NCWIT SCORECARD
a report on the status of women in information technology

national center for women & information technology
ncwit.org/scorecard
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ABOUT NCWIT AND THE NCWIT SCORECARD

NCWIT

The National Center for Women & Information Technology (NCWIT) is a coalition of more than 250 corporations, academic institutions, government agencies, and non-profits working to strengthen the computing workforce and promote technology innovation by increasing the participation of women and under-represented groups. NCWIT’s national programs and alliances focus on reforming the entire pipeline, from K-12 through higher education to corporate, academic, and entrepreneurial careers.

We believe that inspiring more women to choose careers in computing isn’t only about equity, it’s also about innovation, competitiveness, and workforce sustainability. In a global economy driven by innovation, gender diversity in IT means a larger and more competitive workforce and the ability to create technology that is as broad and creative as the people it serves.

THE NCWIT SCORECARD

This report . . .

➢ shows trends in girls’ and women’s participation in computing and computing-related professions in the U.S. over time.
➢ provides a benchmark for measuring progress and identifying areas for improvement.

HOW TO USE IT

➢ Look for sections titled “Make a Difference” to learn what you can do to help.
➢ Download an electronic version of this report, along with PowerPoint slides and .jpeg modules that you can adapt for your presentation needs (www.ncwit.org/scorecard).
➢ Share this information with your colleagues, your organization’s leaders, your students, your children, your local schools, and the key decision-makers for your community.

Together, we can increase girls’ and women’s participation.
WHY GENDER DIVERSITY IS IMPORTANT IN COMPUTING

DIVERSITY EXPANDS THE QUALIFIED EMPLOYEE POOL

The U.S. Bureau of Labor Statistics projects that by 2018, there will be a total of nearly 1.4 million computing-related jobs added in the U.S., an increase of 22% from 2008. That’s the good news. The bad news is that the number of people graduating from college with computer or information sciences degrees has been decreasing steadily since 2004. At this rate, fewer than one-third of the vacant computing jobs expected by 2018 could be filled by U.S. graduates with computing degrees. 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.

DIVERSITY 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 racial and gender diversity were associated with increased sales revenue, more customers, and greater profits.

DIVERSITY ENHANCES INNOVATION

Information technology informs all aspects of modern society. Incorporating women and people of color is vital to the future of technological innovation. When we bring a wider variety of people into IT, our innovation will be enhanced through the valuable contributions that diverse perspectives bring.

DIVERSITY 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.
WHY COMPUTING IS A GOOD CAREER FOR WOMEN

ncwit.org/scorecard
PROFITS HIGH, UNEMPLOYMENT LOW, SALARIES HIGH

Computing can be a secure field for women. In June 2009, when the overall unemployment rate in the U.S. was 9.7%, the unemployment rate for computer and mathematical occupations was 5.4%, and for women in these fields, it was only 3.8%.6

In the post-dotcom era and through the economic downturn, many technology industries showed profits:7

➢ Aerospace and defense
➢ Computers and office equipment
➢ Information technology services
➢ Internet services and retail
➢ Network and communications equipment
➢ Telecommunications

Of the top 50 most profitable companies in 2009, at least half were either tech companies or employed many high-skills technical people.8

<table>
<thead>
<tr>
<th>TOP 50 MOST PROFITABLE COMPANIES, 2009</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Exxon Mobil</td>
</tr>
<tr>
<td>2. Microsoft</td>
</tr>
<tr>
<td>3. Wal-Mart Stores</td>
</tr>
<tr>
<td>4. Procter &amp; Gamble</td>
</tr>
<tr>
<td>5. International Business Machines</td>
</tr>
<tr>
<td>6. Goldman Sachs Group</td>
</tr>
<tr>
<td>7. Merck</td>
</tr>
<tr>
<td>8. AT&amp;T</td>
</tr>
<tr>
<td>9. Wells Fargo</td>
</tr>
<tr>
<td>10. Johnson &amp; Johnson</td>
</tr>
<tr>
<td>12. General Electric</td>
</tr>
<tr>
<td>13. Bristol-Myers Squibb</td>
</tr>
<tr>
<td>14. Chevron</td>
</tr>
<tr>
<td>15. Pfizer</td>
</tr>
<tr>
<td>16. Berkshire Hathaway</td>
</tr>
<tr>
<td>17. Hewlett-Packard</td>
</tr>
<tr>
<td>18. Coca-Cola</td>
</tr>
<tr>
<td>19. Google</td>
</tr>
<tr>
<td>20. Liberty Media</td>
</tr>
<tr>
<td>21. Philip Morris International</td>
</tr>
<tr>
<td>22. Bank of America Corp.</td>
</tr>
<tr>
<td>23. Cisco Systems</td>
</tr>
<tr>
<td>24. PepsiCo</td>
</tr>
<tr>
<td>25. Abbott Laboratories</td>
</tr>
<tr>
<td>26. Apple</td>
</tr>
<tr>
<td>27. Oracle</td>
</tr>
<tr>
<td>28. ConocoPhillips</td>
</tr>
<tr>
<td>29. WellPoint</td>
</tr>
<tr>
<td>30. Amgen</td>
</tr>
<tr>
<td>31. McDonald’s</td>
</tr>
<tr>
<td>32. Constellation Energy</td>
</tr>
<tr>
<td>33. Intel</td>
</tr>
<tr>
<td>34. Eli Lilly</td>
</tr>
<tr>
<td>35. United Technologies</td>
</tr>
<tr>
<td>36. UnitedHealth Group</td>
</tr>
<tr>
<td>37. CVS Caremark</td>
</tr>
<tr>
<td>38. Verizon Communications</td>
</tr>
<tr>
<td>39. Comcast</td>
</tr>
<tr>
<td>40. Travelers Cos.</td>
</tr>
<tr>
<td>41. Walt Disney</td>
</tr>
<tr>
<td>42. Altria Group</td>
</tr>
<tr>
<td>43. 3M</td>
</tr>
<tr>
<td>44. Prudential Financial</td>
</tr>
<tr>
<td>45. Lockheed Martin</td>
</tr>
<tr>
<td>46. Kraft Foods</td>
</tr>
<tr>
<td>47. United Services Automobile Assoc.</td>
</tr>
<tr>
<td>48. Occidental Petroleum</td>
</tr>
<tr>
<td>49. Freeport-McMoRan Copper &amp; Gold</td>
</tr>
<tr>
<td>50. Ford Motor</td>
</tr>
</tbody>
</table>

