Meet Them Where They Are (Case Study 3)

An Engaging Way to Introduce Computing

K-12 Education

To educate girls about information technology and potential careers in the field, the Girl Scouts, Hornets' Nest Council in North Carolina runs a Girls are I.T. program, sponsored by a National Science Foundation research grant. Through its two key components – an educational website and a mobile technology bus—the program aims to increase access to technology by meeting girls where they are, both geographically and experientially. Since its inception, the bus has reached over 5,200 girls, many of whom are in rural locations with limited exposure to technical experiences.

Mobile Technology Classroom

The Mobile Technology Classroom features 12 workstations designed to showcase technology and technology careers in ways that tend to appeal to many girls. For example, four hands-on activities explore how technology helps people live better lives – (see detailed descriptions below). In each activity, girls are encouraged to imagine the future of technology based on the program component they've just completed. The girls then upload their ideas to www.girlsareit.org, a website that presents the history of technology and highlights women who have exciting IT careers.

EXAMPLES OF HANDS-ON ACTIVITIES OFFERED ON THE MOBILE TECHNOLOGY CLASSROOM

- **Nanotechnology**
  Girls explore how a nanodevice is built, what "nano" means, and how tiny nanodevices will be used in the future. Using laptop computers, they create four different nanodevices – light emitters, oscillators, mesh fabric, and DNA Scaffold.
- **Assistive Technology**
  Girls "see" and "talk" using computer software and hardware designed to assist the visually-, hearing- and speech-impaired. They begin to understand how technology aids those with disabilities, software's limitations in this area, and the need for continued progress.
- **HTML Webpage Design**
  Girls learn to create and edit a web page with HTML code. They then design a web page for their troop or for a local non-profit in need of a website.
- **Wireless Sensors**
  Girls operate an explorebot, similar to the Mars Rover. From their laptops, they see what the robot sees and maneuver through various terrains located in the back of the bus, learning how technology enables us to go places that may not be safe for humans. The missions include New Species Discovery, Earthquake Search and Rescue, and Shipwreck in the South Seas.

While this unique program might be difficult to replicate, educators can increase girls' access to IT through curriculum that adapts several key components:

- Use hands-on activities that solve real-life problems and/or call on girls existing knowledge and interests.
- Build in strategies for reaching girls with limited access to technology (e.g. remove geographical or other logistical barriers).
- Develop all-girl activities that are collaborative.

RESOURCES

For more information about this program see the Girls are I.T. website, www.girlsareit.org or contact Heather Doyle, hdoyle@hngirlscouts.org.
For more information about other Girl Scouts of the USA technology programs see www.GirlsGoTech.org.

Case Study Contributors: Girl Scouts, Hornets' Nest Council, and Girl Scouts of the USA

NCWIT offers practices for increasing and benefiting from gender diversity in IT at the K-12, undergraduate, graduate, and career levels.
This case study describes a research-inspired practice that may need further evaluation. Try it, and let us know your results.

ncwit.org **Authors** | **Lecia Barker and J. McGrath Cohoon**

NCWIT Investment Partners: National Science Foundation, Avaya, Microsoft, Pfizer, and Bank of America

How Do You Introduce Computing in an Engaging Way?

with Case Study 3

K-12 Education

Experience with computers between boys and girls has equalized, but boys continue to have greater knowledge of computing and programming *concepts* than do girls. Not so in biology, chemistry, or mathematics, where both boys and girls are encouraged to provide evidence of proficiency when they apply to college. High school study of these subjects familiarizes students with the content and concepts, and gives them confidence. The result is that women's undergraduate completion rates have neared parity in these disciplines.

Because IT study is elective in almost all K-12 schools, developing relevant and interesting assignments that appeal to a broader audience is recommended for:

- fostering a climate where the non-predisposed can belong both academically and socially
- recruiting students who are not predisposed to pursuing computing
- exposing fundamental computing concepts to inexperienced learners

Is prior programming experience required for students to be successful in an IT program? Most undergraduate departments would say no. That is, experience with programming is not the same as expertise in problem-solving, algorithmic thinking, or computing theory. Yet research shows that introductory courses and their embedded assignments work better for students who have *some* experience with programming.

Research also shows that students with programming experience are more confident and more successful in introductory courses than are their inexperienced peers. Students with lower grades or less confidence are less likely to persist in an IT major. What is more, when introductory courses have limited opportunities for talking to other students (e.g., collaborative learning), inexperienced students have little information on which to judge whether they belong academically in the major. Hence more women than men switch out of IT majors (most often to other sciences or mathematics).

MAKING IT MEANINGFUL

Educational researchers emphasize the importance of linking educational materials and curricular programs to students' existing knowledge and experiences. When class syllabi list topics and assignments that focus on unfamiliar concepts with limited, if any, relationship to a student's life experience or interests, she or he is unlikely to take that class. High school curricula contribute to low enrollments in college computing because, under the existing educational policy of election, computing is rarely required in secondary schools. This means that students are likely to have a narrow and inaccurate view of what IT study involves, what careers are possible, or what kind of people "do" IT. Given the very small proportion of females who study computing in high school, females are less likely to choose IT in college.

The challenge to educators at all levels is to develop engaging assignments and curriculum that can appeal to a variety of students with different learning styles, interests, socio-cultural backgrounds, and abilities, while maintaining the rigor of the discipline. Putting the concepts of computing in appealing contexts and building on existing competence can both reduce entry barriers and level the playing field for those with limited experience.

Creative assignments that teach algorithmic thinking while also calling on students' existing knowledge or interests, may serve to both recruit and retain students. When experienced and inexperienced students use non-computer-based assignments to learn computing concepts, they quickly realize that their peers with programming experience are not necessarily better at algorithmic thinking, just more experienced with programming. Building confidence through relevant and interesting assignments is a promising practice for motivating student enrollment and retention.

RESOURCES

Lecia Barker and William Aspray, "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 the Reasons for Under-Representation*. Cambridge, MA: MIT Press, 2006.

Joanne McGrath Cohoon and William Aspray, "A Critical Review of the Research on Women's Participation in Postsecondary Computing Education." In McGrath Cohoon, J. and W. Aspray (Eds.) *Women and Information Technology: Research on the Reasons for Under-Representation*. Cambridge, MA: MIT Press, 2006.

ncwit.org **Authors | Lecia Barker and J. McGrath Cohoon**