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10 – 21 March 2014
New York

INTERACTIVE EXPERT PANEL

Access and participation of women and girls in education, training, science and technology, including for the promotion of women's equal access to full employment and decent work

Focus: Women's and girls' equal access and participation in science, technology, engineering and mathematics (STEM) education

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Against a headwind: why young women need additional support to achieve equality in pursuing computing education*

by

Ms. Leigh Ann DeLyser
Computer Science Education Consultant
with New York City's Department of Education

*The views expressed in this paper are those of the author and do not necessarily represent those of the United Nations.

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I. Introduction

There are many ways to frame the conversation around engaging women in STEM and technology. In the news and media we frequently hear that women are underrepresented (Bureau of Labor Statistics, 2009; U.S. Department of Education, 2009). From the perspective of the employer the underrepresentation of women is a problem in more ways than just optics.

Teams with more diversity have been shown to create products with higher quality (Ashcraft & Breitzman, 2009). Additionally a majority of the consumers encountered in the online market place are women, so designers and developers representing the larger percentage of the target market are desirable in making products that appeal to a broader demographic. This economic argument from the point of view of businesses is often used to sway policy makers to invest in initiatives that will broaden the pipeline and produce more skilled workers. The rate of available jobs is quickly outpacing the supply of professionals with the right educational background to fill these technology jobs (Bureau of Labor Statistics, 2009).

Although the business perspective is important, there is another perspective to consider, the perspective of the individual citizens of a nation. STEM professions, and especially careers focused on technology, are often high-status, high-paying and flexible. With a pipeline that seems to exclude women, a majority of a gender, and therefore a significant portion of the workforce, is being left out of desirable careers (Barker and Aspray, 2006). The development of opportunities for all citizens, regardless of gender or socioeconomic status is important for class mobility and economic stability. Although a lucrative career, the knowledge and training required for these selective jobs can often be obtained without postgraduate work, unlike doctors and lawyers, and in some cases experience and knowledge is even more important than formalized training.

II. The Headwind: Factors diverting young women from technology

There are many factors contributing to the perception that young women are not interested in technology. When we evaluate the numbers of women indicating a choice in a technology-focused career through either employment statistics, or enrollment numbers at post secondary institutions we assume that women are just not interested in technology due to the extreme gender gap. In reality, what we are seeing is an artifact of a barrage of subtle, implicit, social messages that over time persuade women that a career in technology is not for them.

In elementary and early middle school (grades K-5?) there is gender parity in the interest to study a STEM field (citation – michelle). Despite that early interest, the sociological influences of media, gender stereotypes, and the influence of gender roles on play activities of children, have

all contributed to a barrage of messaging signaling to young girls that technology is for boys. The stereotype of the "nerdy" boy who is constantly on his computer sends a message about the type of work that computer scientists do: isolated, computer focused, and "uncool" (Barbercheck, 2001). The gender specific play of young children can also contribute to an "experience gap" where the encouragement of young boys to become users of technology early on leaves young women feeling inadequate or underprepared for more rigorous technology classes later on in school (Margolis and Fisher, 2003). All of these messages are compounded when you include ethnicity, as the stereotypes for computing often include Caucasian as a defining factor.

A few women are able to navigate this headwind without support. They find their way to classes or after school programs, and unfortunately instead of being welcomed, often face even stronger messages of exclusion. The messages can be as subtle as the decorations in the classroom (Cheryn et. al., 2009) or as targeted as directed speech from a teacher or mentor (letter to my daughters CS teacher). The bombardment of messaging often leads young women to drop out of the major or course of study, a decision many of them regret later (Eccles, 2007).

III. The Importance of Exposure

In order to counteract the stereotypes and the perception that a lack of usage will disqualify a young woman before she even enters a course, exposure to opportunities to engage with creative endeavors using technology is very important. From organizations such as Girls Who Code, Black Girls Code, ThoughtStem, Georgia Computes, and the National Center for Women in Technology we know that the exposure of young women to the professional practices involved in technology careers will increase the motivation and expressed desire to pursue technology as a field of study.