This relative stability in IT is expected to continue, which is good news for women — and men — who are considering the field. Computing-related occupations are projected to be the fastest-growing segment of the professional workforce between 2008 and 2018. Compared to all professional occupations, which are projected to grow 18% by 2018, computing-related occupations are projected to grow by 22% and add more jobs than any other category of professional occupation.

### PREDICTED JOB GROWTH, 2000-2018

<table>
<thead>
<tr>
<th>Occupational Classification</th>
<th>Predicted Change, 2008-2018</th>
</tr>
</thead>
<tbody>
<tr>
<td>Computer and Mathematical Sciences Occupations</td>
<td>22%</td>
</tr>
<tr>
<td>Healthcare Practitioners and Technical Occupations</td>
<td>21%</td>
</tr>
<tr>
<td>Life, Physical, and Social Sciences</td>
<td>19%</td>
</tr>
<tr>
<td>Community and Social Services</td>
<td>17%</td>
</tr>
<tr>
<td>Legal</td>
<td>15%</td>
</tr>
<tr>
<td>Education, Training, and Library</td>
<td>14%</td>
</tr>
<tr>
<td>Arts, Design, Entertainment, Sports, and Media</td>
<td>12%</td>
</tr>
<tr>
<td>Architecture and Engineering</td>
<td>10%</td>
</tr>
</tbody>
</table>


With 1.4 million computing-related jobs expected to be added by 2018, encouraging women to pursue careers in computing may make the difference in filling jobs in this strong sector of the U.S. economy.
Many computing professions are predicted to grow at a faster rate than the science, technology, engineering, and mathematics (STEM) average. In fact, network systems analysts and computer software applications engineers are expected to be two of the top 30 fastest-growing professions. Moreover, many other professional occupations now require significant technical skills.

<table>
<thead>
<tr>
<th>Occupational Classification</th>
<th>Predicted Change, 2008-2018</th>
</tr>
</thead>
<tbody>
<tr>
<td>STEM Industry Average</td>
<td>19%</td>
</tr>
<tr>
<td>Network Systems Analysts</td>
<td>53%</td>
</tr>
<tr>
<td>Computer Software Engineers</td>
<td>33%</td>
</tr>
<tr>
<td>Network Administrators</td>
<td>23%</td>
</tr>
</tbody>
</table>

Computing salaries are highly competitive

Bachelor’s degrees in computer science and computer engineering yield two of the highest starting salaries for new graduates.\textsuperscript{12}

### TOP 10 SALARIES FOR UNDERGRADUATE DEGREES, 2009

<table>
<thead>
<tr>
<th>Undergraduate Degree</th>
<th>Starting Salary</th>
<th>Median Salary</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chemical Engineering</td>
<td>$65,700</td>
<td>$107,000</td>
</tr>
<tr>
<td>Computer Engineering</td>
<td>$61,700</td>
<td>$105,000</td>
</tr>
<tr>
<td>Electrical Engineering</td>
<td>$60,200</td>
<td>$102,000</td>
</tr>
<tr>
<td>Aerospace Engineering</td>
<td>$59,600</td>
<td>$109,000</td>
</tr>
<tr>
<td>Mechanical Engineering</td>
<td>$58,900</td>
<td>$98,300</td>
</tr>
<tr>
<td>Industrial Engineering</td>
<td>$57,100</td>
<td>$95,000</td>
</tr>
<tr>
<td>Computer Science</td>
<td>$56,400</td>
<td>$97,400</td>
</tr>
<tr>
<td>Environmental Engineering</td>
<td>$53,400</td>
<td>$94,500</td>
</tr>
<tr>
<td>Physics</td>
<td>$51,100</td>
<td>$98,800</td>
</tr>
<tr>
<td>Economics</td>
<td>$50,200</td>
<td>$101,000</td>
</tr>
</tbody>
</table>

© NCWIT. Source: http://www.payscale.com/

In 2009, starting and median salaries for computing degrees were among the top 10.
COMPUTING HELPS CLOSE THE GENDER WAGE GAP

According to U.S. Census data, women generally make less money than men.

