

# NCWIT SCORECARD

a report on the status of women in information technology



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# WHY GENDER DIVERSITY IS IMPORTANT IN COMPUTING

- ✓ **Expands the Qualified Employee Pool**
- **Improves the Bottom Line**
- **Enhances Innovation**
- **Promotes Equality**
- **Reflecting Customer Base**



## Why is gender diversity important in computing?

**Diversity expands the qualified employee pool** - The U.S. Department of Labor estimates that from 2010-2020 there will be nearly 1.4 million computing-related jobs openings available in US. At current college graduation rates in computing, we can only fill 32% of those jobs with U.S. computing graduates.

Consider this: More than half of professional occupations in U.S. are held by women (57%). But the percentage of computing occupations held by women lags far behind. 26% of computing occupations are held by women, 3% by African-American women, 5% by Asian women, 2% by Hispanic/Latina women.

We're not taking advantage of our diverse population. The industry is failing to **attract this talent**. Indeed, those women already employed in the technology industry are leaving at staggering rates, so we're **not retaining either**.

The number of people graduating from college with computer or information sciences degrees has been decreasing steadily since 2004.

[Sources: U.S. Department of Labor, Bureau of Labor Statistics, Employment by detailed occupation, 2010 and projected 2020 (Occupational Category: 15-1000); U.S. Department of Education, National Center for Education Statistics, Integrated Postsecondary Education Data System (CIP: 11).]

NOTE: "One-third of vacant computing jobs" assumes current degree production levels (CIP: 11) persist for the ensuing 10 years and that xx new jobs are added by 2020, as projected by the Bureau of Labor Statistics.

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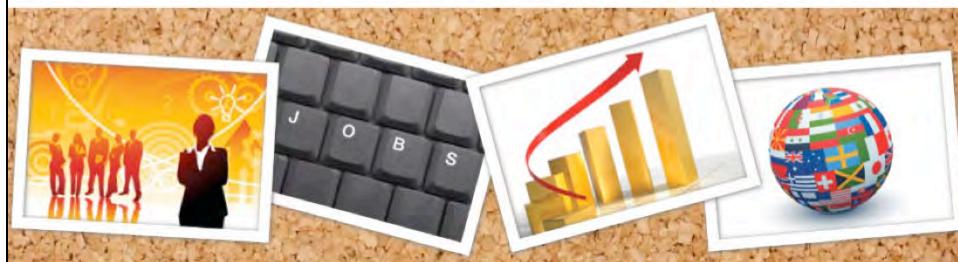
## **Why is gender diversity important in computing?**

**It improves the bottom line** - Technology companies with the highest representation of women in their senior management teams showed a higher return on equity than did those with fewer or no women in senior management. A recent study determined that both racial and gender diversity were associated with increased sales revenue, more customers, and greater profits.

[Sources: Catalyst. (2004). *The bottom line: Connecting corporate performance and gender diversity*. New York: Catalyst; Herring, C. (2009). Does diversity pay?: Race, gender, and the business case for diversity. *American Sociological Review*, 74(2), 208-224.]

# WHY GENDER DIVERSITY IS IMPORTANT IN COMPUTING

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## Why is gender diversity important in computing?

**It enhances innovation** - Computing is a field created by innovative thinkers whose products and systems have become critical to our daily lives. Ideally, these technologies should be developed by a population as diverse as its users. Yet, this is not currently the case. As a society, we lose out on potential innovations when we do not have a diverse workforce fully participating in technology creation.

Research shows that under the right circumstances, diverse teams improve creativity, problem-solving, and productivity. A large study spanning 21 different companies showed that teams with 50:50 gender membership were more experimental and more efficient. Extensive research has found that groups with greater diversity solve complex problems better and faster than do homogenous groups. Culturally diverse teams have been shown to generate a wider variety of possible strategies when setting a course of action.

[Doz, Y., Santos, J. & Williamson, P. (2004). "Diversity: The key to innovation advantage," European Business Forum, 17: 25-27; London Business School. (2007). Innovative potential: Men and women in teams; Page, S. (2009). "The difference: How the power of diversity creates better groups, firms, schools, and societies," Princeton, NJ: Princeton University Press; Knight, D. et al. (1999). "Top management team diversity, group process, and strategic consensus," Strategic Management Journal, 20: 445–465; Cox, T.H. (1993). "Cultural diversity in organizations: Theory, research and practice," Barrett-Koehler, San Francisco, CA. Jackson, S. May, K.E. and Whitney, K. (1995). "Understanding the dynamics of diversity in decision-making teams," In R.A. Guzzo & E. Salas, (Eds.) *Team effectiveness and decision-making in organizations*. Jossey-Bass, San Francisco, CA: 204-261.]

# WHY GENDER DIVERSITY IS IMPORTANT IN COMPUTING

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## Why is gender diversity important in computing?

**It promotes equality** – With technology playing an increasingly crucial role in all of our lives, having more people from different backgrounds participate in its creation can help break down gender and racial economic inequalities. Increasingly, non-IT jobs require deep knowledge of computing as well. A computing major or minor provides a versatile skill set that crosses disciplines and is essential in today's information economy.

## WHY GENDER DIVERSITY IS IMPORTANT IN COMPUTING

- Expands the Qualified Employee Pool
- Improves the Bottom Line
- Enhances Innovation
- Promotes Equality
- ✓ Reflecting Customer Base



**Why is gender diversity important in computing?**

**A diverse workforce reflects the customer base** – Most companies serve a variety of people, so it makes sense then to have a variety of intelligent, skilled people working on services and products.



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*All the charts, tables, and evidence-based practices suggested throughout this Scorecard are available on the NCWIT website ([www.ncwit.org](http://www.ncwit.org)).*

## **WHY COMPUTING IS A GOOD CAREER FOR WOMEN**

### **Unemployment Low**

In 2013...

- the overall unemployment rate in the U.S. was 7.4%
- the overall unemployment rate for computing occupations was a low 3.6%
- and for women in computing, it was only 4.2%

Low unemployment in computing occupations persisted even through the dotcom bust.

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- Computing can be a secure field for women.
- In 2013, when the overall unemployment rate in the U.S. was 7.4%, the unemployment rate for computer and mathematical occupations was 3.6%, and for women in these fields, it was only 4.2%.

[Source: U.S. Department of Labor, Bureau of Labor Statistics, Unemployed persons by occupation and sex, 2013.]

# **WHY COMPUTING IS A GOOD CAREER FOR WOMEN**

## **Tech Companies Remained Profitable**

### **TECH COMPANIES AMONG TOP 50 MOST PROFITABLE, 2013**

1. Wal-Mart Stores	11. AT&T	21. Bank of American Corp.	31. Freddie Mac	41. Johnson & Johnson
2. Exxon Mobil	12. Fannie Mae	22. Costco Wholesale	32. Amerisource Bergen	42. Caterpillar
3. Chevron	13. CVS Caremark	23. Kroger	33. Marathon Petroleum	43. PepsiCo
4. Phillips 66	14. McKesson	24. Express Scripts Holding	34. Home Depot	44. State Farm Insurance Co.
5. Berkshire Hathaway	15. Hewlett-Packard	25. Wells Fargo	35. Microsoft	45. ConocoPhillips
6. Apple	16. Verizon Communications	26. Citigroup	36. Target	46. Comcast
7. General Motors	17. UnitedHealth Group	27. Archer Daniels Midland	37. Walgreen	47. WellPoint
8. General Electric	18. J.P. Morgan Chase & Co.	28. Procter & Gamble	38. American International Group	48. Pfizer
9. Valero Energy	19. Cardinal Health	29. Prudential Financial	39. INTL FCStone	49. Amazon.com
10. Ford Motor	20. International Business Machines	30. Boeing	40. MetLife	50. United Technologies

©NCWIT. Source: [http://money.cnn.com/magazines/fortune/fortune500/2013/full\\_list/](http://money.cnn.com/magazines/fortune/fortune500/2013/full_list/)

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Many of these companies are known as "technical" companies, but all of them employ many computing specialists to support their complex infrastructures and data needs.

[Source: <http://money.cnn.com/magazines/fortune/fortune500/2013/performers/companies/profits/> Based on most profitable in 2013, listed in order of profitability (accessed 12/27/13).]

# WHY COMPUTING IS A GOOD CAREER FOR WOMEN

## Stability Expected to Continue

This relative stability in IT is expected to continue, which is good news for women – and men – who are considering the field.

### PREDICTED JOB GROWTH, 2012-2022

OCCUPATIONAL CLASSIFICATION	Predicted Change 2012-2022
Healthcare Support Occupations	28%
Healthcare Practitioners and Technical Occupations	22%
Construction and Extraction Occupations	21%
Personal Care and Service Occupations	21%
Computer and Mathematical Occupations	18%
Community and Social Service Occupations	17%
Business and Financial Operations Occupations	13%
Building and Grounds Cleaning and Maintenance Occupations	13%

©NCWIT. Source: U.S. Bureau of Labor Statistics, Employment Projections 2012-2022

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- This relative stability in IT is expected to continue, which is good news for women – and men – who are considering the field.
- Compared to all occupations, which are projected to grow 11% by 2022, computing-related occupations are projected to grow by 18%.
- Computing-related occupations are projected to be the 5<sup>th</sup> fastest growing segment of the professional workforce through 2022, and computing has the second highest median annual wage of all occupational categories, second only to management occupations.

[Source: U.S. Department of Labor, Bureau of Labor Statistics, Employment by detailed occupation, 2012 and projected 2022.]

# WHY COMPUTING IS A GOOD CAREER FOR WOMEN

## Growing Faster than Other STEM Fields

PREDICTED JOB GROWTH FOR SELECT COMPUTING PROFESSIONS AND STEM INDUSTRY AVERAGE, 2012-2022

OCCUPATIONAL CLASSIFICATION	Predicted Change 2012-2022
STEM Industry Average	16%
Software Developers, Systems Software	32%
Database Administrators	31%
Database and Systems Administrators and Network Architects	29%
Network and Computer Systems Administrators	28%
Software Developers, Applications	28%
Software Developers and Programmers	25%
Computer Systems Analysts	22%
Information Security Analysts, Web Developers, and Computer Network Architects	22%
Computer and Information Research Scientists	19%
Computer Support Specialists	18%

© NCWIT. Source: U.S. Bureau of Labor Statistics, Employment Projections 2012-2022

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- Many computing professions are predicted to grow at a faster rate than the science, technology, engineering, and mathematics (STEM) average.

[Source: STEM average calculated from Bureau of Labor Statistics, Employment by detailed occupation, 2012 and projected 2022 (STEM defined as Computer Specialists, 15-1000, Mathematical Scientists, 15-2000; Engineering, 17-2000; Life Scientists, 19-1000; Physical Scientists, 19-2000).]

- In fact, Information Security Analyst is expected to be one of the top 30 fastest-growing professions. Moreover, many other professional occupations now require significant technical skills. Encouraging women to pursue careers in computing may mean we can fill jobs in this strong sector of the U.S. economy.

[Source: U.S. Department of Labor, Bureau of Labor Statistics, Employment by detailed occupation, 2012 and projected 2022.]

## WHY COMPUTING IS A GOOD CAREER FOR WOMEN

### Computing Salaries are Highly Competitive

#### TOP 10 SALARIES FOR UNDERGRADUATE DEGREES, 2013

UNDERGRADUATE DEGREE	Starting Salary	Mid-career Salary
Petroleum Engineering	\$98,000	\$163,000
Chemical Engineering	\$67,500	\$111,000
Nuclear Engineering	\$66,800	\$107,000
Electrical Engineering (EE)	\$63,400	\$106,000
Computer Engineering (CE)	\$62,700	\$105,000
Aerospace Engineering	\$62,500	\$118,000
Computer Science (CS)	\$58,400	\$100,000
Actuarial Mathematics	\$56,100	\$112,000
Applied Mathematics	\$50,800	\$102,000
Statistics	\$49,300	\$99,500

© NCWIT. Source: <http://www.payscale.com/college-salary-report-2014/majors-that-pay-you-back>

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- In 2013, bachelor's degrees in computer science and computer engineering yielded two of the highest starting and median salaries for new graduates.

[Source: <http://www.payscale.com/college-salary-report-2013/majors-that-pay-you-back/> (accessed 3-4-2014).]

## WHY COMPUTING IS A GOOD CAREER FOR WOMEN

### Computing Helps Close the Gender Wage Gap

- A woman earns \$0.77 to every \$1.00 a man earns.
- Women who work in computing-related occupations earn a median income that is 81% of men's median income.
- Dice.com salary survey suggests there is no wage gap for tech workers with comparable experience, education, and position.



- According to U.S. Census data, women generally make less money than men.
- In 2012, a woman typically earned \$0.77 to every \$1.00 a man earned.
- But Census data also suggest that women who work in computing-related occupations are better off, with a median income that is 81% of men's median earnings.

[Source: BLS-Median weekly earnings of full-time wage and salary workers by detailed occupation and sex; <http://www.bls.gov/cps/cpsaat39.pdf>.]

- In a different dataset - the Dice online salary survey findings (based on a self-selected sample of over 17,000 people) – indicate that technical women earned an average salary of \$87,527 in 2012 compared to men's average of \$95,929. Once comparable levels of experience, education, and position are controlled for, the wage gap disappears for these tech workers.

