

# The State of Research on Girls and IT

J. McGrath Cohoon  
April 2007

National Center for Women & Information Technology (NCWIT)



What does new research tell us about girls and computing? This report briefly summarizes recent findings and recommendations.<sup>1</sup> First we present a quick description of the Barker and Aspray critical review of the literature, together with a set of practices implied by their analysis. Following the outline of their comprehensive review are sketches of more recent individual projects with concluding recommendations. This report only hints at the contents of the described papers; please see the original sources for more complete explanations of methods, findings, conclusions, and recommendations.

Several themes surface in the research-based advice reported here. More than one project points to the need for improved...

- ▶ access – both home and school access to high quality computing experiences continues to vary by ethnicity, race, and socio-economic status
- ▶ information and image
- ▶ course content
- ▶ teacher training
- ▶ education policies
- ▶ use of girls' social networks to reduce their isolation and insecurity in computing classes

The frequency with which these themes emerge from research gives them weight and calls us to action. For example, several studies recommend improving the image of computing so that students no longer view it as a narrow, lonely, machine-focused endeavor. To overcome the negative image, Zarrett *et al.* encourage us to inform

students, parents, and guidance counselors that computing is a flexible field through which one can contribute to the social good. Goode *et al.* add that the field offers intellectually interesting, scientific challenges. In conjunction with projecting a more positive image, many of the studies recommend that introductory courses focus on intellectual content while both providing a broad range of computing experiences and relating the content to girls' interests and goals (*e.g.*, applying computers to problems from another field). As researchers make these suggestions, they also recognize that it is unrealistic to expect high school teachers to take responsibility for these changes without training and supportive policies. Teachers need training in the theory and practice of both computing and computing education. Their investment in such training is more likely if education policies make real introductions to computing a regular part of high school education. A final example of a theme in recent research is the role girls' social networks can play in their computing participation. By drawing girlfriends into computing activities, girls can feel more comfortable and confident. These themes and others weave through the results of numerous studies, as you can see in the summaries that follow.

***The State of Research on Girls and IT*, by Lecia J. Barker and William Aspray**

This thorough and extensive review of the research on pre-college girls and computing begins by considering the theoretical underpinnings of the literature and the reasons for attempting to increase girls' participation in computing. It covers topics ranging from educational policy to image and gender differences. The follow-



National Center for Women & Information Technology (NCWIT)  
University of Colorado  
Campus Box 322  
Boulder, CO 80309-0322  
www.ncwit.org  
info@ncwit.org

We thank our investment partners: the National Science Foundation, Avaya, Microsoft, and Pfizer

© 2007 by the National Center for Women & Information Technology (NCWIT)  
This booklet may not be reproduced in any form without prior written permission of the National Center for Women & Information Technology.

<sup>1</sup> Unless otherwise noted, the research summarized here is published in *Women and Information Technology: Research on Underrepresentation*, edited by Cohoon and Aspray (2006) MIT Press.

ing are some practices that can be derived from the review:

- ▶ Integrate the fundamentals of computer science into all levels of education and bring computing into the core curriculum.
- ▶ Reconsider course election policies and their gendered effects.
- ▶ Train all teachers in computer use and classroom management of computers.
- ▶ Train computer science teachers in the intellectual content of computing and the theory and practice of education, so they have an accurate understanding of computer science and are able to communicate it to students.
- ▶ Introduce computing to students by using intellectually engaging curriculum.
- ▶ Provide students with a broad range of computing experiences.
- ▶ Inform parents, teachers, children, and counselors about IT career options.
- ▶ Identify and communicate a set of best practices for computing career experiences to facilitate a high-quality experience for the girls who participate.

***Examining the Gender Gap in IT by Race: Young Adults' Decisions to Pursue an IT Career, by Nicole Zarrett, Oksana Malanchuk, Pamela E. Davis-Kean, and Jacquelynne Eccles***

Adolescent decisions to pursue IT careers are affected by students' interest in and feelings of competence related to math and computer-oriented tasks. This study used data that tracked 1,482 adolescents and their families from the youths' seventh grade until three years past high school. It found that girls aspired to IT occupations when they enjoyed computers and believed in their computer competence; when they were advised by parents, teachers, or peers to pursue an IT occupation; and when they held relatively positive attitudes about computers and the type of people who go into computing.

Race also matters, especially with respect to the precursors that lead to these characteristics. For example, white females are less likely than other groups to fit the characteristics of someone likely to aspire to an IT occupation. As a consequence, they are the least likely of the black and white males and females in this study to major in computing or pursue an IT career. In contrast, although black males aspire to IT careers, their attainment may be deterred by a lack of access to resources that hinders academic attainment or expectations.

Based on the gender and racial differences they found, the authors recommend that interventions should:

- ▶ Encourage children's interest and confidence in mathematics as well as technical and physical sciences.
- ▶ Provide access to computers, especially for minority students, who are less likely to have access at home.
- ▶ Teach parents to make computers a priority and value.
- ▶ Inform students, especially black males, about the academic requirements for IT occupations.
- ▶ Provide black females with more resources and opportunity for postsecondary education and encourage them to aim for high-level IT occupations.
- ▶ Communicate a positive image of IT as a flexible field through which one can contribute to the social good.