In 2007, a woman typically earned $0.78 to every $1.00 a man earned. On the other hand, Census data also suggest that women who work in computing-related occupations are better off, with a median income that is 86% of men's median earnings.\(^\text{13}\)

In a different dataset — the Dice online salary survey of nearly 20,000 technology employees — findings indicate that technical women earned an average salary of $70,370 in 2008 compared to men's average of $80,359. Once comparable levels of experience, education, and job title are controlled for, the wage gap disappears for these tech workers.\(^\text{14}\)

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

DISPEL THE MYTHS

Dispel prevailing negative myths about the IT industry by sharing the facts. Low unemployment, high profitability, and a society that is increasingly IT-dependent means that computing is a good career for girls and women.

WHY COMPUTING IS A GOOD CAREER FOR WOMEN
SECONDARY EDUCATION

ncwit.org/scorecard
UNEVEN COMPUTING PREPARATION IN HIGH SCHOOL

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 (i.e., the use of computer applications such as office software).

More than 60% of the 1.5 million students surveyed who reported no high-school computer coursework or experience at all were girls. In spite of these distressing numbers, recent data give some reason for optimism: Girls’ representation among students with programming experience has increased four percentage points since 2005.

Other notable findings from the SAT survey include:

➤ The percentage of high-school students reporting computer literacy coursework or experience has held relatively steady since 1999.

➤ Since 1999, among those reporting programming experience, about 40% have been girls each year.

➤ During the same period, more than half of those reporting only computer literacy experience or no computing experience have been female.\(^{15}\)

Although the percentage of students reporting no computing experience or coursework has increased gradually in the past decade, girls’ representation among students with computer programming experience has also been on the rise.
In the past decade, the percentage of students reporting computer programming experience has decreased slightly. Although still relatively small, the percentage of students reporting no computing experience or coursework has increased gradually since 1999.
HIGH-SCHOOL GIRLS TOO SELDOM PARTICIPATE IN ADVANCED COMPUTING

ADVANCED PLACEMENT EXAMS

Of the 1.6 million U.S. Advanced Placement (AP) exam-takers in 2009, more than half were female (56%). However, of the 21,727 students who took a computer science (CS) AP exam, only 18% were female. Each year since 1999, the CS AP consistently had the lowest female percentage of any of the 37 AP exams, hovering at 18% or lower. In contrast, 47% of AP Calculus test-takers and 31% of AP Physics test-takers were female.16

The number of girls taking the CS AP exam reached a high point in 2009 (3,861). The next highest number of girls taking the CS AP exam was in 2001 (3,531).17

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 do not take the AP exam.18 Yet only 1% of AP exam-takers — whether male or female — took a computer science AP exam in 2009. 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.
Different researchers have found evidence that certain factors help encourage students to pursue computing: early, positive experiences with computing,\textsuperscript{19} adult encouragement (especially from parents),\textsuperscript{20} positive role models (female role models positively influence girls),\textsuperscript{21} and more information about what computing professionals actually do in their jobs.\textsuperscript{22}
**INTEL SCIENCE AND ENGINEERING FAIR PARTICIPATION**

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), the largest pre-college science competition in the world.

Since 1999, between 43% and 49% of all competitors have been girls. Despite a six-year rise (2001-2007), girls’ participation still remains lowest for computer-science projects compared to other topics.23

**COMPUTING — NOT DRAWING TOP MATH ACHIEVERS**

In 2009, as in previous years, 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, physics, engineering, biology, social sciences, foreign language, and philosophy, than in computer and information sciences.²⁴
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.25

In a different 2009 survey, 240,580 incoming college freshmen were asked what major they were planning to pursue. The most oft-intended majors were biology (5.2%) and nursing (4.5%). Interest in the CS major among male and female college freshmen has decreased steadily since the turn of the 21st century, with only about 2% of male freshmen intending a CS major, compared to 0.3% (\% of percent) of female freshmen. On the bright side, the percentage of female freshmen intending a computing major seems to have stopped its historical decline in recent years.26
Computing Education is Low-Profile or Absent in Schools

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.

There are several reasons for the lack of rigorous computing education:

➤ Computing is not a graduation requirement in most public high schools. Only 14 states have education standards for high-school computer science. Only 10 states allow CS AP courses to count toward graduation as an academic subject.27

➤ Computing may be relegated to “vocational” course choices and, therefore, does not attract college-bound students and their parents.28

➤ Computing as an elective course competes with other more traditionally attractive electives, such as music, foreign language, and sports.29

➤ Computing courses are often taught either by individuals with little technical background, or by technically astute individuals with little teaching preparation.30

➤ Federal and State educational and testing requirements make it hard for schools to integrate computing across the curriculum.

➤ There are National Educational Technology Standards for students, but without a graduation requirement, these standards frequently translate into basic familiarity with office software packages.31

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.
CASE STUDY

TARGETED RECRUITMENT RESULTS IN MORE FEMALE STUDENTS

In a case study submitted by Seth Reichelson of Ocoee High School, 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 two 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.”

HOW DID HE DO IT?

This teacher actively recruited girls from 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 the clubs with practical tools. 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.”

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. Seventy percent of Seth’s students typically pass the CS AP exam, whereas the school’s average pass rate for AP exams is 15%.

MORE SUCCESS STORIES

NCWIT’s Promising Practices are available for free download from the NCWIT website. Find case studies describing how the featured practice was implemented successfully.