[Source: Dice Holdings, Inc., (2013). Spotlight on Women in Tech <http://resources.dice.com/report/women-in-tech/> (accessed 3/4/14).]

- **These data suggest there is great potential for income equality between men and women in the computing profession.**

## **WHY COMPUTING IS A GOOD CAREER FOR WOMEN**

**Dispel the myths. Share the facts:**

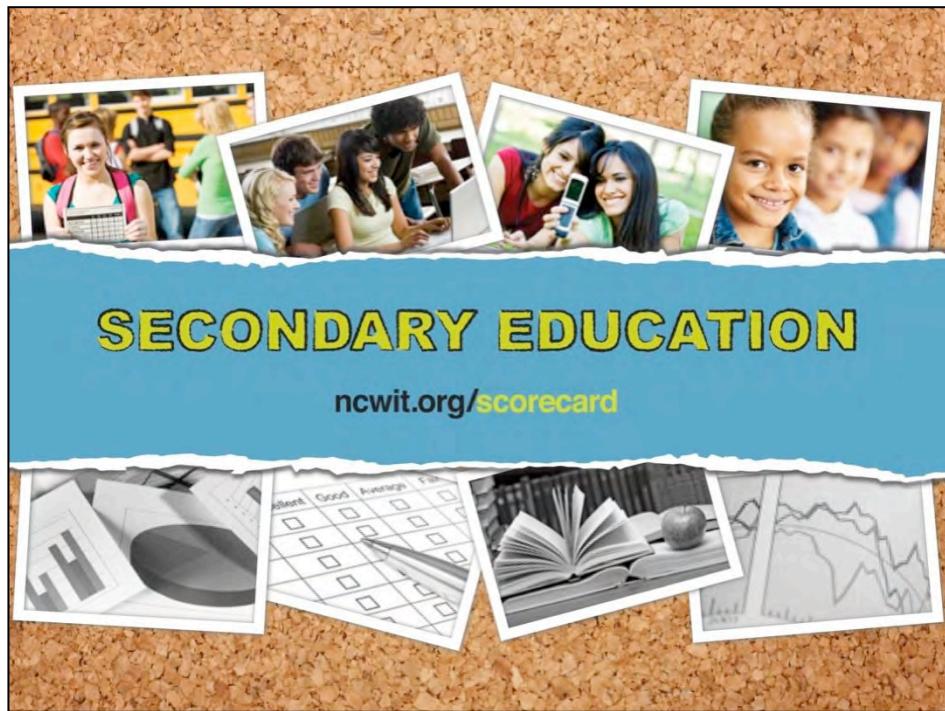
- Low unemployment
- High profitability
- A society that is increasingly IT-dependent
- ... means that computing is a good career for girls and women.



- Let's dispense with the prevailing myths by sharing this research.
- Low unemployment, high profitability, and a society that is increasingly IT-dependent ... means that computing is a good career for girls and women.



Thank you!



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## SECONDARY EDUCATION

### Uneven Computing Preparation in High School

- Students less exposed to computer programming than to computer literacy
- 56% of students who reported no computer courses or experience were girls
- BUT among students with programming experience, the percentage of girls has increased significantly



- According to student responses to surveys administered with SAT exams, college-bound high-school students of both genders are significantly less exposed to computer programming than to computer literacy.
- By computer literacy, we mean use of computer applications (such as office software).
- Of the 1.6 million students surveyed, 17% reported no high-school computer coursework or experience at all, and 60% of these students were girls.
- In spite of these distressing numbers, recent data give some reason for optimism – girls’ representation among students with programming experience has increased from 42% in 1999 to 60% in 2013.

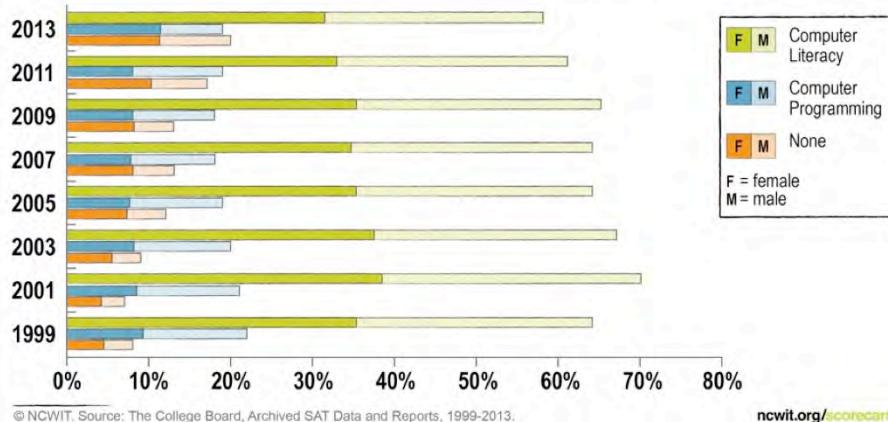
[Source: The College Board, Archived SAT Data and Reports, 1999-2011]

- You can make a difference in girls’ interest in computing by telling them what is compelling about a career in IT.
- Reach out to school teachers, guidance counselors, academic advisors, and principals to help change the image of computing.
- The NCWIT Talking Points card can help you hold these conversations. ([www.ncwit.org/youngwomen](http://www.ncwit.org/youngwomen))

## SECONDARY EDUCATION

### Uneven Computing Preparation in High School

PERCENTAGE OF STUDENTS REPORTING COMPUTER COURSEWORK/EXPERIENCE IN HIGH SCHOOL, 1999-2013



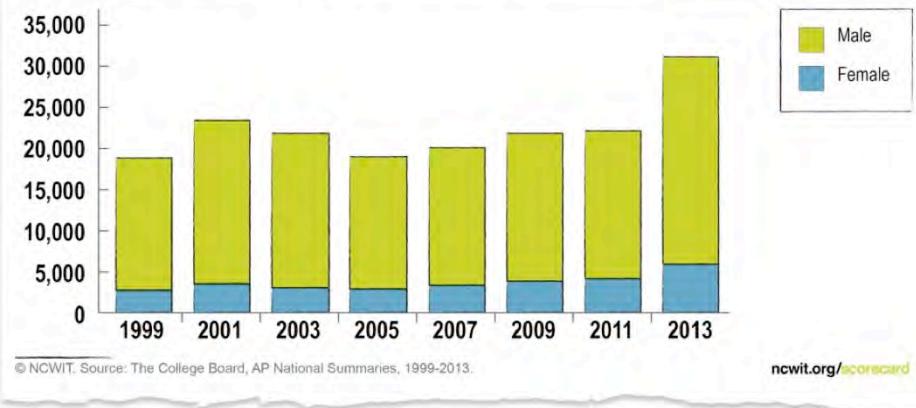
- Here are more detailed findings from that SAT survey:
- The percentage of high-school students reporting computer literacy coursework or experience has been slowly decreasing since 1999.
- The percentage of students reporting computer programming experience has also been similar over time.
- Most disturbing is that the percentage of students reporting no computing experience or coursework has increased since 1999. Thankfully, it is still a small percentage though.
- The good news is that among those reporting programming experience since 1999, about 4 in 10 have been girls, but in 2013, 6 in 10 were female!

[Source: The College Board, Archived SAT Data and Reports, 1999-2013]

## SECONDARY EDUCATION

### High-school Girls Too Seldom Participate in Advanced Computing

NUMBER OF ADVANCED PLACEMENT (AP) COMPUTER SCIENCE EXAM-TAKERS BY GENDER, 1999-2013



- AP research indicates that students taking an AP exam in a given subject area are more likely to take college coursework in that area than students who did not take the AP.
- Yet only 1% of AP exam-takers – whether male or female -- took a computer science AP exam in 2013.
- Increasing the number of girls – and boys – at this stage of the pipeline would be good news for an industry in need of able minds.
- The number of girls taking the CS AP exam has been increasing since the mid 2000's, and reached a high point in 2013 (5,807).

[Sources: Willingham, W. & Morris, M. (1986). *Four years later: A longitudinal study of advanced placement students in college*. Princeton, NJ: College Board; The College Board, AP National Summaries, 1999-2011.]

## SECONDARY EDUCATION

### Disproportionate Numbers Among CS AP-Takers

In 2013:

- 56% of 2.2 million U.S. AP exam-takers were female
- BUT only 19% of those who took a computer science AP exam were female



Present a hands-on activity to  
middle-school students using  
*Outreach-in-a-Box*  
[www.ncwit.org/outreach](http://www.ncwit.org/outreach)  
[ncwit.org/scorecard](http://ncwit.org/scorecard)

- AP exam participation has been growing each year. Of a record number of U.S. AP exam-takers (2.2M in 2013), more than half are female (56%).
- Between 2011 and 2013, there was a jump in the number of students taking the AP CS exam, from about 22,000 to about 31,000.
- The percentage of female students who took the CS AP exam remained at the 19% it has been for years.
- Each year since 1999, the CS AP consistently has had the lowest female percentage of any of the 37 AP exams, hovering at 19% or lower.

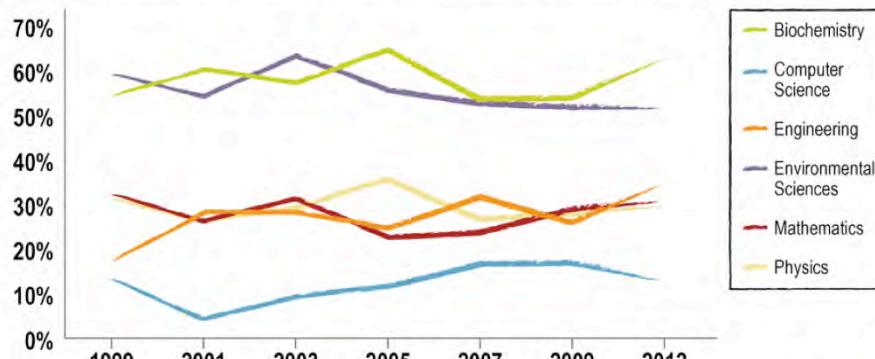
[Source: The College Board, AP National Summaries, 1999-2013.]

- You can make a difference by reaching out into the schools.
- The NCWIT Outreach-in-a-Box can guide you through making middle-school presentations. ([www.ncwit.org/outreach](http://www.ncwit.org/outreach))

## SECONDARY EDUCATION

### Fewer Girls Doing CS in Science Fairs

FEMALE PERCENTAGE OF PARTICIPANTS, INTEL SCIENCE AND ENGINEERING FAIR (ISEF), 1999-2012



© NCWIT. Source: Intel ISEF Participation Statistics (unpublished).

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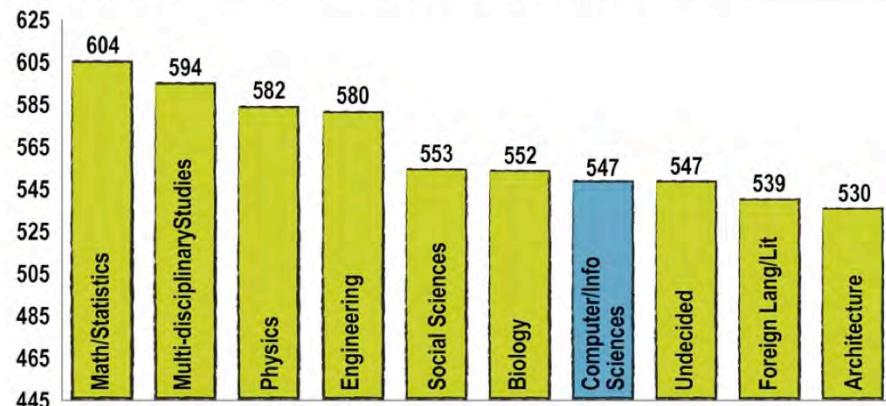
- Each year, approximately 1,500 of the top science and engineering fair students from 51 countries compete for over \$4 million in prizes and scholarships in the Intel Science and Engineering Fair (ISEF).
- ISEF is the largest pre-college science competition in the world.
- Since 1999, between 43% and 49% of all competitors have been girls.
- Despite an 8-year rise (2001-2009), girls' participation still remains lowest for computer-science projects compared to other topics. Engineering, on the other hand, has seen increased female participation, with 1/3 of the engineering projects in 2012 being submitted by girls.

[Source: Intel ISEF Participation Statistics (unpublished).]

## **SECONDARY EDUCATION**

### **Computing Not Drawing Top Math Achievers**

TOP 10 AVERAGE SAT MATH SCORES BY INTENDED MAJOR, 2013



© NCWIT. Source: College Board, SAT Major Categories Report (unpublished).

