of talk

Why are there so few girls in high school computing?

What do we know about girls and their influencers?

Forming messages that appeal to girls

Locating girls, conveying your message

Myths, misconceptions, and underrepresentation: Address them or not?

Evaluate outcomes: Please!

WHY ARE THERE SO FEW GIRLS IN HIGH SCHOOL COMPUTING CLASSES?

Research on Attracting Girls to Computing ζ TAG Organizer Meeting ζ Philadelphia, PA ζ February 12, 2011

Lack of Information and Misconceptions

- Computer science is… Programming? Keyboarding? Using software?
- Few students, parents, or teachers know what computer scientists do

Stereotypes Reduce Confidence and Interest

- Cultural belief: Disconnect between "feminine" and "technical"

- Stereotype threat: Fear of confirming stereotypes about my group
  - Hinders performance
  - Affects choices and aspirations
  - Set harsh standards and opt out if not met

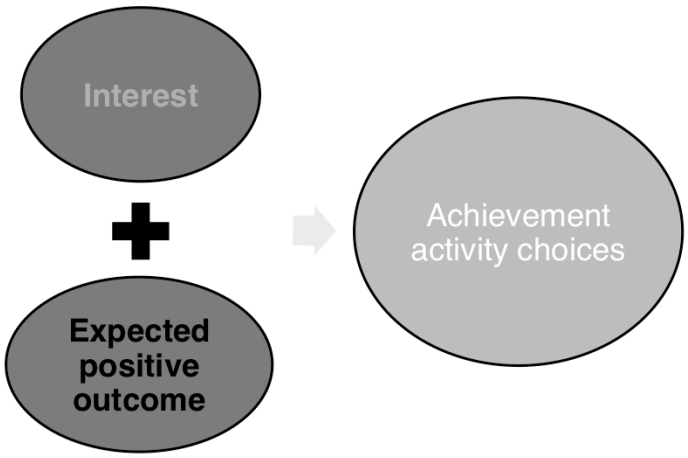
Research on Attracting Girls to Computing ζ TAG Organizer Meeting ζ Philadelphia, PA ζ February 12, 2011

"Girls don't think that way"

Overcome negative consequences of stereotypes

➢Foster belief that intellectual ability grows

Interest, values, expectation affect choice



Girls studied computing when they had

- Early, positive experiences with computing
- Adult encouragement
- Positive female role models
- Information about what computing professionals actually do

Research on Attracting Girls to Computing ζ TAG Organizer Meeting ζ Philadelphia, PA ζ February 12, 2011

Findings from different researchers suggest that certain factors help encourage students to pursue computing:

Early, positive experiences with computing, adult encouragement (especially from parents), positive role models (female role models affect girls), and more information about what computing professionals actually do in their jobs.

SOURCES:

