



Engaging Girls and Women in Science, Technology, Engineering, and Mathematics: The Future Workforce

Highlights of the September 2005 Webcast



Technology at the Crossroads student at work

On September 21, 2005, the NSF ITEST Learning Resource Center (LRC) at Education Development Center, Inc., hosted a national webcast on the topic of engaging girls and women in STEM education and the future scientific and technological workforce. Approximately 100 individuals participated in the online event, which attracted people from academia, private industry, and the research community; policymakers; and the press and media. The webcast was facilitated by Sarita Nair-Pillai, Co-Principal Investigator for the ITEST LRC.

Panelists from beyond the ITEST community included: **Carroll McGillin, National Initiatives Manager for the Cisco Networking Academy Program at Cisco Systems, Inc.;** and **Marcia Kropf, Chief Operating Officer with Girls Inc.,** a national nonprofit youth organization. ITEST community panelists included: **Claudia Morrell, Principal Investigator (PI) of the Enhancing Science and Technology Education and Exploration Mentoring (ESTEEM)** project at the Center for Women and IT at the University of Maryland-Baltimore County—in partnership with the Shriver Center and the Chabot Space and Science Center, the project is working to implement and beta test Chabot's TechBridge curriculum in six middle schools;

Randal August, PI of the Robotics: Fundamentals of Information Technology and Engineering project at Northeastern University, which is working with TechBoston to integrate an innovative robotics curriculum into STEM courses in the Boston Public Schools and in other racially diverse and economically disadvantaged Massachusetts school districts; and **Deborah Muscella, PI of the Technology at the Crossroads** project at Simmons College, which is engaging middle school youth (with particular emphasis on girls) in the use of Geographic Information Systems (GIS), Geographic Positioning Systems (GPS), and HTML programming to conduct environmental research in Boston.

ENGAGING GIRLS IN STEM: WHAT'S THE PROBLEM?

Women continue to be largely under-represented in STEM occupations nationwide, and there is a growing focus on identifying successful strategies to increase the number of girls and women who become interested in, and remain in, science-related careers. Women represent

Key Success Strategies for Engaging Girls in STEM:

- Mentoring
- Experiential learning
- Fostering persistence
- High expectations
- Positive perceptions of STEM careers
- Teaching 21st century skills

47 percent of the workforce, but just 26 percent of computer scientists, nine percent of engineers, and 20 percent of the IT workforce. According to the U.S. Department of Education's National Center for Education Statistics, women in 2001 earned 28 percent of all bachelor's degrees in computer science, 34 percent of master's degrees, and 18 percent of all doctoral degrees. Yet, IT remains the fastest growing occupational sector in the country, and cross-cuts all STEM disciplines.

The ability to meet the demand for individuals with the skills necessary to enter the STEM workforce is hindered by the limited involvement of segments of the population that are severely under-represented and under-served in these occupations, particularly women and minorities. The national demand for STEM workers as a whole can be met only if the needs to diversify the workforce and encourage under-represented groups to pursue careers, and persist, in these fields are addressed.

“The whole issue of attracting, developing, and retaining the very best employees, male or female, is really something that is mission critical for [industry]. We need women in order to have the diversity of thought to be able to generate new ideas, promote better decision making... to create a workforce that mirrors the world we're a part of.”

– Carroll McGillin

The webcast discussion focused around three guiding questions aimed at addressing these issues:

- *What are some successful strategies for the recruitment and retention of girls and women in STEM?*
- *What are promising practices for effectively engaging girls in STEM activities (such as design of activities, the types of environments, the forms of interaction that we know work best?)*
- *And what are some ways of fostering persistence in girls in these disciplines, through youth and self-efficacy development?*

DISCUSSION - WHAT WORKS?

