

How to Recruit Women and Girls to the Science, Technology, Engineering, and Math (STEM) Classroom

By Donna Milgram

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Women in STEM—What’s the Problem?

In the early nineties, nearly two decades ago, I received phone calls from educators around the country about the lack of young women in U.S. Department of Labor School-To-Work demonstration sites. In 1994, I testified as an expert before both the U.S. House and Senate about my research documenting the absence of young women in many “model” sites in hearings for the School-To-Work Opportunities Act. The Act—which passed—was designed to facilitate the creation of a universal, high-quality school-to-work transition system. The result of my testimony was a provision, which I helped draft, to ensure the participation of girls in School-To-Work programs.

Nearly 20 years later, I am once again receiving phone calls and emails from educators, except now it is about the lack of girls in STEM academies. This is despite President Obama’s “Educate to Innovate” campaign, which cites as one of its three goals to “. . . expand STEM education and career opportunities for underrepresented groups, including women and girls.”

So what is the state of STEM education for girls? Unfortunately, numbers don’t exist for the percentage of girls in STEM academies across the U.S. The most recent career and technical education statistics at the secondary level from the U.S. Department of Education are from 2005, and they show very low numbers of female students in STEM. For example, female high school students made up only 15% of engineering technologies concentrators, 8.5% of manufacturing,

14.5% in computer and information sciences, and 9.6% in construction and architecture (National Center for Education Statistics, 2005).

After high school, the statistics also show that there is still more work to be done to increase the number of women in STEM. In 2007, females made up 58% of two-year college enrollment; however, in 2006-2007, females received only 15% of the A.S. degrees in engineering technologies (Milgram, 2010). In 2010, only 18.1% of four-year engineering degrees went to women (Gibbons, 2011). In 2008-2009, the percentage of women receiving degrees in other areas was also low: 17.8% of computer science degrees, and 0% of degrees for programs such as energy management and petroleum engineering (National Center for Education Statistics, 2008-2009).

Why is it important to have more women in STEM? The absence of women from STEM education and careers affects more than the women; it is a missed opportunity for those fields. Women bring a different perspective that shapes and influences STEM disciplines. Having more women in the picture will not only help women themselves, it will also help

society benefit from their expertise—whether it's ensuring women are included in clinical trials for medical research or developing a prosthetic knee that works better for women. We are all enriched when women fully contribute to the advancement of science and technology. In addition, women should not miss out on fulfilling, rewarding careers in technology. A July 2011 report from the U.S. Department of Commerce shows that, over the past 10 years, growth in STEM jobs was three times as fast as growth in non-STEM jobs, even in difficult economic times. STEM workers also command higher wages, earning 26% more than their non-STEM counterparts (Langdon, McKittrick, Beede, Khan, & Doms, 2011).

The Secret to Success

What is the secret to recruiting women and girls to your STEM classrooms?

It's no secret at all.

Women and girls need to see female role models in the workplace that look like them—over and over and over again. They need to receive the message that women can work in STEM careers and be successful and fulfilled in their work life while still having a personal life, and they need to receive this message repeatedly.

When I conduct IWITTS' WomenTech Educator Trainings, the first exercise we do is called "Messages." We brainstorm the messages that are sent by teachers, counselors, peers, and parents/significant others to women and girls about the STEM classroom. I've been doing this exercise for over 17 years around the country, and wherever I am—whether it's Idaho, Massachusetts, California, or Nebraska—the messages sent to women and girls are at best mixed and at worst overwhelmingly negative, as in "This is not a career for you." In light of this, it's no surprise that educators need to repeatedly send a corrective, strong, positive message to women and girls: Yes, You Can!

When negative messaging is combined with the current workplace reality—a very small percentage of women in many engineering, technology, and trades careers—it's easy to see the importance of having an outreach campaign targeting women and girls in STEM. After all, considering that women comprise only 12.9% of all engineers, 20.9% of computer software engineers, 3.9% of installation and maintenance repair workers, 1.2% of automotive service technicians, and so forth (U.S. Dept. of Labor, 2010), it's clear why

Unlimited potential



women and girls don't envision themselves as engineers or technicians (U.S. Bureau of Labor Statistics, 2010). Educators must plant the seed of "You Can Do It!" and water it daily.