***Lost in Translation: Gender in High School Computer Science, by Joanna Goode, Rachel Estrella, and Jane Margolis***

Goode, Estrella, and Margolis ask who is learning what about computing in high school. For this chapter, they use interviews and observations from two of the three schools in their study to find that HS girls' entry into CS is affected by the following conditions:

- ▶ Few computer science learning opportunities actually exist at the high school level, especially in schools that serve communities of color. It is especially rare for computer science to be integrated with other high school subjects.
- ▶ Relevance is important to girls' choices to enroll or not enroll in computer science classes. A narrow view of computing and computer scientists leads students to think of the profession as boring. This image is based on media messages and a lack of other information. High School computer science classes reinforce the image of computing as a lonely machine-focused endeavor when teachers assign only individual work rather than group assignments. Even girls interested in computing choose not to take these courses because they do not see how it will help them achieve their academic goals—they see no reason to endanger their grade point averages.
- ▶ Male experience and expertise, together with female isolation and insecurity, create negative experiences for girls in computing classes. Girls are much less likely than boys to be part of a computing family or social network, or to engage in play and experimentation with computers.
- ▶ Educators routinely fail to provide a compelling context and motivation for learning computing that could attract students who have little interest in the computer. In large part, this failure is due to lack of understanding of computing as a scientific and intellectual field.

To improve the situation, the researchers formed an educational partnership between a university and the Los Angeles Unified School District. In the context of this collaboration, high school students and teachers visited a university department of computer science. They toured the department, viewed current projects, and learned about the requirements for studying CS at a university. Interviews before and after the visit revealed a deeper understanding of what computer science is. Another action resulting from the educational partnership was a summer institute for teachers of Advanced Placement CS. Teachers took part in one week of discussions about equity in computer science, computer science instruction, examples of interdisciplinary applications, and modeling of active engaging instruction. Since the institute, the number of APCS classes doubled in the district, and female enrollment in APCS courses in the district increased 75 percent.

***Recruiting Middle School Girls into IT: Data on Girls' Perceptions and Experiences from a Mixed-Demographic Group, by Lecia J. Barker, Eric Snow, Kathy Garvin-Doxas, and Tim Weston***

What IT recruiting activities will attract middle school girls from different demographic groups? Results from a survey completed by 717 girls attending a STEM recruiting event (90% response rate) show very few differences across racial or ethnic groups. This finding tentatively suggests that girls across racial or ethnic groups may respond similarly to recruiting messages. Year in school, however, does seem to differentiate among girls in terms of what information and activities they consider fun and interesting. The researchers also note a disconnect between girls' stated career interests and their rating of the recruiting event as fun and interesting. Based on their findings, the researchers suggest the following practices for recruiting events:

- ▶ Go beyond "fun and interesting" to show how computing professionals make a difference in the lives of others and that girls can feel that they belong in computing milieu.
- ▶ Show girls the immediate steps toward a computing career (e.g., high school classes).
- ▶ Align recruiting messages and methods with age-relevant interests.
- ▶ Encourage girls to recruit friends into the computing classes and events they attend, and perhaps provide them with other strategies for dealing with male dominant classes.
- ▶ Because survey results show that Latinas are less likely than white or black girls to use computers at home, target this group with informal computer learning opportunities that allow them to tinker with and explore the computer on their own.

***Why Students with an Apparent Aptitude for Computer Science Don't Choose to Major in Computer Science, by Lori Carter. Published by the ACM in the SIGCSE Bulletin, 2006. Volume 38, p 27-31***

The title question is answered with data collected from calculus and pre-calculus students at nine schools in Arizona and California. Of the eleven reasons survey respondents could rate as having positive, negative, or no influence on their decision to choose computer science as their college major, the most common deterrents for both male and female students were "My desire to sit in front of a computer all day," "I am completely sold on another major," and "I would like a more people-oriented major." The most common positive influences were "My desire to use computers in another field (business, medicine)," "My interest in computer games," "The experience that I have with computers." Another important finding of this research is that the vast majority of the students had no idea what a computer science major studies, suggesting that the image of computing may suffer from both misconception and no conception. Based on these and other survey results about student experience, Carter reiterates and revises some recommendations for improving computer science education:

- ▶ Offer multi-disciplinary and cross-disciplinary programs to meet students' desire to use computers in another field.
- ▶ Inform students about what computing really is to overcome its image of involving sitting in front of a computer all day and not being "people-oriented."
- ▶ Raise women's awareness and experience with computer science, perhaps by requiring a broad intro course.
- ▶ The previous recommendation and the finding that very few high school students know what computer science is lead to a recommendation for formal training in CS education for high school teachers who would teach computing courses.
- ▶ Make computer science courses creative and relevant to student interests and goals.