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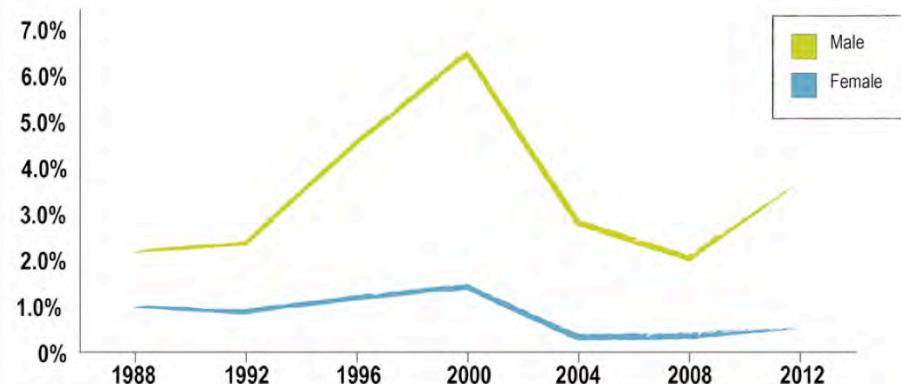
- As you can see in this slide, in 2013, computing majors are not attracting the most mathematically able students.
- Students with the highest SAT math scores were more likely to intend majors in Math, Multi-disciplinary studies, Physical sciences, Engineering, Biology, and Biology than in Computer and information sciences.
- On the bright side, Computing has become a more popular choice for high math scorers than it was in previous years.

[Source: The College Board, SAT Major Categories Report (unpublished).]

## SECONDARY EDUCATION

### First-year Students Not Interested in CS Major

PERCENTAGE OF AMERICAN FRESHMEN INTENDING TO MAJOR IN COMPUTER SCIENCE:  
A LONGITUDINAL LOOK



© NCWIT. Source: Higher Education Research Institute, *The American Freshman: 40-Year Trends*, 1966-2006; Higher Education Research Institute, *The American Freshman: National Norms Fall 2009, Fall 2012*.

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- In a different college major survey, 240,580 incoming college freshmen were asked what major they were planning to pursue.
- The most oft-intended majors overall were Biology (7%), Nursing (6%), and Psychology (5%).
- Interest in the CS major among college freshmen decreased steadily from 2000-2008, but seems to be on the upswing in recent years, particularly among males.

[Source: Higher Education Research Institute, *The American Freshman: National Norms, 1989-2012*]

## SECONDARY EDUCATION

### Research Shows...

...these factors encourage students to study computing:

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



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- Findings from different researchers suggest that certain factors help encourage students to pursue computing:
- Early, positive experiences with computing

[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.]

- Adult encouragement (especially from parents)

[Sources: 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](http://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.]

- Positive role models (female role models positively influence girls)

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

- More information about what computing professionals actually do in their jobs.

[Source: Barker, L. & Aspray, W. (2006). The State of Research on Girls and IT. In McGrath

**Make a Difference**

ENGAGE STUDENTS

- Six engaging ways to introduce computing in class  
[www.ncwit.org/practices](http://www.ncwit.org/practices)
- Recruit girls  
[www.ncwit.org/geset](http://www.ncwit.org/geset)
- More teaching resources  
[www.csta.acm.org](http://www.csta.acm.org)

[ncwit.org/scorecard](http://ncwit.org/scorecard)

- There are a few ways you can make a difference in what girls are exposed to in computing:
  - NCWIT describes 6 key practices for piquing girls' (and boys') interest in computing. You can find these at [www.ncwit.org/practices](http://www.ncwit.org/practices).
  - 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](http://www.ncwit.org/geset).
  - In addition, there are training programs available. Check the Computer Science Teachers Association for many helpful resources and ideas (<http://www.csta.acm.org/>).
  - Whether or not you are a computer science teacher, you may be able to provide computing course support to local schools.

## **SECONDARY EDUCATION**

### **Computing Education is Low Profile or Absent in Schools**

- Advanced computing not taught in most schools
- More computing courses in schools will introduce more girls (and boys) to computing
- Rigorous computing teaches students design, logical reasoning, and problem-solving skills



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- Despite the broad use of computers outside of school, advanced computing is currently not taught in most schools.
- Increasing the opportunities for all K-12 students to study computing is one way to ensure that girls are encouraged and exposed to computing at an influential age.
- When taught well, computing teaches students skills that extend beyond the computing classroom, such as design, logical reasoning, and problem solving.
- You can find out more about the status of computer science education in the nation by going to the Association for Computing Machinery (ACM) website ([www.acm.org](http://www.acm.org)).

## **SECONDARY EDUCATION**

### **Computing Ed Typically...**

- Is not a graduation requirement
- Doesn't count as academic graduation credit
- Is often classified as a "vocational course" or competes with music, foreign language, or sports electives
- Is taught by teachers with little tech background or by techies with little teacher training
- Is hard to integrate across curriculum because of education and testing requirements

Tech standards (NETS) exist, but often translate into familiarity with office software.

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- There are several reasons for the lack of rigorous computing education:
  1. Only 14 states and the District of Columbia allow Computer Science to count toward graduation as an academic subject.  
[Source: Association of Computing Machinery. Google Spreadsheet. (accessed 12/13/13)]
  2. Computing may be relegated to "vocational" course choices and, therefore, does not attract college-bound students and their parents.  
[Source: Barker, L. J. & Aspray, W. (2006). The state of research on pre-college experiences of girls with information technology. In McGrath Cohoon, J. and W. Aspray (Eds.) *Women and information technology: Research on underrepresentation*. Cambridge, MA: MIT Press.]
  3. Computing as an elective course competes with other more traditionally attractive electives, such as music, foreign language, or sports.  
[Source: Barker, L. J. & Aspray, W. (2006).]
  4. Computing courses are often taught either by individuals with little technical background, or by technically astute individuals with little teaching preparation  
[Source: CSTA. (2007). Computer science state certification requirements: Certification committee report <http://csta.acm.org/> ComputerScienceTeacherCertification/sub/TeachCertRept07New.pdf (accessed 09-01-09); CSTA (2009). National secondary computer science survey.]
- Federal and State educational and testing requirements make it hard for schools to integrate computing across the curriculum.
- There are National Educational Technology Standards, but lacking a graduation requirement, these standards translate into basic familiarity with office software.  
[Source: <http://www.iste.org/AM/Template.cfm?Section=NETS> (accessed 09-01-09).]

**Make a Difference**

- *Moving Beyond Computer Literacy: Why Schools Should Teach Computer Science*  
[www.ncwit.org/schools](http://www.ncwit.org/schools)
- Statistics about computing education and workforce in your area  
[www.ncwit.org/cseducation](http://www.ncwit.org/cseducation)
- *Offer Computing Workshops and Camps: They Benefit Both Students and the Teachers Who Offer Them*  
[www.ncwit.org/summercamps](http://www.ncwit.org/summercamps)

[ncwit.org/scorecard](http://ncwit.org/scorecard)

- When advanced computing isn't taught in the schools, or doesn't count toward graduation requirements, then fewer girls are likely to be exposed to computer science concepts.
- This lack of experience hinders interest in a CS major when students enter college.
- You can make a difference in the state of computing at the secondary level by taking action in your local area.
- Push for computing requirements at your school district, state department of education, or federal department of education. At the very least, ask that your local schools allow computing courses (such as AP Computer Science) to count toward academic graduation credit. Use the NCWIT Talking Points card, *Moving Beyond Computer Literacy: Why Schools Should Teach Computer Science* ([www.ncwit.org/schools](http://www.ncwit.org/schools)).
- Get specific statistics about computing education and workforce in your area at the NCWIT website ([www.ncwit.org/cseducation](http://www.ncwit.org/cseducation)).
- Partner with a local youth group or summer camp to work with kids during out-of-school time, when they may be even more receptive. For ideas, refer to NCWIT's card and accompanying website, *Offer Computing Workshops and Camps: They Benefit Both Students and the Teachers Who Offer Them* ([www.ncwit.org/summercamps](http://www.ncwit.org/summercamps)).

case study

## Targeted Recruiting Works

Actively recruiting girls and minority students results in **more students overall and more female students.**

One high-school CS teacher recruited 65 students into 2 AP classes and had to turn away students.

- Gender composition went from 12% girls to 33% girls
- 70% of his students pass the CS AP exam

“We have enough students for the first time in four years to run an AP level Computer Science course.”

[ncwit.org/scorecard](http://ncwit.org/scorecard)

- In a case study submitted by Seth Reichelson at Ocoee High School in Florida, he reported that actively recruiting girls and minority students resulted in **more students overall and more female students.**
- A high-school CS teacher at a school with 65% free or reduced lunch, Seth recruited 65 students into 2 AP classes and had to turn away students.
- The gender composition of his classes went from 12% girls to 33% girls.
- He said, “We have enough students for the first time in four years to run an AP level Computer Science course.”
- He reports that, typically, about 70% of his students pass the CS AP exam.
- Learn more about the theory behind Seth’s actions: See the NCWIT Promising Practice titled “Change the Gender Composition of High-School Computing Courses” ([www.ncwit.org/highschoolrecruit](http://www.ncwit.org/highschoolrecruit)).

**case study**

## How Did He Do It?

- Recruit girls in female-run student clubs
- Connect computing to girls' existing interests
- Tell girls they will stand out as college applicants
- Embrace newbies as a blank slate

For example:

- For yearbook: Using Java, they blended and color-matched pictures
- For National Honor Society: AP CS students programmed a card scanner to streamline roll-call

[ncwit.org/scorecard](http://ncwit.org/scorecard)

### How did he do it?

- This teacher actively recruited girls in female-run student clubs, such as student government, yearbook, and the National Honor Society.
- He connected computing to their interest in these clubs, having his CS AP classes provide those clubs with practical tools [see slide].
- He tells prospective students that many girls take AP exams, but fewer girls take CS AP exams, so those who do take CS AP stand out from other college applicants.
- When girls protest that they don't know anything about computing, he assures them that he prefers "a blank slate."
- He adds that students who work hard in his class often get A's.
- 70% of Seth's students typically pass the CS AP exam, whereas the school's average pass rate for AP exams is 15%.
- Seth told NCWIT, "The numbers of female students who are enrolling in our [computing] courses [for next year] have increased by 50% over this current year."
- See NCWIT Promising Practice documents for more ideas for targeted recruiting and more case studies. [www.ncwit.org/practices](http://www.ncwit.org/practices)

## **SECONDARY EDUCATION**

### **Evidence-based Recruitment and Retention Strategies Can Help**

You can increase the number of girls in computing through...

- Encouragement
- Positive early experiences
- Advocating for a high-school computing requirement

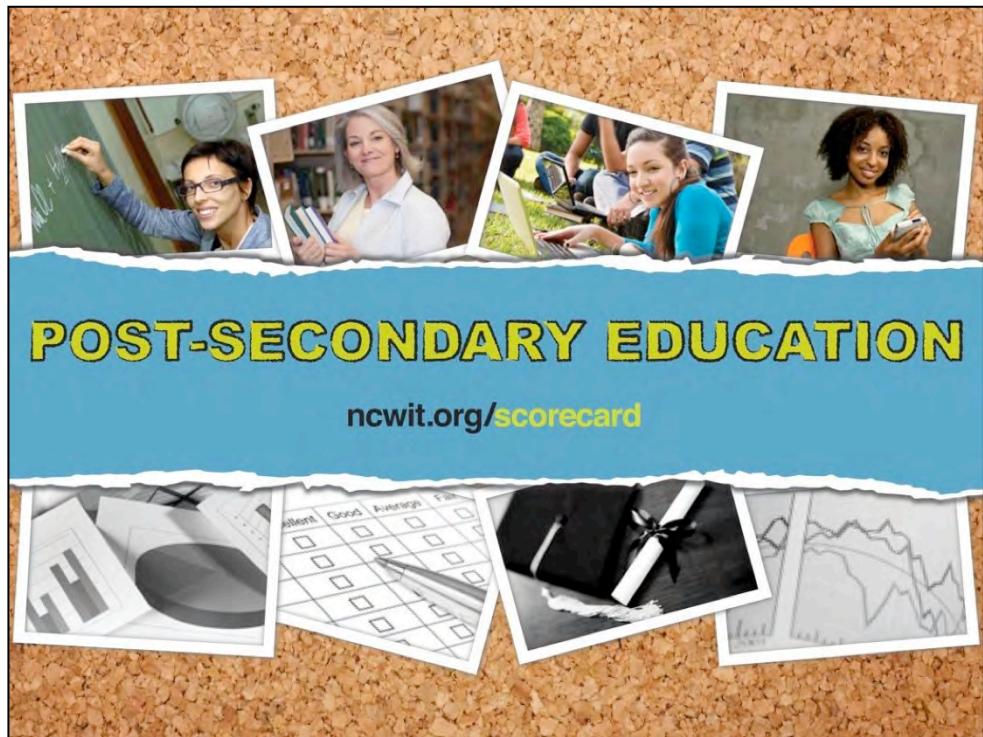


[ncwit.org/scorecard](http://ncwit.org/scorecard)

- Evidence-based recruitment and retention strategies really can help.
- Others have had success increasing the number of girls in computing through ...
  - Encouragement
  - Positive early experiences
  - Advocating for a high-school computing requirement



Thank you!



*We hope you will share this information with your colleagues, your students, your children, your local schools, and the key decision-makers and legislators in your community. You may use the charts and slides in your own presentations, customizing to make the content compelling for your audiences. Please retain the NCWIT copyright as well as source attributions on all charts and tables. Be careful not to alter accuracy as you alter wording.*

*All the charts, tables, and evidence-based practices suggested throughout this Scorecard are available on the NCWIT website ([www.ncwit.org](http://www.ncwit.org)).*

## POST-SECONDARY EDUCATION

### Few Women Study Computing

In the U.S. in 2012, women earned ...