Successful Outreach Campaigns

The best example of an outreach campaign to recruit women to male-dominated jobs is "Rosie the Riveter," developed by the U.S. government and based on a real female factory worker, Rose Monroe. During World War II, the country needed women to work in the factories while men were away at war. Rose starred in a government-sponsored promotional film, shown nationwide in newsreels before movies, which highlighted the war effort at home and sent women the message that it was their patriotic duty to work in the factories. Rose's image was also used in the popular "We Can Do It!" posters. There was even a popular song about Rosie as a tireless assembly-line worker. Did the campaign work? Yes, it did! Between 1940 and 1944, the number of women in the workplace increased by 57% to 20 million, though not all of these women worked in factories (Rosie the riveter, 2011).

A current example of a successful outreach campaign is IWITTS' CalWomenTech Project which, among other initiatives, provided two-year colleges with recruitment strategies and training. For instance, early in the Project, City College of San Francisco's Computer Networking and Information Technology (CNIT) program reached its highest percentage of female students, from a baseline of 18.1% to 30.1% (an increase of 12%). This initial success was repeated in spring 2010 when the average number of women enrolled went to 33.2%—an increase of 15% (Milgram, 2011).

The CalWomenTech Project was highlighted in 2009 by the National Science Foundation, our funder, for demonstrating significant achievement and program effectiveness (Jesse, 2009). Read more about the Project, including case studies of participating community colleges and the recruitment strategies they used, on our website at www.iwitts.org.

Key Message: Work-Life Balance? Yes, You Can!

Another important element of modern outreach campaigns is conveying the message that women in STEM careers can balance their work demands with their personal and family life.

In 2000, the American Association of University Women's study, "Tech-Savvy: Educating Girls in the New Computer



Age," established that girls were reluctant to embark upon computer careers because—among other reasons—they were concerned they would have to work all the time, leaving no time for their personal lives or families (AAUW Educational Foundation Commission, 2000). Many subsequent studies showed the same findings.

For this reason, it is critical that biographies of female role models used in outreach materials emphasize not only the path these women took to arrive at their chosen careers, but also the joy they found in their work, as well as their personal interests and family stories. Examples of these types of biographies are available on the IWITTS website at www.iwitts.org, as well as in the career videos featuring female role models in the IWITTS store.

Many young women are reluctant to sacrifice their personal lives in pursuit of their careers. They want to know they will be able to achieve balance; it's important that recruitment materials and role models send the message that, "Yes, you can!"

Recruitment Strategies that Work

Below are low-cost strategies that can significantly increase the number of female students in your STEM classrooms.

Reach Out to Counselors

The Computer Networking and Information Technology (CNIT) department at the City College of San Francisco (CCSF) increased the percentage of women in its classes from 18.1% to 33.2% (Ragan & Elworth, 2011). One of the strategies they used was that the chair of the department, along with a senior instructor, made a presentation to the counseling department about the CNIT program and related careers. The department chair and instructor told the counselors that a key goal of the CNIT department was to have more female students. The counselors were provided with marketing collateral featuring women in CNIT, including brochures they could distribute to students and posters and tear-off flyers they could display in their offices and put up around the college's multiple campuses.

Reaching out to the counselors is critical because they can provide a pipeline for female students to STEM programs so that instructors and administrators do not have to do all the recruiting directly. Instructors and administrators can provide counselors at their own schools and at feeder schools with career information and marketing materials featuring female role models on the job. Also, it's important to inform counselors that increasing the number of female students is a key goal for targeted programs so that they can help do some of the recruiting. CCSF made their presentation during the monthly counselor meeting. In smaller schools, teachers and administrators might reach out to counselors during one-on-one meetings.

Personal Encouragement of Female Students

One past participant at an IWITTS WomenTech Educators Workshop was the director of an electronics academy at a high school in Colorado. His goal was to have half of the students in an Intel summer chip camp be female. He was not only successful in achieving that goal; he also recruited the first four female students to his electronics academy that fall. The three-day summer chip camp sparked the interest of these female students and served as a feeder into the school's electronics academy.

That educator used several strategies. He made presentations about the camp in the homerooms of his school and explained that it was a good summer enrichment experience

for all students—especially emphasizing that he wanted girls as well as boys to apply to be in the camp. In addition to the classroom presentations, he also issued personal invitations to female students to apply. This educator set aside half of the slots in the camp for boys, and half for girls—knowing that the boys would jump on the opportunity and the girls would be hesitant to participate; most would want to see if any other girls would be in the camp with them. As he anticipated, the boys' slots filled immediately, and the girls' slots filled more slowly. It was especially difficult to get the first few girls; however, once he signed them up, he could tell other potential female applicants about specific girls who would be attending the camp, which made the rest of the slots much easier to fill. Generally, girls prefer to have the company of other girls, so it's more effective to recruit them together in groups.