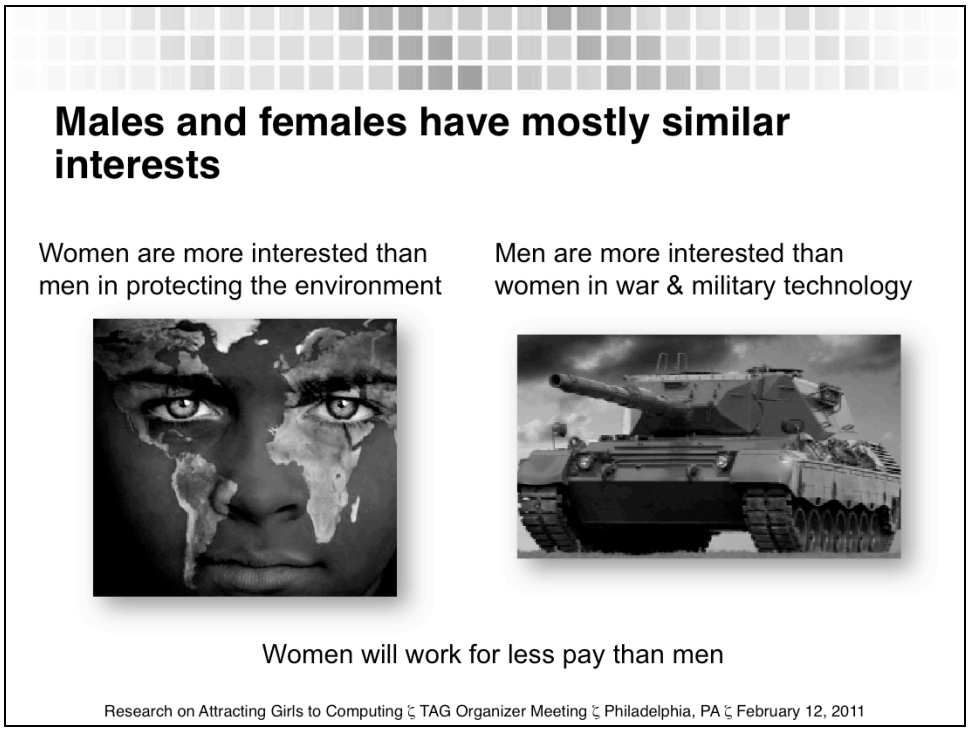
•Cohoon, J. M. and Aspray W. (2006). Introduction. In McGrath Cohoon, J. & W. Aspray (Eds.) *Women and information technology: Research on under-representation*. Cambridge, MA: MIT Press.; Jones, T., & Clark, V.A. (1995). Diversity as a determinant of attitudes: A possible explanation of the apparent advantage of single-sex settings. *Journal of Educational Computing Research, 12*(1), 51-64.; Schaumburg, H. (2001). Fostering girls' computer literacy through laptop learning: Can mobile computers help to level out the gender difference? Paper presented at the National Educational Computing Conference, Chicago.

•Shashaani, Lily. (1993). Gender-based differences in attitudes toward computers. *Computers and Education, 20*(2), 169-181.; Girls Scouts of the USA and NCWIT. (2008). Evaluating Promising Practices in Informal Information Technology (IT) Education for Girls PHASE III: Women in IT—Survey Results (www.ncwit.org/gseval); Tillberg, H. & Cohoon, J.M. (2005). Attracting women to the CS major. *Frontiers: A Journal of Women Studies, 26*(1), 126-140.

•Dryburgh, H. (2000). Underrepresentation of girls and women in computer science: Classification of 1990s research. *Journal of Educational Computing Research, 23*(2), 181–202.

•Barker, L. & Aspray, W. (2006). The State of Research on Girls and IT. In McGrath Cohoon, J. & W. Aspray (Eds.) *Women and information technology: Research on under-representation.* Cambridge, MA: MIT Press.

WHAT DO WE KNOW ABOUT GIRLS AND THEIR INFLUENCERS?