The panelists' presentations and the subsequent question and answer session, surfaced the following key success strategies for engaging girls in STEM:

• Mentoring

The importance and influence of peer and near-peer mentoring of girls was a recurring theme throughout the webcast. In addition to offering girls valuable insights into the STEM interests of their peers and the professional lives of women in STEM, mentoring also helps combat the negative stereotypes that often dissuade girls from pursuing STEM fields (the so-called 'geek' factor). Suggested strategies for incorporating mentoring components into program activities include:

- Using local/community resources and customizing activities around those resources
- Working with local corporations with a strong community presence
- Developing relationships with corporations having women's initiatives to ensure a steady supply of potential mentors
- Recruiting mentors from local high school students, undergraduate students, teacher groups, and local chapters of professional societies (such as the Society for Women Engineers or Association for Women in Science)
- Respecting time constraints on potential mentors and offering them specific activities with limited time commitments

“We involve undergraduate students, a teacher for each group, and a high school student so we can engage in near-peer mentoring.”

–Deborah Muscella

“I support mentoring, but there is a lot to it,” **Claudia Morrell** reflected. “It's very time-consuming and a lot of thought needs to go into it to get the right mentors.” **Marcia Kropf** explained that at Girls Inc., “we don't have a detailed curriculum; what we teach our facilitators is how to design activities at the local level, where they are using their own community resources but also following our philosophy and approach.”

• Experiential learning

The webcast reinforced the notion that youth need experiential, contextual STEM experiences that connect the subject matter to the real world. ITEST projects integrate formal and informal learning strategies such that the connection between discipline-specific and project-based learning are reinforced across the educational spectrum for students, and scientific inquiry is linked to all aspects of programming in which they participate. Specifically, this can be achieved by:

- Embedding STEM concepts in meaningful cultural and human contexts — such as the environmental effects of natural disasters or the importance of salmon recovery in the Pacific Northwest
- Connecting program activities to state education standards
- Working with teachers to facilitate classroom reinforcement of out-of-school educational activities

Deborah Muscella sought to underscore the fact that “Technology is not necessarily taught in real-world problems; it seems for girls it’s really important that it have an understandable cultural and human context.”

“Learn from the girls... what they want to learn and experience. All of our work focuses on experiential learning and a very supportive environment where girls are not afraid to do things.”

–Marcia Kropf

“[Focus on] activities and interventions where girls are actually seeing how technology can make a difference,” advised **Carroll McGillin**, “in critical issues and problems like the tsunami. How was technology used, how was networking used to address that issue?”

• Fostering persistence

Key to the success of many programs is the ability to develop an overall sense of positive self-efficacy in girls, which in turn leads to greater levels of confidence and achievement in STEM subjects. Engaging programs that capture the imagination of girls and inspire them to succeed are critical in overcoming obstacles related

to their own self-perceptions. Some important contributors to self-esteem development in girls include:

- Early involvement of parents and family members in program activities, such that they:
 - are well-informed about the importance of STEM
 - become an integral component of the program, and
 - support and encourage girls outside their classroom and program environments
- Helping girls understand the impact of society and culture on their own behavior and how to think differently about their capabilities
- Maintaining open communication with girls about these issues

From **Marcia Kropf’s** perspective, “Girls today [are] facing a lot of stereotypes that girls have faced for a long time — girls are expected to speak softly and not cause trouble, and smarter girls are not popular.”



ESTEEM girls collaborate to create a product of the future.

“This year we had a parent program. We had 250 parents participate and 97 percent of the parents said they would change their behavior as a result of participating! It suggests to me that parents learned that something they were doing wasn’t encouraging their daughters to go in the science and technology fields.”

– Claudia Morrell

Randal August emphasized that

“Our biggest goal is to present engineering in science, engineering, and mathematics programs in such a way that will keep all these students interested on into high school. Once they have gotten into high school we are hoping that because they have kept up with these subjects... they can make a better or more informed decision when they go on to select their colleges and careers.”

• High expectations

The webcast stressed the importance of setting high standards for all program participants by:

- Beginning program design with the assumption that girls can and will excel
- Reinforcing this message continually with program participants
- Designing programs that are compensatory and intentional about battling negative stereotypes
- Allowing girls to make big and interesting mistakes and offering a ‘safe’ and judgment-free environment in which to succeed and fail
- Providing a supportive, safe, all-girl environment where girls may feel more comfortable taking risks and assuming leadership roles

“We try to build a conducive environment where girls can participate and overcome the typical 12-13 year old young teen issues and the ‘geek’ factor.”