Browse them all at www.ncwit.org/practices.
Others have had success increasing the number of girls in computing through encouragement, positive early experiences, and advocating for a high-school computing requirement.

**EVIDENCE-BASED RECRUITMENT AND RETENTION STRATEGIES REALLY CAN HELP**

**TALK TO GIRLS**

- The NCWIT Talking Points card can help you, school teachers, guidance counselors, academic advisors, and principals have conversations with girls that can change their image of computing: “Why Should Young Women Consider a Career in Information Technology?” ([www.ncwit.org/youngwomen](http://www.ncwit.org/youngwomen)).

**ENGAGE STUDENTS**

- NCWIT describes six key practices for inspiring girls’ (and boys’) interest in computing. Find these at [www.ncwit.org/practices](http://www.ncwit.org/practices).
- Learn some key components for recruiting girls into technology by referring to NCWIT’s Promising Practice, “What Are the Important Components of Targeted Recruiting? Girls Exploring Science, Engineering, and Technology Event” ([www.ncwit.org/geset](http://www.ncwit.org/geset)).
- Whether or not you are a computer science teacher, you may be able to provide computing course support to local schools. Training programs are available. Check the Computer Science Teachers Association (CSTA) website for many helpful resources and ideas ([http://www.csta.acm.org/](http://www.csta.acm.org/)).
REACH OUT

➤ NCWIT’s Outreach-in-a-Box (www.ncwit.org/outreach) can guide you through making presentations to middle-schoolers about IT. Using the box, IT professionals can customize and deliver a classroom presentation and engage youth in hands-on activities.

TAKE ACTION

➤ 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 graduation credit. Use the NCWIT Talking Points card, “Moving Beyond Computer Literacy: Why Schools Should Teach Computer Science” (www.ncwit.org/schools).

➤ Get specific statistics about computing education and workforce in your area at the NCWIT website (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).
FEW WOMEN STUDY COMPUTING

In the U.S. in 2009, women earned . . .

- 57% of all undergraduate degrees
- 52% of all math and science degrees
- 59% of the undergraduate degrees in biology and 42% of mathematics degrees
- 18% of all computer and information sciences undergraduate degrees

HOW CAN WE ATTRACT MORE FEMALE STUDENTS?

Often, a good first step is raising awareness among decision-makers. The NCWIT Scorecard has been shared with faculty, department chairs, and deans to help raise awareness within departments and garner support for more intensive recruiting and retention efforts. The pages to follow in the Post-secondary Education section provide data to make a strong case.

NCWIT offers two comprehensive workbooks of research-based techniques for recruiting and retaining undergraduates as well as other key practices for retention:

- [www.ncwit.org/recruitingworkbook](http://www.ncwit.org/recruitingworkbook)
- [www.ncwit.org/retainingworkbook](http://www.ncwit.org/retainingworkbook)
- [www.ncwit.org/retainundergrads](http://www.ncwit.org/retainundergrads)
**FEMALE PERCENTAGE OF STEM UNDERGRADS LOWEST IN COMPUTING**

Women’s representation in STEM disciplines at the bachelor’s level has risen since the 1970s, although some ground has been lost since 2006. In computing, however, women’s share of undergraduate degrees saw a moderate to rapid rise, followed by a steep decline. In recent years, the decline in the female percentage of computing undergraduate degree completions has leveled off.\(^3\)
WOMEN’S UNDERGRADUATE COMPUTING DEGREES HAVE DECLINED OVER TIME

Compared to 1985, more total bachelor’s degrees in computing were completed in 2009. However, in the 1980s and again in the early 2000s, women were awarded twice as many computing bachelor’s degrees as in 2009. The gap between the number of males and females receiving computing degrees has widened since the turn of the 21st century.34

FROM ASSOCIATE’S DEGREES TO DOCTORAL DEGREES: WOMEN RECEIVE FEWER THAN MEN

At 18%, the proportion of bachelor’s degrees in computing received by women in 2009 was lower than for associate’s (25%), master’s (27%), or doctoral (22%) 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 degrees has held steady the past two years, while the female percentage of doctoral degrees in computing has held steady since 2002.35

RACIAL/ETHNIC COMPOSITION OF COMPUTING DEGREES HAS CHANGED

The racial/ethnic diversity of women who completed post-secondary degrees shifted between 2000 and 2009, but the percentage of non-residents stayed steady. The percentage of female non-residents earning computing degrees was considerably higher at the graduate level than at the other undergraduate level. In 2009, at all degree levels there was more racial/ethnic diversity among female degree-earners in Computer and Information Sciences (CIS) than among male degree-earners.³⁶

There were fewer women who received CIS associate’s degrees in 2009 compared to 2000, and the racial/ethnic composition shifted, especially for Asian/Pacific Islanders, African American/Blacks, and Hispanic/Latinas.³⁷

There were substantially fewer women who received CIS bachelor’s degrees in 2009 compared to 2000, and the racial/ethnic composition of the non-white students shifted as well, most notably for Asian/Pacific Islanders.38
There were more women who received CIS master’s degrees in 2009 compared to 2000. The number of women receiving CIS master’s degrees increased from 2008, when it was 4,615. The racial/ethnic composition shifted in 2009, compared to 2000, especially for Asian/Pacific Islanders and for African American/Blacks.\(^3\)