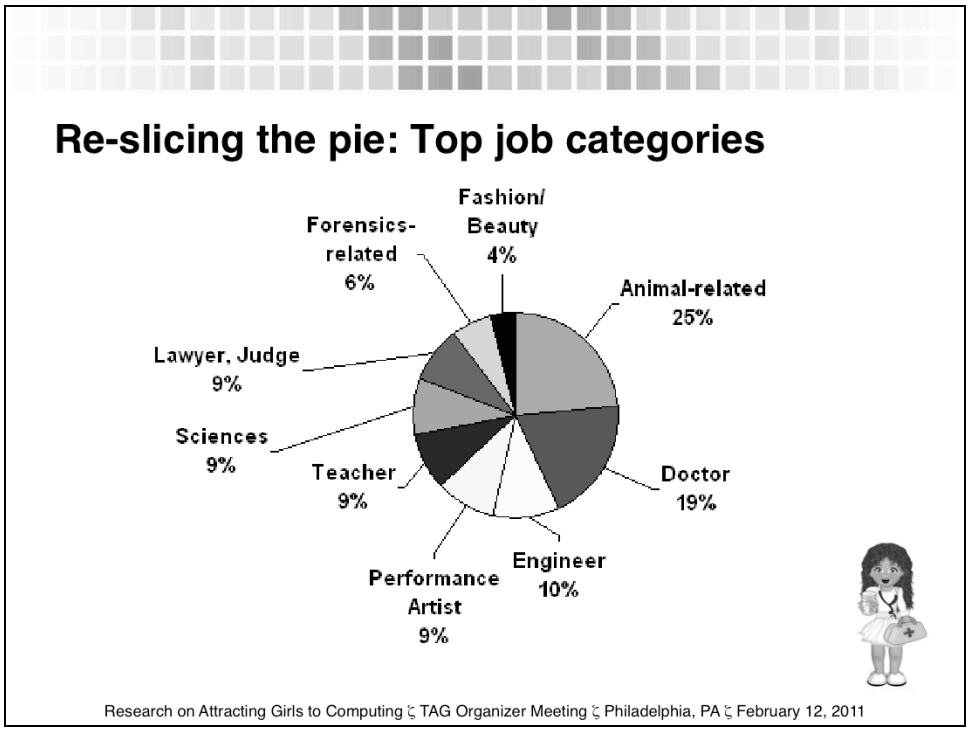
The implications of these aspects of socialization are 1) It is important that girls understand that they are capable of entering a computing pathway. White and Hispanic women may lose confidence of their abilities more easily than their male counterparts. 2) Influencers of girls must understand that they should encourage the girls, praise them.

According to Elaine Seymour's interview study of 335 college students around the nation, "most men experience a life-long pressure to develop and express an intrinsic sense of self-worth, to respond to challenge with displays of self-sufficiency and stoicism, and to show independence from the need for nurturing. By contrast, the socialization of most young women (including their formal education) encourages the development of a more extrinsic sense of identity. From early childhood, throughout the years of formal education, girls are encouraged to perform for the approval of others and to attach feelings of confidence and self-worth to signs (such as praise) that others are pleased by what they do. The degree to which any woman depends on significant others for her sense of achievement varies (as illustrated in many women's accounts) according to the mix of cultural influences that have been part of her socialization experience. The tendency to perform for others is not gender-exclusive: depending on the circumstances of their upbringing and education, we found young men may also exhibit this trait. However, the consequence of this pattern of socialization was clearly embedded in women's accounts across the data set, with one important exception—that of black women. This group reflected a pattern of socialization that encourages the development of independence in self-image and career choice, and of self-reliance and assertiveness in getting educational needs met. This group was distinctively inner-directed and determined, compared both with most other women and with most black men." (Seymour, 1999, Annals of the New York Academy of Sciences).

Category	N
Veterinarian/Work with Animals	455
Doctor	431
Don't Know	423
Engineer	227
Performance Artist	209
Teacher	208
Lawyer, Judge	194
Forensics-related	141
Scientist, non-specific science	127
Fashion- or beauty-related	88
Architect	77
Astronaut, Astronomer, Rocket Scientist	69
Nurse	68
Athlete	67
Marine Biologist	67
Writer	60
Designer, Interior Designer	57
Computer-related, Technologist	41
Chef	34
Miscellaneous	457
Total	3,500

Young girls' career interests

Source: Survey responses, 3,500 middle school girls at a science, technology, engineering recruiting event; 2004-2007



In this categorization, helping animals and various types of doctoring (pediatrician, neurosurgeon, plain old doctor) seem to be very appealing goals to middle school girls and it seems that activities embedded within these kinds of goals would have a high chance of success.

Data can be categorized in many ways. Here, I combined anything having to do with animals (e.g., veterinarian, marine biologist, animal control officer, etc.); anything to do with science (e.g., scientist of any sort, but not forensics or marine biologist, since the motivations for these may be criminal analysis and working with animals rather than discovery).