- Randal August

• Positive perceptions of STEM careers

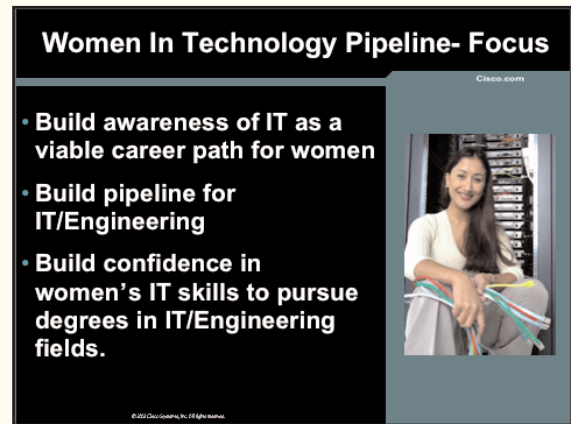
Webcast participants stressed the importance of integrating STEM career information into programs and activities in ways that promote positive perceptions of STEM fields and workplaces for women.

“Recognize that an IT company is a great place to work,” **Carroll McGillin** commented. “It’s an area for career development.”

“One of the components of our summer program is called Lunch Buddies,” **Claudia Morrell** reported. And, she suggested that “If you are close to a business or your program is close to an organization, once a week invite them to come have lunch with the kids.”

• Teaching 21st century skills

The most successful programs combine quality STEM content and technical skill development with exposure to 21st century skills such as critical thinking and the ability to work collaboratively.



“Women in Technology Pipeline” — slide from presentation by Carroll McGillin

According to **Carroll McGillin**:

“The other thing [industry] is looking for as much as technical capabilities is that we want young people to know that flexibility, the ability to work in a collaborative environment, the ability to quickly learn, higher order thinking skills, a lifelong learning environment, are critical elements for success in the IT industry and what employers want girls to know about careers in STEM.”

“If I were to say what is the ‘So what?’ for private industry around this whole issue, it’s that we are at a critical time right now competitively in our nation and that this type of engagement and recruiting of women is critical.”

–Carroll McGillin

The webcast raised and addressed several key issues facing the nation in regards to the engagement of girls in STEM. Addressing these issues was fundamental to the National Science Foundation’s development of the ITEST program. Specifically, NSF states that, "because of the proven success enrichment programs have in increasing student interest, the Congressional Commission on the Advancement of Women and Minorities in Science, Engineering and Technology Development recommends that these programs be made available to all students." Yet, increasing interest alone is insufficient, and many other factors contribute to sustaining interest and helping youth make successful transitions from middle school to high school, and high school to college. To this end, the ITEST program is committed to not only increasing youth interest in IT through the creation of effective student STEM education programs, but also maintaining interest through supportive activities that include parental involvement, career exploration, externships, and research.

RELATED RESOURCES

Read an *eSchool News* online article about the webcast: www.eschoolnews.com/news/showStoryts.cfm?ArticleID=5877

Cisco Systems Gender Initiative
www.cisco.com/web/learning/netacad/digital_divide/gender/index.html

I am an Engineer (video)
www.cisco.com/web/learning/netacad/digital_divide/gender/MarketingMaterials.html

Girls Inc.
www.girlsinc.org

ESTEEM ITEST project
www.umbc.edu/cwit/esteem.html

Technology at the Crossroads ITEST project
www2.edc.org/itestlrc/itestprojects/Crossroad_ma.htm

Robotics ITEST project
www2.edc.org/itestlrc/itestprojects/Robotics_ma.htm

The FunWorks (STEM career exploration digital library)
www.thefunworks.org

The Gender & Science Digital Library
www.gsdl.org

Proceedings from the International Symposium on Women and ICT
www.umbc.edu/cwit/symposium.html

Public awareness campaign & resources for girls and IT
www.ncwit.org/cisco

About ITEST

The Information Technology Experiences for Students and Teachers (ITEST) program was established by the National Science Foundation in direct response to the concern about shortages of IT workers in the United States. The ITEST program funds projects that provide opportunities for both school-age children and teachers to build the skills and knowledge needed to advance their study and to enable them to function and contribute in a technologically rich society. The ITEST National Learning Resource Center at EDC supports, synthesizes, and disseminates the program’s learnings to a wide audience.



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