- **57%** of all undergraduate degrees
- **59%** of the undergraduate degrees in biology
- **42%** of the undergraduate degrees in mathematics

But only...

- **18% of undergraduate computing degrees and 19% of engineering degrees**

[ncwit.org/scorecard](http://ncwit.org/scorecard)



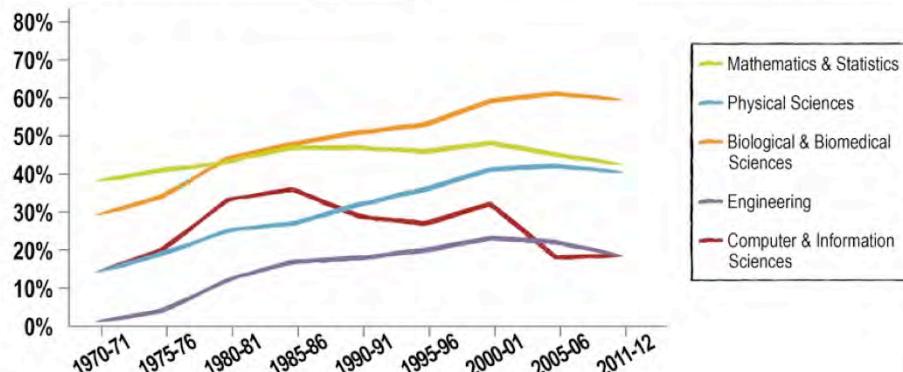
- There are few women in computing at all levels of postsecondary education.
- If we just look at undergraduate degrees in the U.S. in 2012, we find women earned ...
  - **57%** of all undergrad degrees
  - **59%** of the undergraduate degrees in biology
  - and **42%** of mathematics degrees
- Yet women earned **less than 1/5 of all computer and information sciences undergraduate degrees and engineering degrees.**
- These statistics have held steady for many years now.

[Source: U.S. Department of Education, National Center for Education Statistics, Integrated Postsecondary Education Data System. *Math and science undergraduate degree calculations were based on completed majors in the following categories: CIP 11: Computer and information sciences and support services, CIP 14: Engineering, CIP 15: Engineering technologies/technicians, CIP 26: Biological and biomedical sciences, CIP 27: Mathematics and statistics, CIP 40: Physical sciences.*] ]

# POST-SECONDARY EDUCATION

## Female Percentage of STEM Undergrads Lowest in Computing

FEMALE PERCENTAGE OF SELECT STEM UNDERGRADUATE DEGREE RECIPIENTS:  
A LONGITUDINAL LOOK



© NCWIT. Source: U.S. Department of Education, National Center for Education Statistics,  
Integrated Postsecondary Education Data System.

[ncwit.org/scorecard](http://ncwit.org/scorecard)

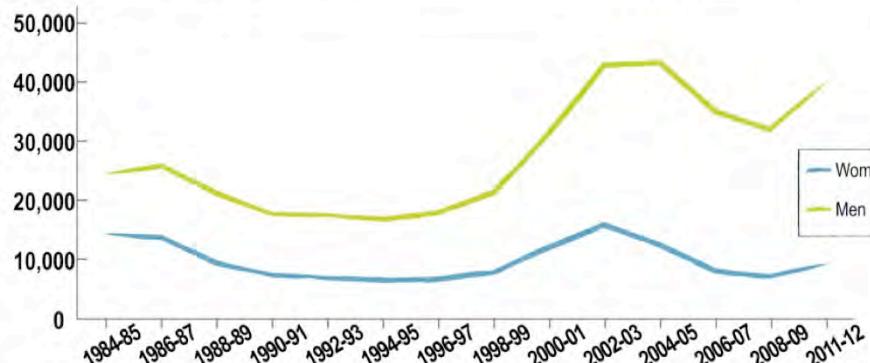
- Women's representation in STEM disciplines at the bachelor's level has risen since the 1970s, although some ground has been lost since the early 2000's.
- In computing, however, women's share of undergraduate degrees saw a general rise, followed by a steep decline.
- In recent years, the decline in the female percentage of computing undergraduate degree completions has leveled off and is on par with Engineering now.

[Source: U.S. Department of Education, National Center for Education Statistics, Integrated Postsecondary Education Data System]

# POST-SECONDARY EDUCATION

## Women's Undergraduate Computing Degrees Have Declined Over Time

BACHELOR'S DEGREES IN COMPUTER AND INFORMATION SCIENCES, BY GENDER:  
A LONGITUDINAL LOOK



©NCWIT. Source: U.S. Department of Education, National Center for Education Statistics,  
Integrated Postsecondary Education Data System.

[ncwit.org/soforecard](http://ncwit.org/soforecard)

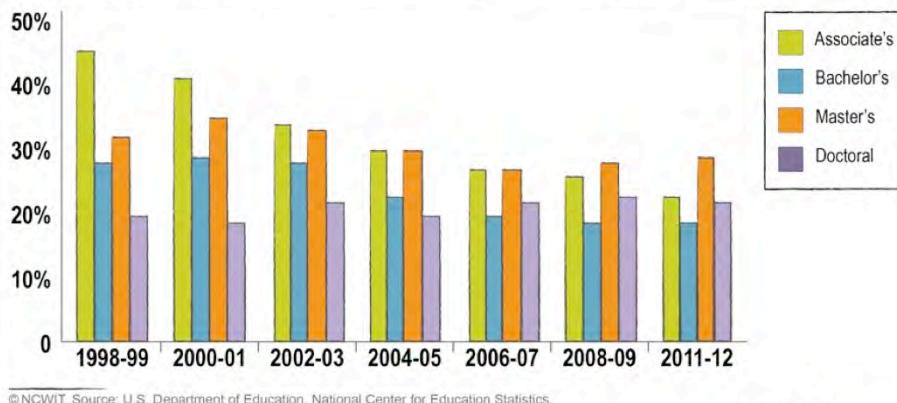
- Compared to 1985, more bachelor's degrees in computing were completed in 2012, BUT the gap between the number of males and females receiving computing degrees continues to widen.

[Source: U.S. Department of Education, National Center for Education Statistics, Integrated Postsecondary Education Data System]

# POST-SECONDARY EDUCATION

## From Associate to Doctorate: Women Receive Fewer than Men

FEMALE PERCENTAGE OF COMPUTING POST-SECONDARY DEGREES, 1998-2012



© NCWIT. Source: U.S. Department of Education, National Center for Education Statistics, Integrated Postsecondary Education Data System.

[ncwit.org/scorecard](http://ncwit.org/scorecard)

- At 18%, the proportion of bachelor's degrees in computing received by women in 2012 was lower than for associate's (22%), master's (28%), or doctoral (21%) degrees in computing.
- The female percentages of associate's and bachelor's degrees in computing have decreased over time. In contrast, the female percentage of master's and doctoral degrees in computing have held relatively steady over time.

- \* Note: The 2012 CRA Taulbee survey data showed that undergraduate CS degrees had increased for the fifth year in a row in their sample of Ph.D.-granting institutions ([www.cra.org](http://www.cra.org)). The data shown on this slide are drawn from a dataset that includes all degree-granting institutions in the U.S., not just PhD-granting.

[Source: U.S. Department of Education, National Center for Education Statistics, Integrated Postsecondary Education Data System]

**Make a Difference**

**Use NCWIT's Promising Practices**  
[www.ncwit.org/practices](http://www.ncwit.org/practices)

- *Small Steps Toward Systemic Change*
- *Peer-Led Team Learning*
- *Pair Programming*
- *Designing for Diversity*

[ncwit.org/scorecard](http://ncwit.org/scorecard)

- Changing curricula works to attract students to computing. At [www.ncwit.org](http://www.ncwit.org), you can read about how others have changed curriculum and improved diversity and retention.
- NCWIT collects promising and best practices and posts them on its website for free downloading.
- The practices listed on this slide describe curricula changes that worked to bring more students into computing.
- Some examples of curricular change include incorporating peer-led team learning, pair programming, and rethinking simple pedagogical practices.
- Go to NCWIT's website to find out more ([www.ncwit.org/practices](http://www.ncwit.org/practices)).

## **POST-SECONDARY EDUCATION**

### Racial/Ethnic Composition of Computing Degrees Has Changed

- Racial/ethnic diversity of women earning post-secondary degrees has not shifted much since 2000
- Percentage of non-residents has recently decreased

In 2012, at all degree levels...

- There was more racial/ethnic diversity among female degree-holders in CIS than among male degree holders.



- The slides that follow show degree completions in Computer and Information Sciences for all post-secondary degrees in 2000 and 2012 (i.e., associate's, bachelor's, master's, and doctoral degrees in CIP 11).
- Overall, fewer women and more men earned associate's, bachelor's, or master's degrees in CIS in 2012, compared to 2000.
- The number of women earning doctoral degrees has almost tripled since 2000.
- At all degree levels, the racial-ethnic composition of the female degree earners has not shifted much since 2000, with a notable exception: The percentage of women who were Asian has decreased since 2000 at all levels. This pattern holds true for men, except at the PhD level, where the proportion of Asian men increased from 2000 to 2012.
- There was, however, more racial/ethnic diversity among female degree earners in CIS than among male degree earners.

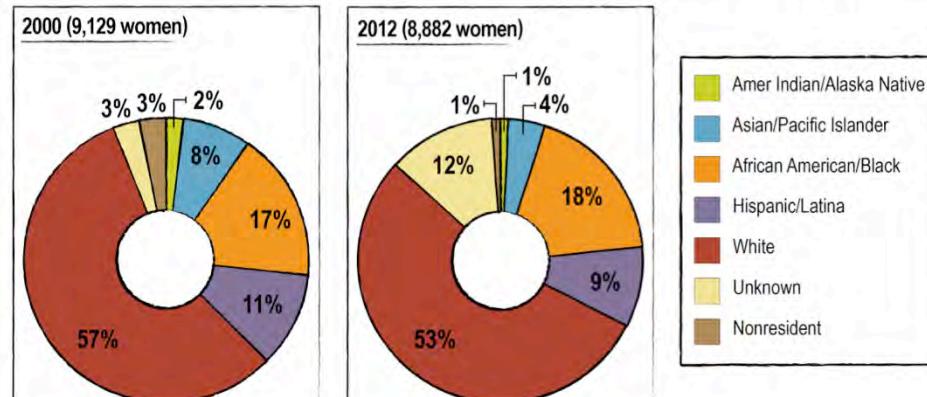
\* Note: CIS = Computer and Information Sciences. CIP 11 is the National Center for Education Statistics Integrated Postsecondary Education Data System (NCES IPEDS) category for CIS.

[Source: U.S. Department of Education, National Center for Education Statistics, Integrated Postsecondary Education Data System]

# POST-SECONDARY EDUCATION

## Associate's Degrees, 2000 and 2012

RACIAL/ETHNIC PERCENTAGES OF FEMALE COMPUTING ASSOCIATE'S DEGREES

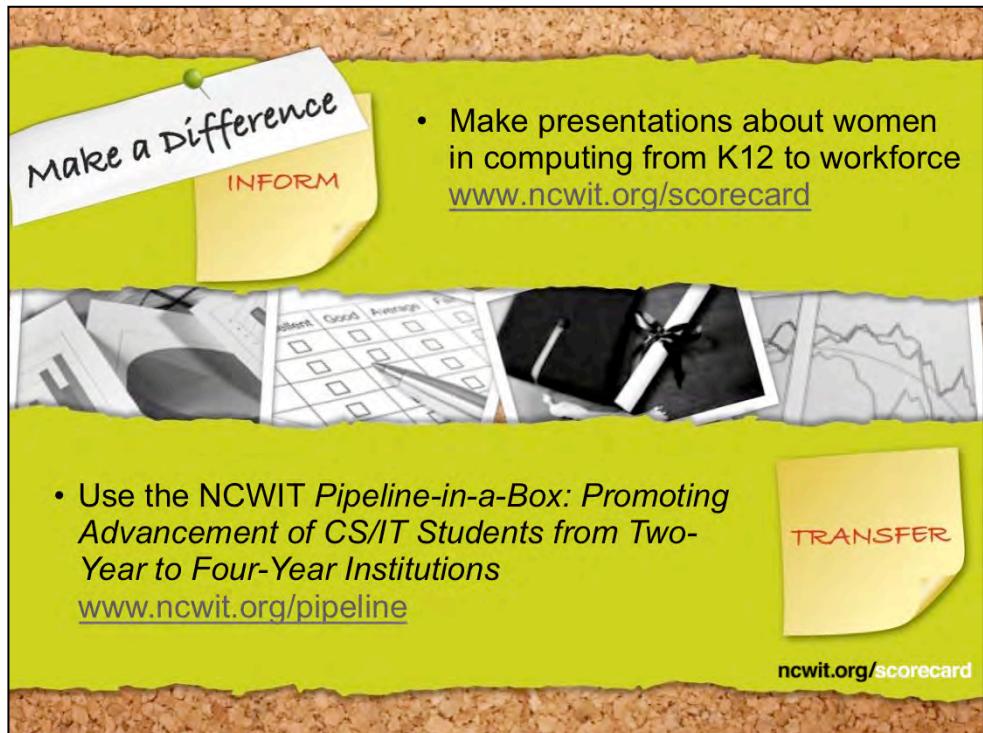


©NCWIT. Source: U.S. Department of Education, National Center for Education Statistics, Integrated Postsecondary Education Data System, 2000, 2012.