Intended Major 2006: Females	N	%
Health and Allied Services	132,857	24%
Social Sciences and History	69,552	13%
Business and Commerce	66,673	12%
Education	62,434	11%
Arts: Visual and Performing	50,583	9%
Biological Sciences	38,942	7%
Communications	26,838	5%
Public Affairs and Services	17,237	3%
Language and Literature	13,951	3%
Architecture or Environmental Design	13,608	2%
Undecided	12,466	2%
Engineering/Engineering Technologies	12,134	2%
Physical Sciences	6,288	1%
Agriculture or Natural Resources	5,417	1%
Foreign or Classical Languages	5,188	1%
Computer or Information Sciences	4,605	1%
Mathematics	3,611	1%
Other	12,176	2%
Total	554,560	100%

Present goals: High school girls' intended majors

Source: College Board, College-Bound Seniors, 2006

Data provided by College Board directly to NCWIT.

Intended Major 2006: Males	N	%
Business and Commerce	77,621	18%
Engineering/Engineering Technologies	70,249	16%
Health and Allied Services	46,511	11%
Arts: Visual and Performing	34,245	8%
Computer or Information Sciences	33,338	8%
Social Sciences and History	31,925	7%
Biological Sciences	22,106	5%
Education	18,516	4%
Architecture or Environmental Design	18,476	4%
Undecided	14,188	3%
Communications	13,459	3%
Public Affairs and Services	12,395	3%
Physical Sciences	9,297	2%
Technical and Vocational	7,481	2%
Mathematics	5,606	1%
Language and Literature	5,542	1%
Military Sciences	4,434	1%
Other	12,705	3%
Total	438,094	100%

Present goals: High school boys' intended majors

Source: College Board, College-Bound Seniors, 2006

One might infer from these numbers that planning for being a breadwinner is acting on the boys' choices.

What typically influences teen girls?

- Belonging, with potential to have status in the group
- Role fulfillment - conforming to expectations
- Not conforming

Who are the influencers of girls?

Family
Friends
Teachers
Counselors
Other adult leaders
Celebrities
Boys

Sons: Plan for future family responsibilities

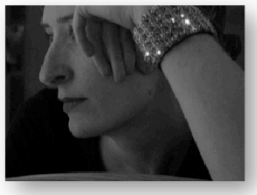
Daughters: Be happy in career choice

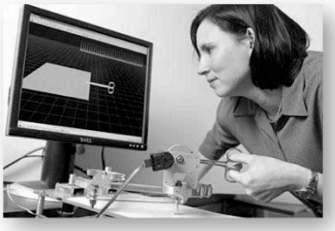
Research on Attracting Girls to Computing ζ TAG Organizer Meeting ζ Philadelphia, PA ζ February 12, 2011

Parents of teens and tweens may have a hard time believing this, but family is the single largest influence of a girl's career choices. In this sense, family stands for years of socialization in a particular socio-economic group, the awareness of family members of different types of job possibilities and careers, beliefs about appropriate behaviors for boys and girls, etc.

Families expected sons to finish what they had begun and to persevere for the sake of their future family responsibilities: they were more concerned that daughters "were happy" in what they chose to do (Seymour)

Implication for messaging: be sure that parents, teachers, other important adults also believe that this is a do-able, acceptable career path for young women.





FORMING MESSAGES THAT APPEAL TO GIRLS

Messaging overview

- Appeal to present beliefs, goals, values
- Consider opposing viewpoints
- Consider competing goals

What career-related message content is important?

- Economic security
- Flexibility: industry, geographic
- Job projections (BLS)
- High salaries for 4-year degree
- Job satisfaction
- Social relevance
- Challenging, problem solving
- Work with others
- Time for personal life

Tell parents that computing careers are enjoyable and offer financial independence

BLS includes job projects in the annual “Occupational Outlook.” It also includes comparisons of different types of jobs.

Teamwork and flexibility were found by Elizabeth Creamer (Virginia Tech) and colleagues to be important message components for women. While economic stability (presence of jobs and reasonable salaries) is important to women, it is not as big an attractor as it is for men. However, this will be important to your secondary and very important audience: parents.

Economic security is of especial importance to “up and coming” families. A four-year, rather than 8-year, degree is of especial importance to Latino families, when the parents may view college as an interruption in ability to work.