**RACIAL/ETHNIC PERCENTAGES OF FEMALE COMPUTING MASTER’S DEGREES**

<table>
<thead>
<tr>
<th>Ethnicity</th>
<th>2000 (4,764 women)</th>
<th>2009 (4,858 women)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Amer Indian/Alaska Native</td>
<td>0%</td>
<td>0.2%</td>
</tr>
<tr>
<td>Asian/Pacific Islander</td>
<td>18%</td>
<td>10%</td>
</tr>
<tr>
<td>African American/Black</td>
<td>23%</td>
<td>7%</td>
</tr>
<tr>
<td>Hispanic/Latina</td>
<td>2%</td>
<td>2%</td>
</tr>
<tr>
<td>White</td>
<td>49%</td>
<td>50%</td>
</tr>
<tr>
<td>Unknown</td>
<td>4%</td>
<td>8%</td>
</tr>
<tr>
<td>Nonresident</td>
<td>2%</td>
<td>2%</td>
</tr>
</tbody>
</table>

The number of women receiving CIS doctoral degrees had nearly tripled in 2008, compared to 2000, with 303 women completing CIS doctorates. In 2009, however, that number slipped back to 215 (compared to 1,037 men in 2008 and 752 men in 2009). In 2009, the percentage of White females substantially decreased, while the percentage of Asian/Pacific Islander and non-resident females increased.40

Within both genders, a large percentage of doctoral students were non-residents in 2009. This is similar to trends in all doctorates awarded in science and engineering in the U.S. In 2007, for instance, non-residents accounted for 46% 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.41

**CASE STUDY**

**SMALL STEPS CAN RESULT IN MORE FEMALE STUDENTS**

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

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

**HOW DID THEY DO IT?**

Carnegie Mellon implemented systemic-change practices 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

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
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, and cooperative learning within the major.

INFORM

➤ Make presentations about women in computing from K-12 to workforce using the NCWIT Scorecard (www.ncwit.org/scorecard).

CHANGE CURRICULA

Read the following NCWIT Promising Practices to find out how others have changed curricula and improved diversity and retention:

➤ “How Do You Recruit or Retain Women through Inclusive Pedagogy? Designing for Diversity” (www.ncwit.org/pedagogydesign)


➤ “How Do You Retain Women through Collaborative Learning? Peer-Led Team Learning” (www.ncwit.org/pltl)

➤ “How Do You Retain Women through Collaborative Learning? Pair Programming” (www.ncwit.org/pairpractice)
GET INVOLVED

➤ Review NCWIT’s Promising Practices about providing Research Experiences for Undergraduates (REUs), which have been shown to help retain women — “How Can REUs Help Retain Female Undergraduates? Faculty Perspectives” (www.ncwit.org/reufaculty) and “How Can REUs Help Retain Female Undergraduates? Affinity Research Groups” (www.ncwit.org/reuaffinity).

➤ 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. Read NCWIT’s Promising Practice “How Do You Support Completion of Graduate Degrees and Engender Commitment to a Research Career? Advisor as Steward of the Discipline” (www.ncwit.org/gradadvisor).

➤ Share statistics. Post a copy of NCWIT’s By the Numbers on your office door or department bulletin board (www.ncwit.org/bythenumbers).

➤ Want to learn more about the issues? Read Stuck in the Shallow End: Education, Race, and Computing by Jane Margolis.42

RETHINK

➤ Improve the recruitment and retention of women in graduate programs by reviewing admissions criteria systematically. Read NCWIT’s Promising Practice, “How Do Admissions Criteria Affect Women’s Representation in Graduate Computing? Attempts to Equalize a Subjective Process” (www.ncwit.org/gradadmissions).

➤ NCWIT’s Pipeline-in-a-Box is a turnkey toolkit specifically targeted at facilitating the bridge between two- and four-year colleges for potential computing students (www.ncwit.org/pipeline).
WOMEN WELL-REPRESENTED IN SCIENCE PROFESSIONS, BUT LESS SO IN COMPUTING

From 2000 to 2009, women comprised 55% to 58% of the overall professional workforce. Women’s representation in life, physical and social sciences and among physicians and surgeons increased between 2000 and 2009. Meanwhile, the percentage of women in computing-related occupations declined between 2000 and 2009, with the exception of 2008 to 2009, when the proportion of women held steady.43
The overall number of women in the computing workforce decreased markedly between 2000 and 2009, and the racial/ethnic diversity of technical women shifted. The proportions of women in computing occupations who are African American/Black or Latina/Hispanic increased gradually between 2000 and 2009. Meanwhile, the percentages of White and Asian/Pacific Islander women in computing-related occupations decreased.44

RACIAL/ETHNIC PERCENTAGES OF WOMEN IN COMPUTING-RELATED OCCUPATIONS


MOST COMPUTING OCCUPATIONS LOSING WOMEN

Women’s representation in the specific computing occupations tracked by the U.S. Bureau of Labor Statistics has decreased since 2000. Only the female percentage of network systems and data communications analysts has remained stable. Since 2005, the female percentages of database administrators and network and computer systems administrators have increased slightly, but neither has reached the same percentage of women in those occupations as in 2000.45