[ncwit.org/scorecard](http://ncwit.org/scorecard)

- There were fewer women who received CIS associate's degrees in 2012 compared to 2000, but more than in recent years. The racial/ethnic composition remained similar.

[Source: U.S. Department of Education, National Center for Education Statistics, Integrated Postsecondary Education Data System, 2000, 2012]

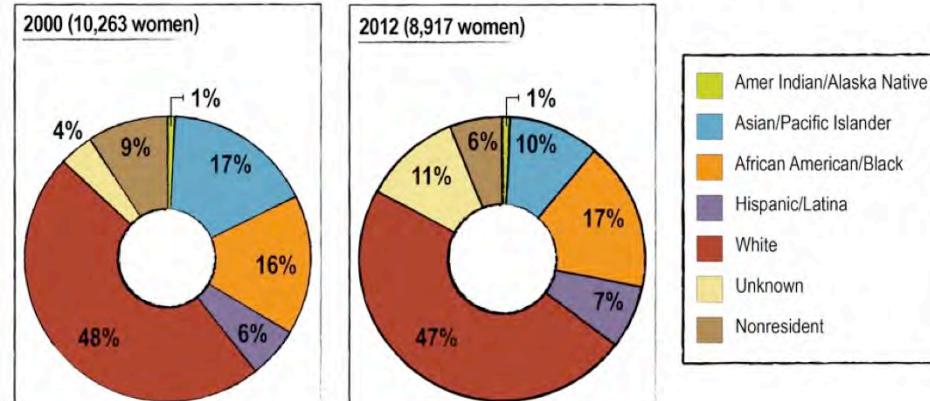


- You can make a difference in the gender composition of computing students by reaching out to guidance counselors, academic advisors, and two-year college faculty.
- Sometimes all people need is to understand the facts in order to take action.
- Use the Scorecard to help you share the facts ([www.ncwit.org/scorecard](http://www.ncwit.org/scorecard)).
- The NCWIT Pipeline-in-a-Box is a turnkey toolkit specifically targeted at facilitating the bridge between two- and four-year colleges for potential computing students.
- Let two-year colleges know about this free toolkit ([www.ncwit.org/pipeline](http://www.ncwit.org/pipeline)).

# POST-SECONDARY EDUCATION

## Bachelor's Degrees, 2000 and 2012

RACIAL/ETHNIC PERCENTAGES OF FEMALE COMPUTING BACHELOR'S DEGREES



© NCWIT. Source: U.S. Department of Education, National Center for Education Statistics, Integrated Postsecondary Education Data System, 2000, 2012.

[ncwit.org/scorecard](http://ncwit.org/scorecard)

- There were substantially fewer women who received CIS bachelor's degrees in 2012 compared to 2000, but more than in preceding years. The racial/ethnic composition has shifted slightly, with an increase in Asian/Pacific Islanders and non-residents.

[Source: U.S. Department of Education, National Center for Education Statistics, Integrated Postsecondary Education Data System, 2000, 2012]

*Make a Difference*

- Provide REUs  
[www.ncwit.org/reufaculty](http://www.ncwit.org/reufaculty)  
[www.ncwit.org/reuaffinity](http://www.ncwit.org/reuaffinity)
- Share Statistics  
[www.ncwit.org/bythenumbers](http://www.ncwit.org/bythenumbers)
- Learn more  
*Stuck in the Shallow End: Education, Race, and Computing* (2008)

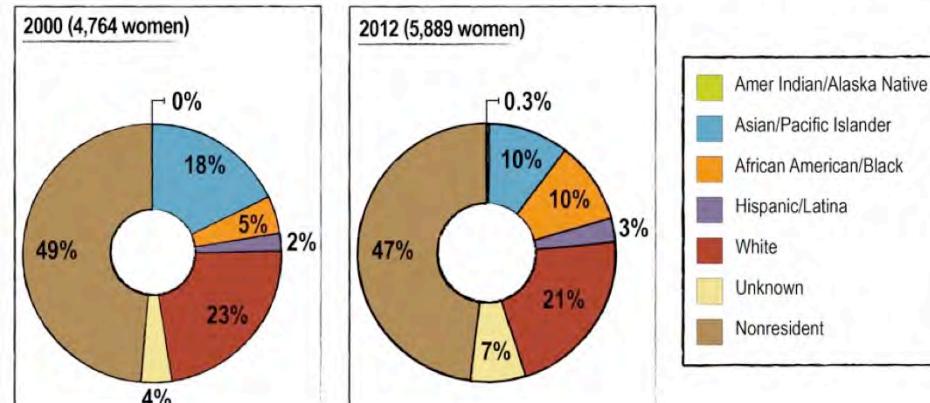
[ncwit.org/scorecard](http://ncwit.org/scorecard)

- You really can make a difference in the participation of women in computing.
- Provide Research Experiences for Undergraduates (REUs). These have been shown to help retain women.
- NCWIT has two publications that describe successes with this practice ([www.ncwit.org/reufaculty](http://www.ncwit.org/reufaculty) and [www.ncwit.org/reuaffinity](http://www.ncwit.org/reuaffinity)).
- Share statistics. Post a copy of NCWIT's By the Numbers on your office door or department bulletin board ([www.ncwit.org/bythenumbers](http://www.ncwit.org/bythenumbers)).
- Want to learn more about the issues? Read *Stuck in the Shallow End: Education, Race, and Computing* by Jane Margolis et al (2008, MIT Press).

# POST-SECONDARY EDUCATION

## Master's Degrees, 2000 and 2012

RACIAL/ETHNIC PERCENTAGES OF FEMALE COMPUTING MASTER'S DEGREES

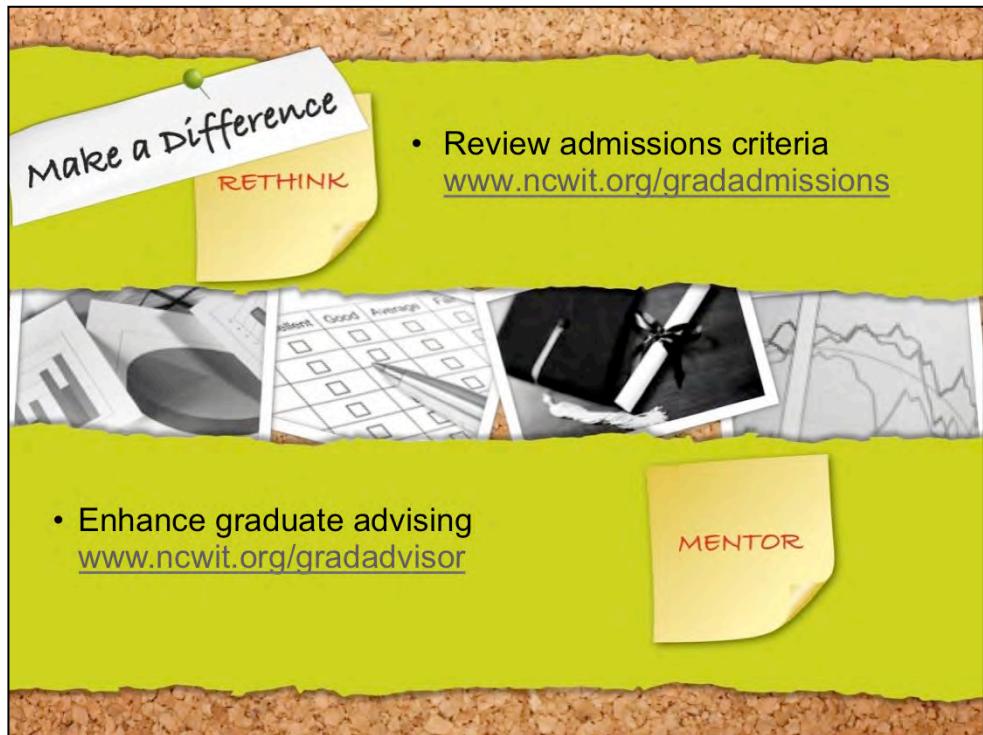


© NCWIT. Source: U.S. Department of Education, National Center for Education Statistics, Integrated Postsecondary Education Data System, 2000, 2012.

[ncwit.org/scorecard](http://ncwit.org/scorecard)

- There were more women who received CIS master's degrees in 2012 compared to 2000.
- The racial/ethnic composition shifted in 2012, compared to 2000, especially for Asian/Pacific Islanders and for African Americans.
- In both years, nearly half of the women earning master's degrees in computing were non-residents.

[Source: U.S. Department of Education, National Center for Education Statistics, Integrated Postsecondary Education Data System, 2000, 2012]



- Two more actions you can take to change the status quo:
  - Improve the recruitment and retention of women in graduate programs by reviewing admissions criteria systematically ([www.ncwit.org/gradadmissions](http://www.ncwit.org/gradadmissions)).
  - Coordinate mentoring programs and other professional development activities for women in graduate programs.
- Support the completion of graduate degrees and encourage research careers through graduate advising ([www.ncwit.org/gradadvisor](http://www.ncwit.org/gradadvisor)).

## **POST-SECONDARY EDUCATION**

### **PhD's Show Differences from Other Degrees**

- For both genders, a large proportion of CIS doctoral students are non-residents.
- Data indicate that CS PhDs are more likely to remain in the U.S., compared to PhDs in most other science & engineering fields.



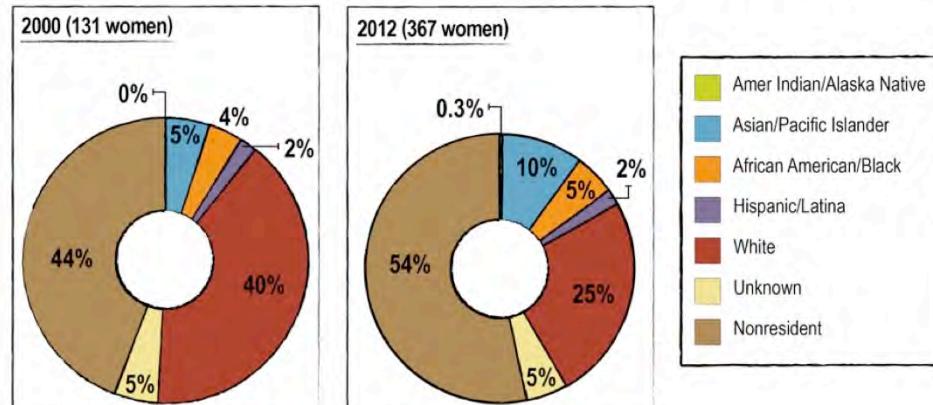
- Within both genders, a large percentage of doctoral students were non-residents in 2012.
- This is more pronounced than the trends in science and engineering doctorates in general in the U.S.
- In 2012, for instance, non-residents accounted for 36% of the science and engineering doctorates awarded in the U.S.
- Interestingly, data indicate that graduates of computer science PhD programs are more likely to remain in the U.S., compared to doctorate recipients in most other science and engineering fields.

[Source: Finn, M. (2010). Stay rates of foreign doctorate recipients from U.S. universities, 2007. Oak Ridge Institute for Science and Education, U.S. Department of Energy.]

# POST-SECONDARY EDUCATION

## Doctoral Degrees, 2000 and 2012

RACIAL/ETHNIC PERCENTAGES OF FEMALE COMPUTING DOCTORAL DEGREES



© NCWIT. Source: U.S. Department of Education, National Center for Education Statistics, Integrated Postsecondary Education Data System, 2000, 2012.

[ncwit.org/scorecard](http://ncwit.org/scorecard)

- The number of women receiving CIS doctoral degrees had nearly tripled in 2012, compared to 2000, with 367 women completing CIS doctorates.
- In 2012, the percentage of White females substantially decreased, while the percentage of Asian/Pacific Islander and non-resident females increased.

[Source: U.S. Department of Education, National Center for Education Statistics, Integrated Postsecondary Education Data System, 2000, 2012]



- Effective recruitment and retention strategies are key.
- NCWIT offers two comprehensive workbooks of research-based techniques for recruiting and retaining undergraduates ([www.ncwit.org/recruitingworkbook](http://www.ncwit.org/recruitingworkbook) and [www.ncwit.org/retainingworkbook](http://www.ncwit.org/retainingworkbook)) as well as other key practices for retention ([www.ncwit.org/retainundergrads](http://www.ncwit.org/retainundergrads)).
- You can share these workbooks and practices with academic deans and faculty to help academic departments become more supportive of diverse students and faculty.
- If you are in industry, make sure your company's campus recruiters emphasize to students that there is high demand for computing majors and minors.

case study

## Small Steps Can Make a Big Difference

Change a small number of factors and end up with a **large number of female computing majors**.