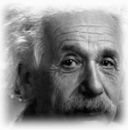
Remember that socially relevant work varies by target group. Use local knowledge (teachers, etc.) to find out what is interesting to this group of kids. They make have just had a unit on GPS and finding lost pets… etc.

What messages influence counselors?

- Positive forecasts for
- Job openings
- Career trajectories
- Pleasant work

What other content is important?

- Use local knowledge to plan events, activities
- Customize, demonstrate understanding, build trust
- An attainable goal with hard work
- Apply problem solving and interpersonal skills
- Be creative



Avoid implying that you have to be a genius

Research on Attracting Girls to Computing ζ TAG Organizer Meeting ζ Philadelphia, PA ζ February 12, 2011

Use local knowledge in planning your events. It will help you to understand your audience and to customize. Ask a teacher, parent, or even some of the kids what will be of interest locally. Doing this will also build trust, because they will believe you care about their interests, not just your own and your enrollment numbers.

Truth in advertising: this is not an easy major. It is time consuming, yet students frequently talk about the rewards when a program or system implementation works, solves an expressed problem. They will have to take a lot of math in most computing majors. But remember, you don't have to like it, you have to be able to do it.

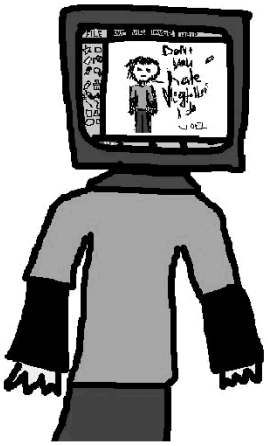
When a program of study is described as something for really smart people, it is a turnoff to girls especially, who may 1) not want to admit they are really smart for fear of putting themselves above their peers; 2) may not have the confidence that they are really smart, even if they are. This is a problem that has plagued engineering for year. Focus on problem solving and interpersonal skills.

Messages embedded in activities, assignments, and examples

- E.g., Robots
  - Just for fun?
  - For competition?
  - Saving lives?
  - Housecleaning?

Remember that despite their attention to fun and games, young people also want to do meaningful jobs and/or jobs that gain them status. That is, becoming a doctor is more than helping people, it's also one of a few people that actually has authority (usually) over one's parents. Lawyers go out and defend people from injustice (in the imagination of a middle schooler) and make a lot of money.