When young women engage with activities related to technology and experience the satisfaction of producing an artifact they have created, we offer a temporary barrier from the headwind pushing them away from technology. Changemakers and advocates know this, and as a result many programs are launched in order to bring these experiences to young men and women around the globe.

Girls Who Code is one such program that has had enormous success. [GWC talking points here]

IV. Self Selected Exposure is not enough

After school and non traditional programs can provide a safe environment that is targeted to the needs of young women. The curriculum can be focused to include topics and messages that are

generally applicable to young women, and the projects and activities can encourage a broader view of computing, often a key aspect in engaging under represented groups.

Although the out of the classroom programs can have a significant impact on the young women lucky enough to attend them, the programs alone will never change the headwind fueled by societal stereotypes. There are three problems that are almost impossible to address in non-traditional, voluntary educational experiences. They are infinite scalability, the need to educate the non-attending population, and consistency and accountability of outcomes.

Many organizations provide after school, or out of classroom programs to engage youth with a variety of curricula. Girl Scouts are one example of a wildly accessible and successful program. Yet even the Girl Scouts do not reach every young woman. Imagine if we left mathematics instruction up to the Girl Scouts. Many young women would not choose to access mathematics, despite its integration into their lives and most modern careers.

In addition to scalability problems, the stereotypes and misconceptions about technologists and technology careers are not only held by young women. The pervasive stereotype of a computer scientist as a shy, introverted, perhaps even socially awkward boy, is held by more than just women. The pervasive nature of the stereotype means that all students (boy and girl) should be presented with the models and examples of who are technologists and the types of problems they work on. Only by educating the larger population will we help reduce the headwind.

Finally, when education is offered through informal educational experiences, there is little consistency across programs, each with their own goals. Only through a well defined curriculum or set of outcomes can we ensure a consistency in what students will learn. Consistency is important to create a common understanding between stakeholders (employers, universities) and provide them a clear picture of the knowledge and skills of the general population.

VI. Outcomes and Successes of Early Programs

I present outcomes from two early programs, both launched since 2011, engaging today's youth in the United States, and more specifically New York City, in technology education. Girls Who Code is a non profit organization providing summer intensive programs and after school clubs to young women. Secondly, the Academy for Software Engineering is a public high school in New York City focused on computer science and software engineering.

Girls Who Code (GWC) focuses on developing a community of confident young women, who often become leaders, through their 7 week summer intensive workshop. During the 7 weeks the young women are embedded in a company with a strong technology workforce. Girls Who Code

provides them with a teacher, equipment if needed, curriculum, and a series of speakers and mentors to connect with the girls. The summer intensive program has been running for two years and has already reached over 150 young women, and continues to expand. In addition to the summer program, GWC offers an after school club model that teachers with little to no computer science experience can adopt. Students in clubs gain access to online instruction as well as a network of other girls across the country to work with.

Girls Who Code has been successful on both a programmatic level, and in the individual stories told by its young women. After the first summer intensive 100% of the young women indicated they were thinking of majoring or minoring in computer science. The summer intensive program culminates in a final project that is reviewed by peers as well as industry professionals who often offer the girls internships for the following year. Individually, you hear stories of students such as Julia who took what she has learned to start her own web design business and is teaching her father to code so he can leave his janitorial position to work with his daughter.

The Academy for Software Engineering (AFSE) takes a different approach from GWC. As a public high school, AFSE offers a standard curriculum of math, language arts, history, and science. Additionally, each student at the school takes a computer course every year focused on programming and web design in preparation for either college or career. AFSE students engage in robotics competitions, hackathons, and internships to make use of the knowledge and skills they learn in school.

In March of 2014, four AFSE students participated in a professional hackathon for the Partnership for a Healthier America (PHA), a NGO focused on fighting childhood obesity in the US, and the winning team contained an AFSE student who presented his work with his team at the PHA Summit in Washington DC. Part of the success of AFSE is that all students take rigorous computer science as a part of their general literacy.

VII. Conclusion

Programs such as Girls Who Code and AFSE provide us with insight into the strengths and weaknesses of in school and outside of the classroom instruction. Both programs have experience phenomenal growth and outcomes, and both serve their target populations very well, developing leaders and the next generation of technologists.