The strategy of personally encouraging girls can be effective in high-demand STEM classes even if half of the seats are not set aside for female students. In this case, it will require more work to recruit the female students in advance of enrollment, and it will be important to communicate to the female students that they will have to apply immediately to ensure a space. This is not a concern in STEM classes with many available seats. As will be examined below, personal encouragement by a teacher was the top recruitment strategy that female students in the CalWomenTech Project reported experiencing.

Develop Outreach Materials That Feature Female Role Models

STEM classes or programs will need to develop the equivalent of the Rosie the Riveter campaign described above. This campaign should include outreach materials such as posters and flyers and brochures featuring photographs of female role models. In addition, it would be very helpful to have career video clips of women in your area of study that show them in the field. This is the equivalent of the Rosie newsreels shown in the 1940s, to imprint images of female role models on the minds of female (and male) students. Outreach materials can be distributed by teachers and counselors at the targeted school and at any feeder schools, and they can also be sent to parents to persuade them that this is a good educational choice for their daughters.

One high school that I worked with asked its multimedia class to develop posters and screensavers of their female students doing hands-on activities in the labs. The theme was "Yes She Can!" The posters were displayed all around the

school, and the screensavers were installed on the computers. This not only served to recruit female students, it also conveyed the message that this was a school that strongly supported female students in STEM classes.

Using the Color Pink to Recruit Women and Girls—Should We?

My answer is a resounding yes! It works; research shows that females really do prefer pink. If you have the opportunity to make flyers in pink or use pink as part of a poster's color scheme, then go for it. Women and girls identify with the color pink. According to Wikipedia, "The color pink is often used to represent women or young girls" (Pink, 2011). The Boston Red Sox successfully used the color pink to increase sales of clothing to women coming to their baseball games. Pink baseball hats are the second best-selling color at the souvenir store (Dreilinger, 2005). The pink ribbon is the international symbol of breast cancer awareness. Pink was chosen partially because it is so strongly associated with femininity (Pink, 2011).

In 2007, Anya Hurlbert and Yazhu Ling, neuroscientists at Newcastle University, conducted a color-selection experiment with 208 volunteers between the ages of 20 and 26. On average, the study found, all people generally prefer blue, something researchers have long known. The study also

found that while both men and women liked blue, women tended to pick redder shades of blue—reddish-purple hues—while men preferred blue-green (Hurlbert & Ling, 2007).

Personally, I love the color pink. However, using the color pink to recruit is not a personal preference; it's based on hard data.

Appeal to Female Interests in STEM When You Recruit

Of course, appealing to female interests means much more than using the color pink. Males and females—overall as a group—have different learning styles, and what appeals to them and what engages them in STEM is different (Margolis & Fisher, 2001). For example, research shows that, as a group, women care most about how STEM will be used to make a difference in the world, such as using engineering to make prostheses, while men are often fascinated with the technology itself, such as how big a hard drive is and how fast a processor works (Extraordinary Women Engineers Project, 2005). These differences have implications for outreach materials and strategies. The best way to attract girls to STEM classes is to emphasize how the program helps others, and also focus on teamwork and collaboration, another area that research shows is appealing to women.

Ready-Made Outreach Materials Featuring Female Role Models

For schools that would prefer not to develop outreach materials from scratch, consider using some of these off-the-shelf solutions to recruit more female students.

- **Engineering role model videos:** An excellent gallery of female role model videos that can be used for recruitment purposes: www.engineeryourlife.org
- **Career videos in 35 occupations:** IWITTS has 35 career videos featuring female role models in a wide range of industries ranging from video game development to auto technology to robotics: www.iwitts.org/store/recruitment-products/career-videos
- **Role model posters and banners:** Featuring inspirational female role models on the job in industries ranging from manufacturing to welding to engineering: www.iwitts.org/store/
- **Women in Technology Outreach Kit:** Includes a series of customizable templates that guide you in developing recruitment materials for your school: www.iwitts.org/store/recruitment-products/outreach-kit

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