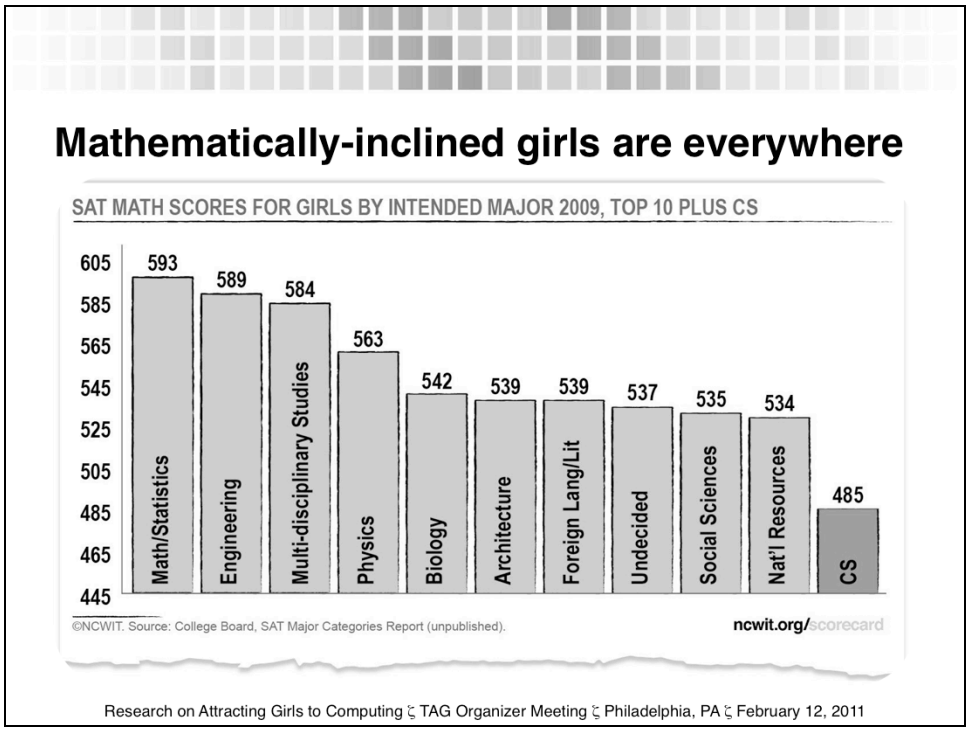
Test messages and images



LOCATING GIRLS AND CONVEYING YOUR MESSAGE

- Go where the capable kids are
- Recruit friendship groups so kids won't be isolated

- Personally extend invitations
- Ask other teachers who's good in their classes
- "Use your love of math…"



•In 2009, as in previous years, the computer science major missed out on some highly competent girls.

•Girls with the top SAT math scores were more likely to intend majors in math, engineering, multi-disciplinary studies, physical sciences, biological sciences, architecture, languages, social sciences, or natural resources rather than computer science.

•Of the majors chosen by top SAT math scorers in 2009, engineering (88,719 students), biological sciences (62,709 students), and undecided (42,120 students) attracted the most male and female students.

•It is worth noting that 31,022 students intended to major in computer science; unfortunately, only 13% of those intended majors were female.

One way you can Make a Difference:

•Learn some key components for recruiting girls into science, engineering, and technology by referring to a Promising Practice sheet created by NCWIT at www.ncwit.org/geset.

What to Do If Talented Students Object

Computer science
is
Boring
Hard
Machine-focused

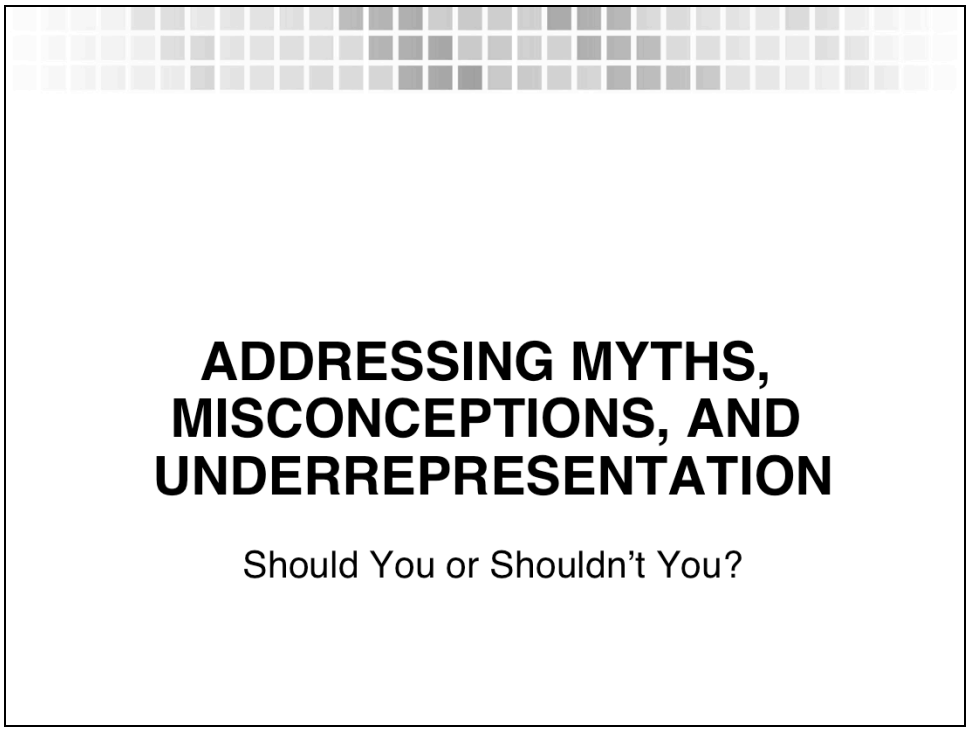
There are no jobs

Overcome objections and biases

- Use student's name
- Assure student s/he can succeed (if you believe that)
- Listen, acknowledge student's expressed beliefs – "I understand why you think that CS is …"
- Offer persuasive evidence – "… but can I show you the actual numbers?" or "but can I tell you about my former students?"
- Don't let refusal be permanent – "Can we talk again before you choose your courses for next year?"