FEMALE PERCENTAGE EMPLOYED IN COMPUTING-RELATED OCCUPATIONS, 2000-2009

<table>
<thead>
<tr>
<th>Occupational Classification</th>
<th>2000</th>
<th>2005</th>
<th>2009</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operations research analysts</td>
<td>51%</td>
<td>50%</td>
<td>47%</td>
</tr>
<tr>
<td>Database administrators</td>
<td>43%</td>
<td>33%</td>
<td>35%</td>
</tr>
<tr>
<td>Computer support specialists</td>
<td>35%</td>
<td>33%</td>
<td>27%</td>
</tr>
<tr>
<td>Computer scientists and systems analysts</td>
<td>34%</td>
<td>30%</td>
<td>27%</td>
</tr>
<tr>
<td>Network systems and data communications analysts</td>
<td>25%</td>
<td>25%</td>
<td>25%</td>
</tr>
<tr>
<td>Computer programmers</td>
<td>26%</td>
<td>26%</td>
<td>20%</td>
</tr>
<tr>
<td>Network and computer systems administrators</td>
<td>23%</td>
<td>19%</td>
<td>22%</td>
</tr>
<tr>
<td>Computer software engineers</td>
<td>24%</td>
<td>22%</td>
<td>20%</td>
</tr>
<tr>
<td>Computer hardware engineers</td>
<td>22%</td>
<td>11%</td>
<td>9%</td>
</tr>
</tbody>
</table>


While the female percentage in certain computing occupations has fallen drastically since 2000 (computer hardware engineers, computer support specialists, computer scientists and systems analysts), women’s percentages of database administrators, network systems analysts, and network administrators have held steady or improved since 2005.
DESPITE JOB SECURITY AND GOOD SALARIES, MID-CAREER WOMEN LEAVE COMPUTING

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 in other science and engineering fields. 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 in industry. Most of these women who leave technology companies remain in the workforce, but in a different capacity:

- 49% continue in IT, either in the public sector or in their own businesses
- 31% work in a non-technical field
- Only 20% leave the workforce (whether temporarily or permanently).46

WOMEN’S QUIT RATES IN SCIENCE, ENGINEERING AND TECHNOLOGY, 2008

<table>
<thead>
<tr>
<th>Field</th>
<th>Women who quit</th>
<th>Women who stayed</th>
</tr>
</thead>
<tbody>
<tr>
<td>Science</td>
<td>47%</td>
<td></td>
</tr>
<tr>
<td>Engineering</td>
<td>39%</td>
<td></td>
</tr>
<tr>
<td>Technology</td>
<td>56%</td>
<td></td>
</tr>
</tbody>
</table>

Used by NCWIT with permission from “The Athena Factor: Reversing the Brain Drain in Science, Engineering, and Technology” by Sylvia Ann Hewlett, et al. © 2008 by Harvard Business Publishing; all rights reserved.
FEW WOMEN IN LEADERSHIP ROLES

ACADEMIA
The female percentage of computing faculty has increased substantially at all ranks since 2002.\textsuperscript{47} 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.\textsuperscript{48}

\begin{figure}
\centering
\includegraphics[width=\textwidth]{female_percentage.png}
\caption{Female percentage of Computer Science Faculty at PhD-granting institutions, 1995-2009}
\end{figure}

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, the reality is there are few female leaders in the business world, and even fewer in IT.\(^4^9\)

- The percentage of female CEOs of Fortune 500 companies was a dismal 3% in 2009.\(^5^0\)
- For Fortune 500 companies classified as "professional, scientific, and technical," women held only 10% of corporate officer positions and made up just 11% of board of directors positions in 2008.\(^5^1\)
- Women accounted for 9% of “IT Management” positions among 2008-09 Dice Tech Salary Survey respondents.\(^5^2\)

**WHY WOMEN LEAVE THE WORKPLACE**

Research shows that five 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.\(^5^3\)
CASE STUDY

ACCOUNTABILITY RESULTS IN GREATER DIVERSITY

Establishing unit-specific accountability can increase diversity. NCWIT learned about one company that 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.

HOW DID THEY DO IT?

To create accountability, the company established a diversity committee to oversee nine diversity councils — one for each major business unit.

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 vice presidents and also made available to all staff members.
EVIDENCE-BASED RECRUITMENT AND RETENTION STRATEGIES REALLY CAN HELP

You can increase the number of women who persist in the computing workforce by reducing institutional barriers through systemic change.

DIVERSIFY LEADERSHIP

➤ Get tips for incorporating diverse leadership into your strategic planning efforts from NCWIT’s workbook, “Strategic Planning for Increasing Women’s Participation in the Computing Industry” (www.ncwit.org/industryworkbook).

REDUCE BIAS

➤ Uncover institutional barriers to diversity by reading NCWIT’s Talking Points card, “Institutional Barriers and Their Effects: How can I talk to colleagues about these issues?” (www.ncwit.org/ib)

➤ Use NCWIT’s Supervising-in-a-Box Series to hone your skills at spotting bias in performance evaluations, and personalize the issues by viewing a video of real women who have left their corporate positions because of bias (www.ncwit.org/supervising).


RETAINT

Learn all about retention of technical women in NCWIT’s Women in IT: The Facts (www.ncwit.org/thefacts).

Learn one way to attract and retain mid-career female employees in particular with NCWIT’s Promising Practice, “How Can Companies Attract and Retain Mid-Career Female Employees? Constructing On-Ramps” (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).

Help your organization overcome barriers in order to both hire and retain female employees. NCWIT’s Supervising-in-a-Box Series touches on many aspects of encouraging gender diversity in the workplace (www.ncwit.org/supervising).