- Carnegie Mellon went from 7% female CS majors to 40% in 4 years.
- UC Irvine improved male and female pass and retention rates without lowering the bar.
- UVA changed its introductory course, and 27% of minority students and 33% of female students then chose CS majors.

Are your faculty members satisfied with the number and quality of students in your degree program?

[ncwit.org/scorecard](http://ncwit.org/scorecard)

- NCWIT provides case studies for many of its promising practices.
- This slide refers to three different universities that found that changing a small number of factors gave them a **large number of female computing majors**.
- In the first instance, Carnegie-Mellon made changes that resulted in an increase from 7% female CS majors to 40% in 4 years.
- In the second example, the University of California at Irvine was able to improve male and female pass and retention rates without lowering the bar.
- In the third example, the University of Virginia changed its introductory course, and 27% of minority students and 33% of female students then chose CS majors.
- You can learn more about the theory behind these three examples by reading the NCWIT Promising Practice sheet “Small Steps Toward Systemic Change” ([www.ncwit.org/reengineerundergrad](http://www.ncwit.org/reengineerundergrad))
- The next slide explains a little more about the steps each institution took.

case study

## How Did They Do It?

They used evidence-based practices, including:

- Actively recruiting
- Revising admission criteria
- Accommodating different entry levels
- Creating a female peer community
- Implementing pair programming
- Providing better TA training
- Introducing peer lab tutors

[ncwit.org/scorecard](http://ncwit.org/scorecard)

Carnege Mellon used research-based systemic change that included:

- recruiting through feeder networks and outreach
- revising admission criteria to maintain high academic standards, while deemphasizing experiences women were less likely to have
- offering multiple entry points to accommodate incoming students' different levels of programming experience
- creating a supportive peer community for women

UC Irvine made pedagogical changes that included:

- implementing pair programming
- providing better training for TAs
- introducing peer lab tutors

Irvine also:

- redistributed course topics to reduce duplication & increased shared lab time

UVA instituted curricular changes that included:

- mandating an intro to CS course for incoming freshmen
- directing students into different sections, depending on their programming experience level

## **POST-SECONDARY EDUCATION**

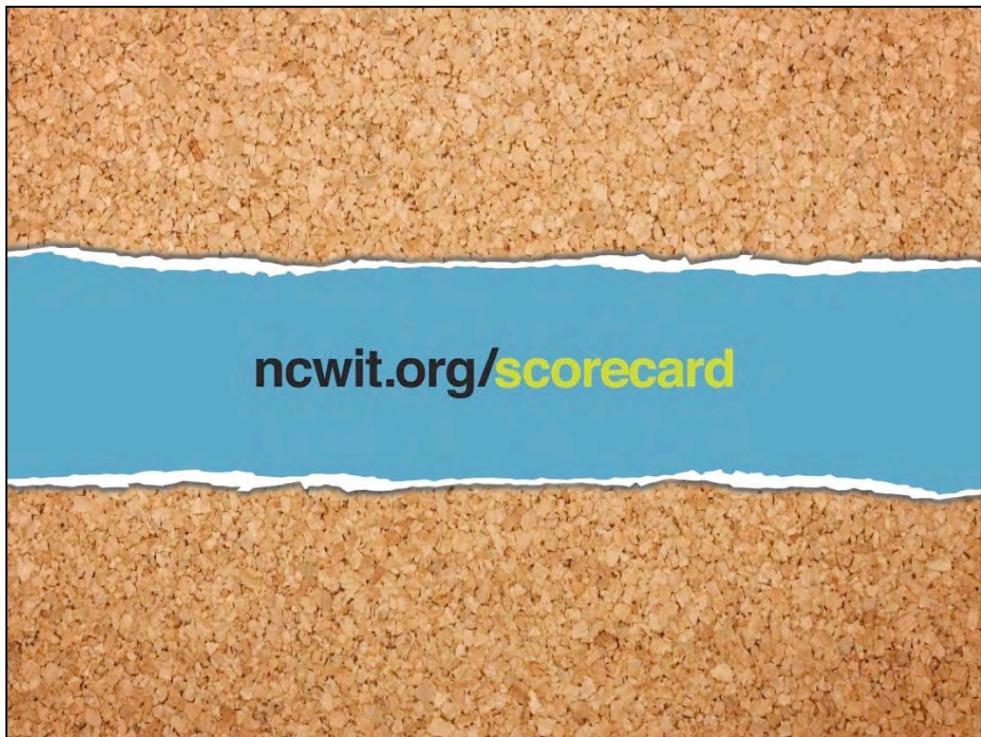
### **Evidence-based Recruitment and Retention Strategies Really Can Help**

You can increase the number of degree completions in computing through...

- Effective outreach
- Compelling introductory courses
- Cooperative learning within the major



- Evidence-based recruitment and retention strategies really can help.
- You can increase the number of degree completions in computing through...
  - Effective outreach
  - Compelling introductory courses
  - Cooperative learning within the major



Thank you!



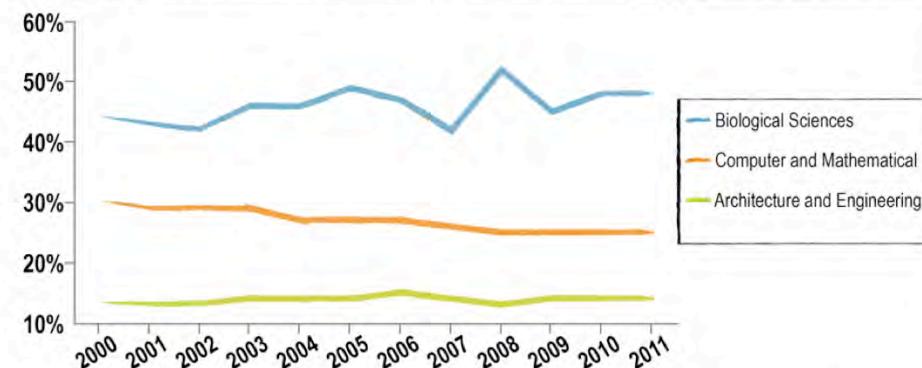
*You may use these charts and slides in your own presentations, customizing to make the content compelling for your audience. Please retain the NCWIT copyright as well as source attributions on all charts and tables. Be careful not to alter accuracy as you alter wording.*

*All the charts, tables, and evidence-based practices suggested in the NCWIT Scorecard are available on the NCWIT website ([www.ncwit.org](http://www.ncwit.org)).*

## WORKFORCE

### Women Well-represented in Science Professions, Less So in Computing

FEMALE PERCENTAGE OF WORKFORCE IN SELECTED SCIENCE PROFESSIONS,  
2000-2011



©NCWIT. Source: U.S. Department of Labor, Bureau of Labor Statistics, Employed persons by detailed occupation and sex, annual averages, 2000-11.

[ncwit.org/scorecard](http://ncwit.org/scorecard)

- From 2000 to 2011, women comprised 55% to 58% of the overall professional workforce.
- Women's representation in biology is essentially at parity in the last decade.
- Meanwhile, the percentage of women in computing-related occupations has declined between 2000 and 2011, but now seems to be holding steady.
- The percentage of women in Engineering (and Architecture) has increased slightly in the last decade, but remains the lowest of all STEM fields.

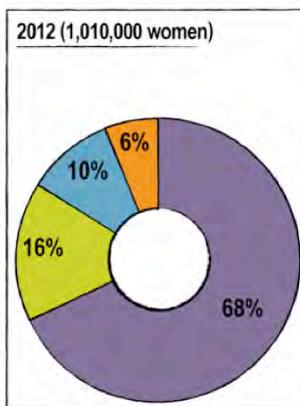
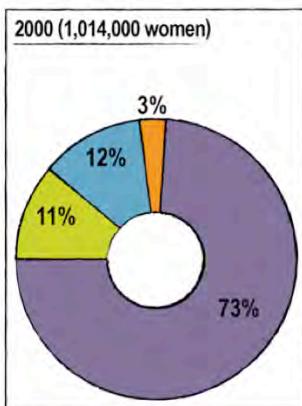
\*Note: By “professional work force,” we refer to the “professional and related occupations” classification used by the U.S. Bureau of Labor Statistics.

[Source: U.S. Department of Labor, Bureau of Labor Statistics, Employed persons by detailed occupation and sex, annual averages 2000-11.]

# WORKFORCE

## Women in Computing-related Occupations, 2000 and 2012

RACIAL/ETHNIC PERCENTAGES OF WOMEN IN COMPUTING-RELATED OCCUPATIONS



- African American/Black
- Asian/Pacific Islander
- Latina/Hispanic
- White

©NCWIT, Source: U.S. Department of Labor, Bureau of Labor Statistics, 2000, 2012.

[ncwit.org/scorecard](http://ncwit.org/scorecard)

- In 2012, the number of women in the computing workforce has regained the relatively high level of 2000, with higher percentages of Latinas and Asian Pacific Islanders.
- The percentage of African American/Black women has been decreasing over time and is now lagging behind Asian-Americans.
- The racial/ethnic percentages of women in computing have shifted in the last four years (since 2009), when women in computing were 6% Latina, 9% Asian, and 16% African-American.

[Source: U.S. Department of Labor, Bureau of Labor Statistics, 2000, 2012]

# WORKFORCE

## Most Computing Occupations Losing Women

FEMALE PERCENTAGE EMPLOYED IN COMPUTING-RELATED OCCUPATIONS, 2000-2012

OCCUPATIONAL CLASSIFICATION	2000	2005	2009	2012
Operations research analysts	51%	50%	47%	55%
Database administrators	43%	33%	35%	37%
Computer support specialists	35%	33%	27%	27%
Computer scientists and systems analysts	34%	30%	27%	31%
Computer programmers	26%	26%	20%	23%
Network and computer systems administrators	23%	19%	22%	25%
Computer software engineers	24%	22%	20%	20%
Computer hardware engineers	22%	11%	9%	15%

© NCWIT. Source: U.S. Department of Labor, Bureau of Labor Statistics, annual averages, 2000, 2005, 2009, 2012. [ncwit.org/scorecard](http://ncwit.org/scorecard)

Make a Difference

RECRUIT

Reduce bias in recruiting

[www.ncwit.org/biasselection](http://www.ncwit.org/biasselection)

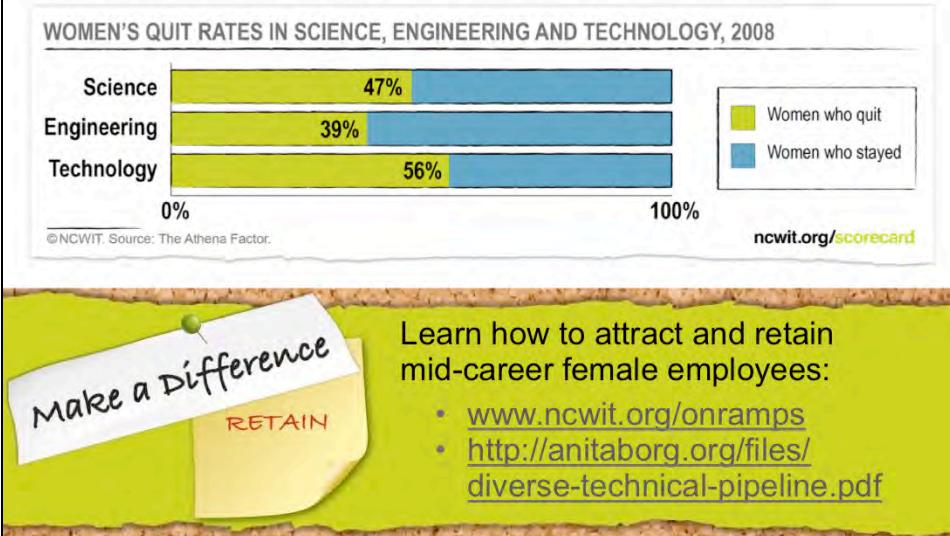
- Women's representation in the specific computing occupations tracked by the U.S. Bureau of Labor Statistics is holding steady or on the rise in the last several years.
- The percentage of women employed as Operations Research Analysts or Network & Computer Systems Administrators has surpassed 2000 levels, with Operations Research Analysts exceeding 50% women.
- As you can see from this table, the percentage of women in other computing-related occupations is holding steady or increasing.

[Source: U.S. Department of Labor, Bureau of Labor Statistics, Annual Averages, 2000, 2005, 2009, 2012.]

- You can make a difference in these percentages by reducing unconscious bias in your organization's approach to recruiting.
- Learn more by reading the NCWIT promising practice called "How Can Reducing Unconscious Bias Increase Women's Success in IT? Avoiding Gender Bias in Recruitment/Selection Processes" ([www.ncwit.org/biasselection](http://www.ncwit.org/biasselection)) and also "How Can Organizations Recruit Diverse Talent in Ways that Promote Innovation and Productivity? Interview Strategies that Identify Functionally Diverse Perspectives" ([www.ncwit.org/interviewstrategies](http://www.ncwit.org/interviewstrategies)).
- Get these practices and more from the NCWIT website.

## WORKFORCE

### Despite Job Security and Good Salaries, Mid-career Women Leave The Private Sector



- In the private sector, women leave the computing workforce at twice the rate of their male peers.
- Women's quit rate in technology exceeds that of other science and engineering fields.