Leverage your assets

- Alumni
- Parents of former students
- After-School Programs
- Recruiting Materials from National Sources (e.g., NCWIT, CSTA)
- ???



Geek image? Offshoring of jobs? Why do so few women pursue these college degrees in relation to men? What is the risk of addressing these issues head-on? What is the risk of not addressing them?

"Mythbusting": Geeks, cubicles, and guys

- May actually create awareness
- May create familiarity if they forget the details
- Once implanted, idea may be difficult to dislodge

"I've heard that before so it must be true"

See "How Warnings about False Claims Become Recommendations"
www.acrwebsite.org/topic.asp?artid=250

The basic finding is that once an idea has entered people's heads, repeated exposure to the idea tends to reinforce its original message, regardless of whether new information contradicts that message. So even though people are repeatedly reminded that Saddam Hussein wasn't involved in planning the Sept. 11 terrorist attacks, a pretty steady 40 percent continue to believe it.

What about offshoring?

- Parents, counselors may believe popular claims
- Alternatives:
  - Address head on
  - Describe BLS predictions
  - Address objections only if they arise

Address offshoring head on: “You may have heard that… but let me tell you which types of jobs are likely to be offshored – low-level programming jobs (fastest declining job in U.S.) and jobs that require little interaction….etc.) (a pre-emptive strategy)

You could instead simply be sure to state the BLS predictions, assuring the important audience member that there will be a job market (a pre-emptive strategy)

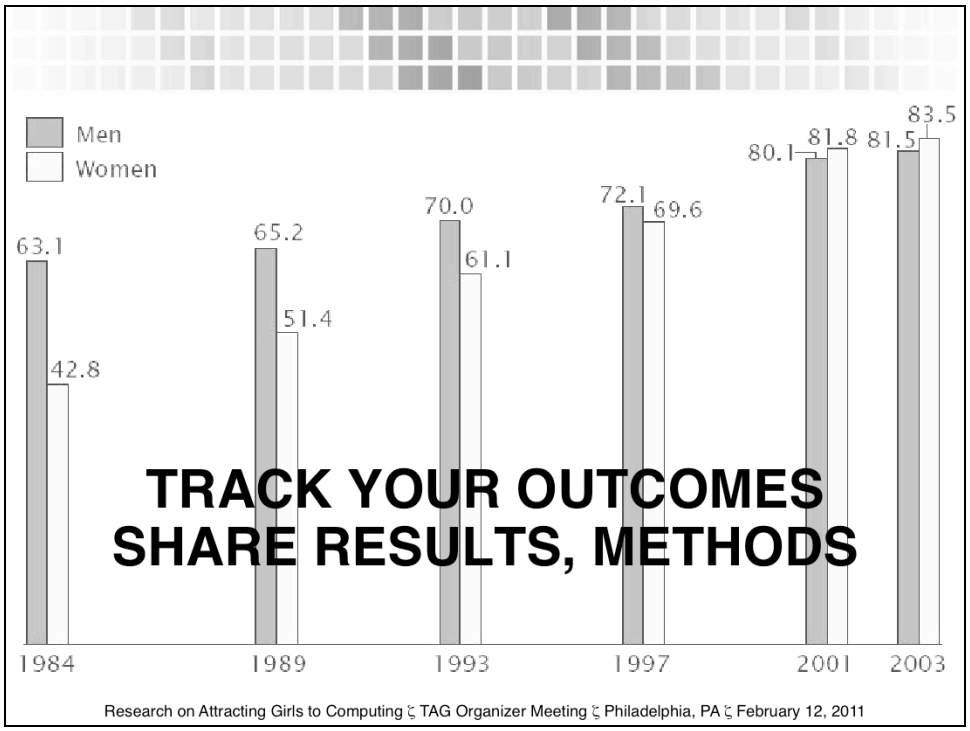
You can wait to address objections when they arise, then agree that there is popular reporting on this, and then tell about the BLS predictions (etc.)