MENTOR EMPLOYEES


MENTOR FACULTY

Good mentoring programs can help female faculty advance in the ranks. Read NCWIT’s Promising Practice, “How Do You Mentor Faculty Women? Georgia Tech Mentoring Program for Faculty Advancement” (www.ncwit.org/gatechmentoring).

NCWIT’s Mentoring-in-a-Box: Women Faculty in Computing spells out all the steps for setting up a mentoring program (www.ncwit.org/facultymentor).
ENTREPRENEURSHIP

ncwit.org/scorecard
WOMEN TECH ENTREPRENEURS A MINORITY, BUT SUCCESSFUL

In 2009, firms that were majority-owned by women accounted for 40% of all private companies in the U.S. Estimates of the percentage of start-ups majority-owned by women hover around 8%.

Although they operate in a male-dominated arena, women have been successful in IT entrepreneurship:

- Women have successfully co-founded high-tech companies with less funding and fewer failures than the average.
- Firms with at least some female senior managers outperform those without women in leadership positions.
- At the smaller and newer venture capital firms in the U.S. IT sector, the percentage of women in managing-director and general-partner positions is higher than among the 50 most active firms. On average, in the 50 most active firms, there were 5% women partners. In the smaller and newer firms, women held 10% of the investing partner seats.
**FEMALE AND MALE COMPANY FOUNDERS SHARE SIMILAR CHARACTERISTICS**

In a study that used a stratified random sample of technical entrepreneurial firms, wherein 8% of founders were women, findings suggest that men and women founders share many characteristics. These successful entrepreneurs were similar in almost every respect, with only a few statistically significant differences.

Women were more likely than men to express concern about protecting their company’s intellectual capital, to consider their own prior experience important to their success, or to consider encouragement by a co-founder important to their success. Men were more likely than women to feel pressured to be the primary family breadwinner.59

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**CHARACTERISTICS OF FEMALE AND MALE TECH ENTREPRENEURS**

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Female Tech Entrepreneur</th>
<th>Male Tech Entrepreneur</th>
</tr>
</thead>
<tbody>
<tr>
<td>Level of education</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Early interest in starting her/his own business</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Desire to build wealth or to capitalize on a business idea</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Perception of what are top facilitators and challenges to entrepreneurship</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Access to mentors</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Expressed concern about protecting company’s intellectual capital</td>
<td>✓</td>
<td>—</td>
</tr>
<tr>
<td>Considered their own prior experience important to their success</td>
<td>✓</td>
<td>—</td>
</tr>
<tr>
<td>Considered encouragement by a co-founder important to their success</td>
<td>✓</td>
<td>—</td>
</tr>
<tr>
<td>Felt pressured to be primary family breadwinner</td>
<td>—</td>
<td>✓</td>
</tr>
</tbody>
</table>

**NOTE:** Double checkmarks indicate no statistically significant differences between genders. A checkmark and a dash indicate that the checked group was significantly more likely to show this characteristic.

WOMEN ENTREPRENEURS MAY HAVE DIFFERENT FINANCIAL BASES THAN MEN

A study completed in 2009 by the Kauffman Foundation revealed that in their start-up years, female-owned high-tech firms had an average of $64,638 in assets, compared with an average of $116,430 in assets for male-owned high-tech firms. Male-owned firms’ first year-revenues and profits were also double those of new female-owned firms ($34,324 vs. $12,713).

In this study, male and female entrepreneurs used different financing strategies. Most of the women’s start-up capital was internal (family loans, credit cards, etc.), while more of the men’s was external (bank loans, venture capital, etc.); these trends continued through the four years of the study, with women relying more often on personal assets or loans, compared to men.60

However, in a more recent Kauffman study of IT entrepreneurs, successful men and women entrepreneurs were shown to have funding from the same sources, with one exception: women’s business partners were a main source of funds more often than were men’s.61

### FINANCIAL BASES AT TECH START-UPS, BY GENDER

<table>
<thead>
<tr>
<th>Financials</th>
<th>Female-owned</th>
<th>Male-owned</th>
</tr>
</thead>
<tbody>
<tr>
<td>Start-up capital</td>
<td>Internal</td>
<td>External</td>
</tr>
<tr>
<td>Average start-up assets</td>
<td>$64,638</td>
<td>$116,430</td>
</tr>
<tr>
<td>First year-revenues and profits</td>
<td>$12,713</td>
<td>$34,324</td>
</tr>
</tbody>
</table>

CASE STUDY

NOT TOO LATE TO START

Elaine Wherry, co-founder of meebo.com, was interviewed for the NCWIT Entrepreneurial Heroes series. This case study is based on that interview.

Elaine Wherry’s story suggests that you needn’t be a full-blown techie early in life to launch a successful IT company. Elaine had a full-ride music scholarship for college. Instead, she took a year off to explore her musical and other interests. Winter quarter of freshman year, she took her first computer science course out of frustration at being unable to program a graphic calculator to play tic-tac-toe. Four years later, she had a CS degree and landed a great IT job. She quit her job to launch meebo.com before she had a functional product, an audience, or funding.

HOW DID SHE DO IT?

Step 1. Found good team members.

Step 2. Built the product, then gathered feedback.

Step 3. Focused on the business plan.

Step 4. Established excellent hiring practices.