[Source: Hewlett, S.A., Buck Luce, C., Servon, L.J., Sherbin, L., Shiller, P., Sosnovich, E., et al (2008). *The Athena factor: Reversing the brain drain in science, engineering, and technology*. New York: Center for Work-Life Policy.]

You can make a difference in these statistics:

- Try some evidence-based approaches to retain technical employees.
- Learn how to attract and retain mid-career female employees in particular ([www.ncwit.org/onramps](http://www.ncwit.org/onramps)).
- Leadership and technical skills development, flexible scheduling, virtual workplaces, and mentoring programs are some of the evidence-based retention practices included in the Anita Borg Institute report, "Retaining a Diverse Technical Pipeline During and After a Recession" (<http://anitaborg.org/files/diverse-technical-pipeline.pdf>).

## WORKFORCE

### Women May Leave The Private Sector, But Most Keep Working

Private sector:

- Women leave computing at twice the rate of male peers.
- 56% of women in tech companies leave at mid-level point (10-20 years) in their careers, so they do not reach upper ends of earning and leadership potential.

Most of these women remain in the workforce, but in a different capacity:

- 49% stay in computing (public sector or self-employed)
- 31% move to non-technical field
- 20% leave work force

[ncwit.org/scorecard](http://ncwit.org/scorecard)

- As I mentioned in the previous slide, women leave the computing workforce in the private sector at twice the rate of their male peers.
- Research has shown that 56% of women in technology companies leave their organizations at the mid-level point (10-20 years) in their careers, so many do not reach the upper ends of their earning and leadership potential.
- Most of these women who leave technology companies (i.e., the 56% referred to above) remain in the workforce, but in a different capacity:
  - 49% of these women continue in IT, either in the public sector or in their own businesses
  - 31% work in a non-technical field
  - 20% leave the work force, some temporarily and some permanently

[Source: Hewlett, S.A., Buck Luce, C., Servon, L.J., Sherbin, L., Shiller, P., Sosnovich, E., et al (2008). *The Athena factor: Reversing the brain drain in science, engineering, and technology*. New York: Center for Work-Life Policy.]

## WORKFORCE

### Women in Industry Leadership Roles

94% of Americans feel comfortable with a woman heading a large technical company. To date, there have been few female leaders in business, and even fewer in IT. But those stats may be shifting...

#### In 2013...

- 4% of Fortune 500 CEOs were female
- In Fortune 500 companies, women held 14% of executive officer positions and 16% of board of director positions

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- Although a Pew Research Center survey found that 94% of U.S. Americans said they feel comfortable with a woman as the head of a large technical company, historically there have been few female leaders in the business world, and even fewer in IT.

[Source: The White House Project (2009). Benchmarking women's leadership.]

#### But things may be beginning to shift ...

- In Fortune 500 companies, women held 14% of executive officer positions (up from 10% in 2009) and made up 16% of board of director positions (up from 11% in 2009). Women of color make up 3% of board of directors in the Fortune 500.

[Source: Catalyst (2011). 2011 Catalyst: Census of corporate officers and top earners of the Fortune 500. New York: Catalyst. ]

- The percentage of female CEOs of Fortune 500 companies was 4% in 2013 (up from 3% in 2008 and 2009).

[Source: Fortune 500 Women CEOs.

<http://www.catalyst.org/knowledge/2011-catalyst-census-fortune-500-women-executive-officers-and-top-earners> (accessed 12-09-13)]

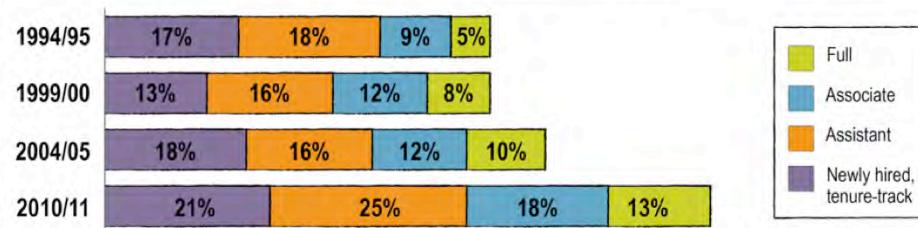


- You can make a difference through mentoring and taking steps to diversify your leadership.
- Learn how by checking out these NCWIT publications, available for free download on the NCWIT website.
- Workplace mentoring programs can help the careers and morale of mentors and mentees. The first URL on the slide is for those in industry ([www.ncwit.org/imentor](http://www.ncwit.org/imentor)) and the second ([www.ncwit.org/seed](http://www.ncwit.org/seed)) for those in academia.
- Get tips for incorporating diverse leadership into your strategic planning efforts. NCWIT has developed a strategic planning workbook specifically for industry. Download it for free at [www.ncwit.org/industryworkbook](http://www.ncwit.org/industryworkbook).

# WORKFORCE

## Few Women in Leadership Roles: Academia

FEMALE PERCENTAGE OF COMPUTER SCIENCE FACULTY AT PHD-GRANTING INSTITUTIONS, 1995-2011



©NCWIT. Source: CRA Taulbee Survey, 1994-95, 1999-00, 2004-05, 2010-11.

[ncwit.org/scorecard](http://ncwit.org/scorecard)

The female percentage of computing faculty has increased at all ranks since 1995. Still, the higher the faculty rank, the fewer the women.

- The female percentage of computing faculty has increased substantially at all ranks since 2002.

[Source: CRA Taulbee Survey, 1994-95, 1999-00, 2004-05, 2010-11.]

- Still, the higher the faculty rank, the fewer the women.
- Even allowing for academic hiring and promotion practices that result in slow changes in the population of full professors, computing lags behind the rest of academia, where women comprised between 20% and 30% of full professors in 2005-2006.

[Source: West, M. & Curtis, J. (2006). AAUP faculty gender equity indicators 2006.]

- Good mentoring programs can help female faculty advance in the ranks.  
[www.ncwit.org/gatechmentoring](http://www.ncwit.org/gatechmentoring)
- The NCWIT *Mentoring Faculty Women Program-in-a-Box* spells out all the steps for setting up a program.  
[www.ncwit.org/facultymentor](http://www.ncwit.org/facultymentor)

[ncwit.org/scorecard](http://ncwit.org/scorecard)

- You can make a difference by establishing and supporting faculty mentoring programs.
- These have been shown to make a positive difference when done right.
- Learn more from these free NCWIT materials.
- The first one listed explains the practice of mentoring and provides a brief case study from Georgia Tech University.
- The second resource listed on this slide provides all the background you need to set up a mentoring program for female faculty at your university.
- Both are available for free download from the NCWIT website.

# WORKFORCE

## Why Women Leave the Workplace

Women often leave technology because of perceived barriers in the workplace.



- Research shows that 5 primary barriers often lead women to leave the technical workplace.
- These barriers to gender diversity are unconscious bias, isolation, supervisory relationships, promotion processes, and competing life responsibilities.

[Source: Ashcraft, C. & Blithe, S. National Center for Women and Information Technology. (2009). *Women in IT: The Facts*. Boulder: NCWIT.]

### Make a Difference:

Help your organization overcome barriers in order to hire **and** retain female employees. NCWIT has a Supervising-in-a-Box series that touches on many aspects of encouraging gender diversity in the workplace ([www.ncwit.org/supervising](http://www.ncwit.org/supervising)).

**Make a Difference**

- Uncover institutional barriers to diversity  
[www.ncwit.org/ib](http://www.ncwit.org/ib)
- Hone your skills at spotting bias in performance evaluations  
[www.ncwit.org/supervising](http://www.ncwit.org/supervising)
- Personalize the issues by viewing a video of real women who have left their corporate positions because of bias  
[www.ncwit.org/supervising](http://www.ncwit.org/supervising)

[ncwit.org/scorecard](http://ncwit.org/scorecard)

- We all have unconscious biases. It's part of human nature.
- To reduce the effects of these biases, we can increase our awareness.
- NCWIT has a number of materials to help your organizations.
- Some are Programs-in-a-Box; some are Talking Points cards; and some are descriptions of promising practices with case studies.
- You can start with a simple Talking Points card to give you strategies for discussing bias in the workplace.
- NCWIT has a Talking Points card titled "Institutional Barriers and Their Effects: How can I talk to colleagues about these issues?" ([www.ncwit.org/ib](http://www.ncwit.org/ib))
- Despite the best intentions, there is often implicit bias in supervisory relationships.
- NCWIT has a series of Supervising-in-a-Box tools to help your organization overcome some of these barriers in order to both hire and retain female employees ([www.ncwit.org/supervising](http://www.ncwit.org/supervising)).
- Hone your skills at spotting bias in performance evaluations ([www.ncwit.org/supervising](http://www.ncwit.org/supervising)).
- Personalize the issues by showing a video of real women who have left their corporate positions because of bias ([www.ncwit.org/supervising](http://www.ncwit.org/supervising)).

**Make a Difference**

**REDUCE BIAS**

- Gain high-level support for diversity efforts within your organization  
[www.ncwit.org/institutionalaccountability](http://www.ncwit.org/institutionalaccountability)
- Read about solutions major companies are trying  
<http://app.post.hbsp.harvard.edu/athena/athena2/index.html>

[ncwit.org/scorecard](http://ncwit.org/scorecard)

- Try new techniques for gaining high-level support for diversity efforts within your organization ([www.ncwit.org/institutionalaccountability](http://www.ncwit.org/institutionalaccountability)).
- Read about solutions major companies are trying to reverse the “brain drain,” featured in The Athena Factor, a research report published by *Harvard Business Review* (<http://app.post.hbsp.harvard.edu/athena/athena2/index.html>).

case study

## Accountability Can Make a Big Difference

Establishing unit-specific accountability can **increase diversity**.

- Company ABC had 30,000 employees in 100 offices worldwide developing information-storage solutions.
- Within five years of establishing formal accountability for diversity, the company saw its diversity numbers improve.
- African-American managers were promoted to executive positions and African-American interns returned as employees.

Are your diversity initiatives improving the status quo?

[ncwit.org/scorecard](http://ncwit.org/scorecard)

- NCWIT collects case studies that illustrate promising and best practices in action.
- In this case study, one company found that establishing unit-specific accountability increased diversity.
- This company, whom we will call Company ABC, had 30,000 employees developing information-storage solutions in 100 offices worldwide.
- Within five years of establishing formal accountability for diversity, the company saw its diversity numbers improve.
- The company had focused on increasing the representation of African-American employees at all ranks.
- After five years, 14 African-American managers were promoted to executive positions and 60% to 80% of African-American interns returned as employees.
- Are your diversity initiatives improving the status quo like this?
- This case study can be found on the publication titled, “Establishing Institutional Accountability” ([www.ncwit.org/institutionalaccountability](http://www.ncwit.org/institutionalaccountability)).
- In the next slide, we will learn more about what steps they took at Company ABC.

case study

## How Did They Do It?

By establishing unit-specific accountability through:

- Central diversity committee with company-wide oversight
- Diversity councils from each major business unit in company
- Executive VP on each council to assign & review council work
- Public support from the CEO & attendance at council meetings
- Local focus and control
- Diversity councils evaluated each other's programs

[ncwit.org/scorecard](http://ncwit.org/scorecard)

- To create accountability, the company established a diversity committee to oversee 9 diversity councils — one for each major business unit within the company.
- Several features of this structure were important:
- **Top management support and accountability** - Each council included executive vice presidents who assigned the council's work, to ensure focus on recruitment, employee development, and data collection.
- Importantly, the CEO publicly supported diversity efforts by attending some council meetings and acting as an advisor.
- **Local focus and control** - Each council was encouraged to create programs that improved upon their unit's existing demographics and fit their specialized programs.
  - This local control also helped each council tie diversity goals to their own unit's business goals.
- **Internal responsibility and oversight** - Diversity councils evaluated each other's programs.
  - Statistics were reported to Executive VPs and also made available to all staff members.

## WORKFORCE

### Evidence-based Recruitment and Retention Strategies Really Can Help

You can increase the number of women who persist in the computing workforce by ...

- Reducing unconscious bias
- Uncovering institutional barriers
- Improving supervisory relationships



- Evidence-based recruitment and retention strategies really can help.
- You can increase the number of women who persist in the computing workforce by reducing unconscious bias, uncovering institutional barriers, and improving supervisory relationships.



Thank you!



*Please use the charts and slides in your own presentations, customizing to make the content compelling for your audiences. We just ask that you retain the NCWIT copyright as well as source attributions on all charts and tables. Be careful not to alter accuracy as you alter wording.*

*All the charts, tables, and evidence-based practices suggested throughout this Scorecard are available on the NCWIT website ([www.ncwit.org](http://www.ncwit.org)).*

# **THOUGHT LEADERSHIP AND INNOVATION**

## **Diversity's Role in Technology Thought Leadership**

NCWIT tracks women's participation in technology thought leadership. Here's what we know so far about...