What about underrepresentation?

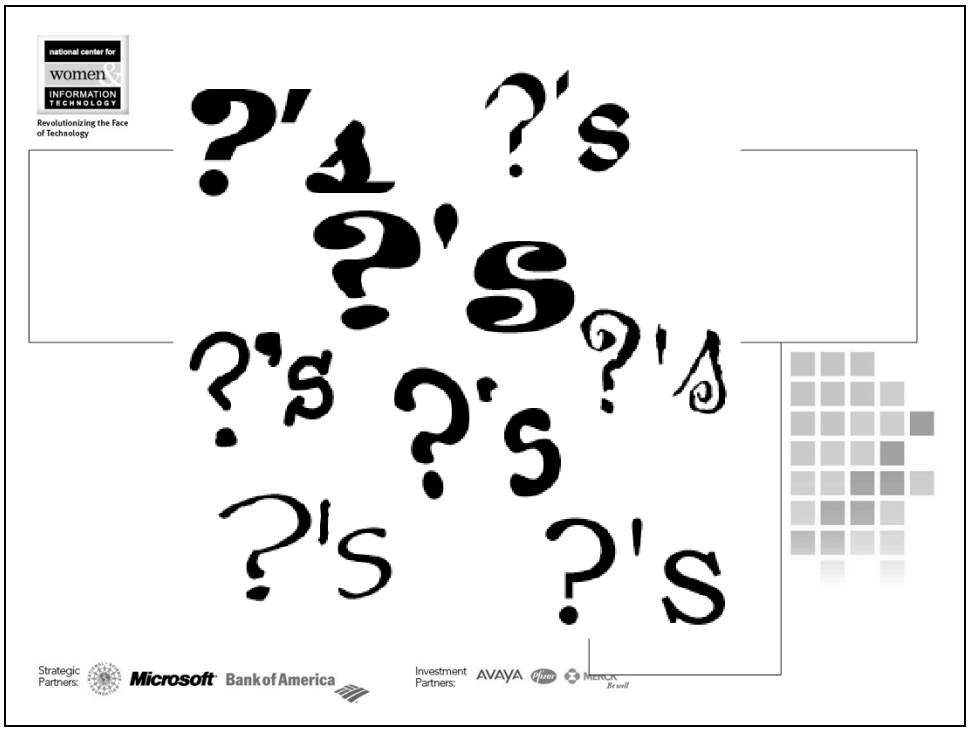
- If you tell them, you may scare them away
- If you don't tell them, it is like denying reality
  - Liken computing to other fields where women have historically been underrepresented, like medicine, law, or space science/astronauts
  - Show some very interesting and valued contributions of women computer scientists

"To talk about underrepresentation would scare away a lot of girls interested in technology. They don't want to be different." (contributed by Sylvia Beyer)

"To not address the underrepresentation of women is like denying reality. It would become the big elephant in the room." If you tell them, "talk about how this field is one of many others that historically have had few women, what a loss this is for girls who could be interested and for the field, and how fields do change---as has medicine, astronauts, etc.---and show some cool women who are doing computer science. In other words, the showing of the great/neat women counterbalances the discussion of the underrepresentation." (contributed by Jane Margolis)



TRACK YOUR OUTCOMES
SHARE RESULTS, METHODS


national center for
women
INFORMATION
TECHNOLOGY
Revolutionizing the Face
of Technology
?'s
?'s
?'s
?'s
?'s
?'s
?'s
Strategic
Partners:
Microsoft
Bank of America
Investment
Partners:
AVAYA