Browser-based instant messaging wasn’t possible until Elaine co-founded meebo.com in 2005. The company integrates social networking and communication channels into a single interface. It is used by more than 100 million people.

HEROES INTERVIEW SERIES

NCWIT Entrepreneurial Heroes are women innovators from small companies, large corporations, and non-profit organizations. Their ideas and products are changing the way we think, work, play, and communicate.

Listen to more than 50 interviews available for free download or streaming at www.ncwit.org/heroes.
MORE RESEARCH NEEDED ON TECHNICAL ENTREPRENEURS

The research on technical entrepreneurship and the participation of women is in its infancy. As more knowledge is accumulated, we will have a better sense of what steps to take to improve women’s meaningful participation.

RESEARCH

➢ Fund, or undertake, research into female tech entrepreneurship.

ROLE MODEL

➢ Draw attention to successful women IT entrepreneurs and get tips on tech entrepreneurship by listening to NCWIT’s series of magazine-style audio interviews — NCWIT Entrepreneurial Heroes (www.ncwit.org/heroes) and the NCWIT Entrepreneurial Toolbox (www.ncwit.org/etoolbox).
PATENTING, PUBLICATIONS, AND OPEN SOURCE CAN BENEFIT FROM DIVERSITY

The innovative thinking that more gender and racial/ethnic diversity could bring to computing would advance the field by highlighting new problems and solutions.

**DIVERSITY CONTRIBUTES TO INNOVATION**

Diversity of thought contributes to innovation. Research shows that groups with greater diversity solve complex problems better and faster than do homogenous groups. 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.

NCWIT tracks women’s participation in technology innovation and thought leadership by looking at women’s participation in activities such as patenting and entrepreneurship, contribution of conference and journal papers, and creation of open-source software.

**Groups with greater diversity have been shown to solve complex problems better and be more experimental and efficient than homogeneous groups.**
FEMALE U.S. IT PATENTING LOW, BUT IMPROVING WITH TIME

From 1980 to 2005, women held on average 4.7% of all U.S.-invented U.S. IT patents. During this period, U.S. IT patenting increased approximately 6-fold, while female U.S. IT patenting (the upward trendline shown in the chart) increased approximately 20-fold.64

NCWIT’s patenting research suggests that diversity contributes to useful creativity. **Mixed-gender teams produced the most frequently cited patents** — with citation rates that were 26% to 42% higher than the average rate for patents of similar age and type.\(^6^6\)
**WOMEN MAKE 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 doctorate 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.67

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.68

**OPEN SOURCE LACKS GENDER DIVERSITY**

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.69 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.

Read more about research on diversity in open source in NCWIT’s “The Culture of Open Source Computing” at www.ncwit.org/cultureos. This annotated bibliography briefly describes recent research and is organized into five topic areas: Gender Dimensions, Entry & Internal Advancement, Knowledge Acquisition, Membership & Organization, and Motivations & Intentions to Participate. The bibliography identifies pertinent articles, two of which focus on gender and OSS, and offers a brief summary of research findings.
RESEARCH NEEDED ON THOUGHT LEADERSHIP AND INNOVATION

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.

REDUCE BIAS

➢ Read NCWIT’s Promising Practice, “How Does Combating Overt Sexism Affect Women’s Retention? Assessments for Identifying Overt Sexism” (www.ncwit.org/overtsexism) and find other publications on the NCWIT website that explain the influence of unconscious, or unintended, bias.

DIVERSIFY PATENTING

➢ Read the research on women’s technology patenting (www.ncwit.org/patentreport).
➢ To learn more about implementing learning communities focused on patenting, read NCWIT’s Promising Practice, “How Can Companies Promote Innovation with Diverse Employees? Patenting Learning Communities” (www.ncwit.org/patentinglearning).
Diversify Conferences

➤ 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, encourage a variety of authors to submit their work, and then use a double-blind review process to overcome the effects of unconscious bias.

Diversify Open Source

➤ Read more about research on diversity in open source with NCWIT’s “The Culture of Open Source Computing” (www.ncwit.org/cultureos).
➤ 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.
1. For the purposes of this report, we use “computing,” “computer science,” and “information technology,” or “IT” interchangeably to mean the design, development, and application of all forms of technology to manipulate, store, exchange, and use information in its various forms.


17. See Endnote 16.


29. See Endnote 28.


33. See Endnote 3. The 2009 CRA Taulbee survey data showed that undergraduate CS degrees had increased overall for the second year in a row in its sample of Ph.D.-granting institutions.

34. See Endnote 3.

35. See Endnote 3.


37. See Endnote 36.

38. See Endnote 36.

39. See Endnote 36.

40. See Endnote 36.


51. Catalyst. (2008). Census of corporate officers and top earners of the Fortune 500. New York: Catalyst. Some IT companies (e.g., Microsoft, EMC, Cisco) may be included under a different NAICS industry in these calculations.

52. Dice Holdings, Inc., 2008-09 Tech Salary Survey Results. IT management defined as CEO, CIO, CTO, VP, Director, Strategist, Architect.


58. See Endnote 56.


61. See Endnote 59.


66. See Endnote 64.

67. Cohoon, J. M., Nigal, S., & Kaye, J. (2010). Women’s Thought Leadership in Computing. Manuscript under review. The dataset included papers published within Association of Computing Machinery (ACM) publications. “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.

68. See Endnote 67.