- Diverse teams
- Patenting
- Conference papers
- Open source software



- The innovative thinking that more gender and racial/ethnic diversity could bring to computing would advance the field by highlighting new problems and solutions.
- NCWIT tracks women's participation in technology innovation and thought leadership. The next several slides show what NCWIT has learned so far about...
  - Diverse teams
  - Patenting
  - Conference papers
  - Open source software

# THOUGHT LEADERSHIP AND INNOVATION

## Innovation Benefits from Diversity

Diversity of thought contributes to innovation. Research shows that ...

- groups with greater diversity solve complex problems better and faster than do homogenous groups.
- teams with 50:50 gender membership are more experimental and more efficient.



- A wealth of research shows that diversity of thought improves innovation. There are studies showing that diversity also improves **problem-solving, productivity, decision-making**, and even the **bottom line**.

[Sources: Page, S. (2009). *The difference: How the power of diversity creates better groups, firms, schools, and societies*. Princeton, NJ: Princeton University Press; Knight, D. et al, “Top management team diversity, group process, and strategic consensus,” *Strategic Management Journal*, 1999, 20: 445–465.]

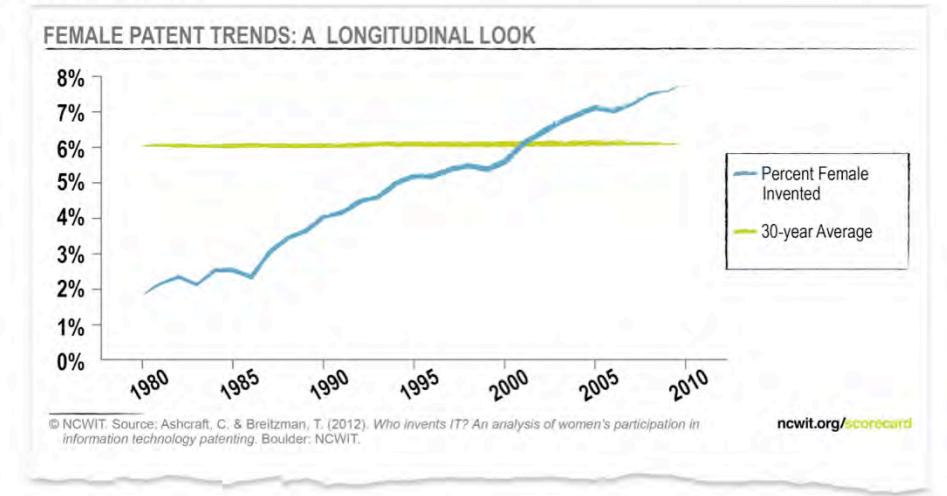
- Likewise, a study of over 100 teams at 21 different companies showed that teams with 50:50 gender membership were more experimental and more efficient.

[Source: London Business School. (2007). *Innovative potential: Men and women in teams*.]

- You can make a difference by creating – and joining – diverse teams.
- NCWIT makes it easy by providing you with tools for achieving diversity in your employee base.
- The NCWIT Supervising-in-a-Box series contains great tips for how to recruit and hire diverse employees, and how to manage diverse teams.
- The Supervising-in-a-Box Series is available for free download from the NCWIT website ([www.ncwit.org/supervising](http://www.ncwit.org/supervising)).

## THOUGHT LEADERSHIP AND INNOVATION

### Female U.S. IT Patenting Low, but Improving with Time

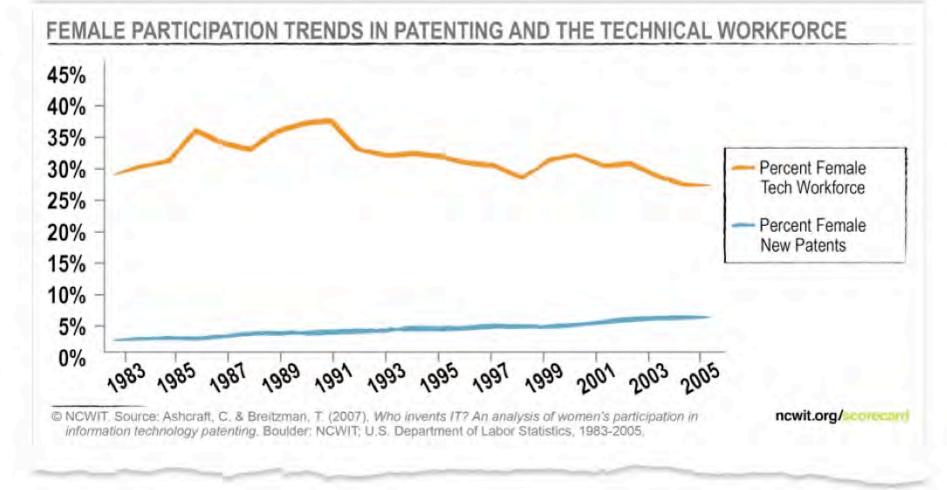


- Over the 30-year period shown on the graph, 6.1% of U.S.-invented IT patents were produced by female inventors; in other words, if you add up all patents issued in those 30 years, 6.1% of them were invented by women. (7.5% were produced by women in the last five years)
- The upward trendline you see on the graph shows the percentage of patents women produced each year from 1980 to 2010.
- That percentage has increased steadily from nearly 2% in 1980 to 6% in 2001 to 7.8% in 2010 — nearly a 4-fold increase.

[Source: Ashcraft, C. and Breitzman, T. (2012). *Who invents IT? An analysis of women's participation in information technology patenting*. Boulder: NCWIT. ]

# THOUGHT LEADERSHIP AND INNOVATION

## Female Patenting Increased While Women in Computing Decreased



- During this period when female patent activity was increasing, women's participation in the computing field was declining.
- Mixed-sex teams still produce the most highly cited patents, with citation patterns 30-40% higher than the norm.
- But further analysis suggests that the larger team sizes in mixed-sex teams account for the higher citation rates.

[Sources: Ashcraft, C. and Breitzman, T. (2012). *Who invents IT? An analysis of women's participation in information technology patenting*. NCWIT; U.S. Department of Labor, Bureau of Labor Statistics, 1983-2005.]

**Make a Difference**

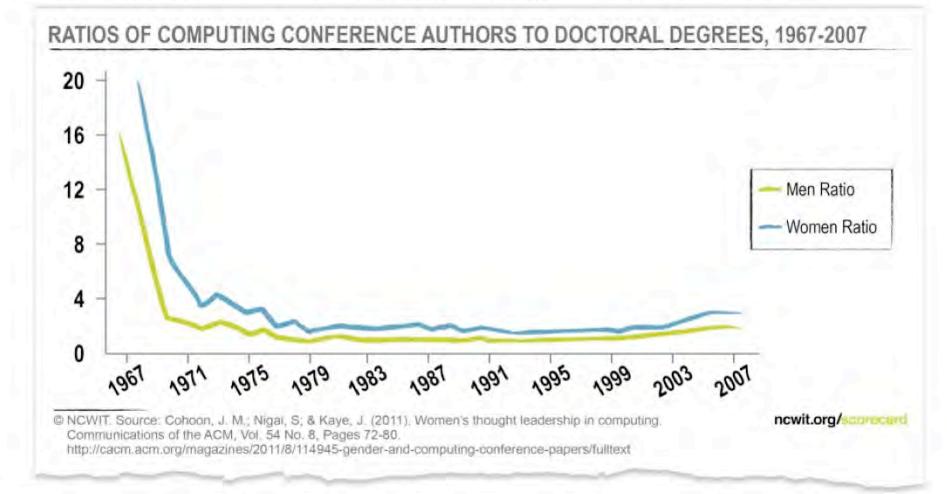
- Read the research on women's tech patenting  
[www.ncwit.org/patentreport](http://www.ncwit.org/patentreport)
- Implement learning communities in your department  
[www.ncwit.org/patentinglearning](http://www.ncwit.org/patentinglearning)

[ncwit.org/scorecard](http://ncwit.org/scorecard)

- You can make a difference by learning more about the research on women's technology patenting and by creating learning communities and diverse teams.
- To see more of the NCWIT research on patenting, go to [www.ncwit.org/patentreport](http://www.ncwit.org/patentreport).
- This report is available as a free download.
- To learn more about implementing learning communities in your department, read NCWIT's Promising Practice on how to promote innovation among diverse employees.  
([www.ncwit.org/patentinglearning](http://www.ncwit.org/patentinglearning))

# THOUGHT LEADERSHIP AND INNOVATION

## Women Make Disproportionately High Contributions to Computing Conferences



- In the only study of its kind, NCWIT researcher Joanne Cohoon found that during a 40-year time span, women have made disproportionately high contributions to computing conferences.
- From 1967 to 2007, the average woman with a computing PhD authored more conference papers than did the average man with a computing PhD.
- For each woman who earned a PhD in computer science between 1967 and 2007, there were 2.7 female author credits in 2007, whereas for each male PhD, there were 1.6 male author credits.
- The dataset included papers published within Association of Computing Machinery (ACM) publications.

\*Note: “Author credits” count authors each time they publish. The researchers in this study compared degree recipients with instances of authorship, not degree recipients to papers published, or degree recipients to authors.

[Source: Cohoon, J. M., Nigai, S., and Kaye, J. (2010) Women’s Thought Leadership in Computing. Manuscript under review.]

## **THOUGHT LEADERSHIP AND INNOVATION**

### **Women and Computing Conference Publications**

- Among 64 long-standing ACM conferences, most had 20%-25% women authors
- Most men and women published on topics of design and theory
- Women were more likely to publish on human factors and less likely to publish on algorithms



[ncwit.org/scorecard](http://ncwit.org/scorecard)

- ACM conferences vary in their proportions of papers authored by women, but among 64 long-standing conferences, most had about 20% to 25% female authors.
- Like men, most women published on topics of design and theory, but women were more likely than men to publish on human factors and less likely than men to publish on algorithms.

[Source: Cohoon, J. M.; Nigai, S; and Kaye, J. (2010) Women's Thought Leadership in Computing. Manuscript under review.]

*Make a Difference*

- Call conference organizers' attention to diversity of speakers and presenters.
- Encourage more women to submit work for publication.
- Use a double-blind review process in reviews.

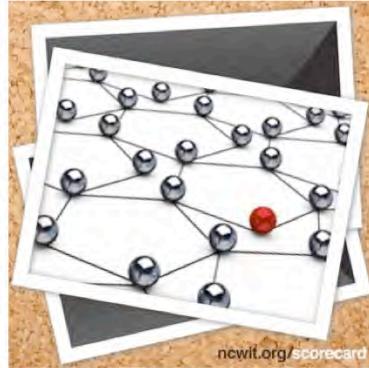
[ncwit.org/scorecard](http://ncwit.org/scorecard)

- You can make a difference by working to diversify the conferences you are involved in.
- When you attend conferences, call the organizers' attention to whether or not the conference represents diverse perspectives.
- If you are on the conference planning committee, actively recruit female speakers and presenters.
- If you sit on an editorial board for a journal, bring up diversity at editorial meetings and encourage a variety of authors to submit their work; then use a double-blind review process to overcome the effects of unconscious bias.

## THOUGHT LEADERSHIP AND INNOVATION

### Open Source Lacks Gender Diversity

- Only 1.5% of all Open Source Software (OSS) developers are women.
- Anecdotal evidence suggests that the open source community is less than welcoming to women.



- While women's representation in computing is low in general, it is even lower in open source computing – only 1.5% of all Open Source Software (OSS) developers are women.
- Research about the participation of women in open source is just beginning, but there is anecdotal evidence that the open source community is less than welcoming to women.
- This may mean women are missing opportunities to make important professional connections, contribute to new software, and hone their coding skills.

[Source: Nafus, D., Leach, J., & Krieger, B. (2006). *Free/Libre and Open Source Software: Policy Support* (Integrated Report of Findings). Cambridge: FLOSSPOLS.]



You can make a difference:

- Be inclusive.
- If you contribute to open source forums, do your part to ensure it is a welcoming environment for diverse contributors and encourage others to follow suit.
- Read more about research on diversity in open source at the NCWIT website ([www.ncwit.org/cultureos](http://www.ncwit.org/cultureos)).
- This annotated bibliography describes recent research and is free to download from the NCWIT website.

# THOUGHT LEADERSHIP AND INNOVATION

## More to Learn

- NCWIT continues to follow indicators of thought leadership in computing communities, to gauge women's inclusion (or lack thereof) and its effect on innovation.



- *Mentoring-in-a-Box: Technical Women at Work*  
[www.ncwit.org/imentor](http://www.ncwit.org/imentor)
- Recognize bias in the workplace  
[www.ncwit.org/overtsexism](http://www.ncwit.org/overtsexism)

- In the coming years, NCWIT will continue to follow indicators of thought leadership in both mainstream and non-mainstream computing communities, to gauge women's inclusion (or lack thereof) and its effect on innovation.
- Meanwhile, you can make a difference in a number of ways.
- You can mentor. Find out how by downloading Mentoring-in-a-Box: Technical Women at Work ([www.ncwit.org/imentor](http://www.ncwit.org/imentor))
- You can learn to better recognize bias in the workplace.
- Read the NCWIT Promising Practice on overt sexism ([www.ncwit.org/overtsexism](http://www.ncwit.org/overtsexism)) and find other publications on the NCWIT website that explain the influence of unconscious, or unintended, bias.



Thank you!