Donna Milgram

Executive Director, National Institute for Women in Trades, Technology and Science

Forming the complete picture

Donna Milgram's desire to foster female success in traditionally male-dominated fields led her to found a national institute. In an exclusive interview, she talks openly about the Institute's belief in the potential of women to enhance STEM, and its important work to ensure they occupy a prominent place within the science and technology landscape

What inspired you to found the National Institute for Women in Trades, Technology and Science (IWITTS)?

I founded IWITTS because I realised that many problems supposedly considered to be 'women's issues' could be solved if we had more women working in these fields.

For example, original airbags for cars disproportionately injured children and women less than 5 foot 4 inches tall. Although this is in fact the average height for women, if women had been part of the design team, I'm sure those below the average would have been taken into account.

Another example is that there's now a lot of training for domestic violence in law enforcement. However, with more female police officers and police chiefs I believe significantly less training on domestic violence calls and the importance of responding to them would be required.

Therefore, it made sense to me to found an organisation that, rather than be an individual professional association for one group, worked across different career pathways with a national focus, and sought not to change women, but rather the educational institutions and how employers recruit and retain women.

Could you provide an insight into the work currently underway at the Institute?

What's most exciting is our focus on disseminating strategies for recruitment and retention. The schools we've been working with have seen increases in female enrolment over the space of a year, and increased retention of not only female students in STEM subjects, but male students as well.

So, we know what is successful and our current National Science Foundation (NSF)-funded CalWomenTech Scale Up Project strives to reach as many people as possible. We are greatly involved with professional development and our online resources enable us to reach a growing number of people. We also provide free webinars and our proven practices collection contains a host of great content – over 100 evidence-based articles, as well as case studies.

You strive to help women succeed in fields such as engineering, technology and computer networking, that have traditionally been led by men. Have you encountered challenges here?

Often, schools will actively want more females in STEM areas. Teachers may have tried different things, but they're usually not aware of the evidence-based practices and strategies we recommend. For example, we have a whole component on online recruitment, which is of course really important these days, as well as a personal encouragement conversation. It's not enough to want to have women, or to bring in one female role model. Instead, we have created an effective system of training, and recruitment and retention plans.

I would say the biggest barrier for us is that schools and individual teachers think they have the knowledge to make the change. It's frustrating because people with good intentions think they're doing the right thing, but really all they're doing is creating career awareness and aren't using strategies to increase enrolment. We have to help them to see the difference and know how to go about effecting change.

On the retention side, we see the same kind of thing. Often, the most popular strategy is mentoring, whilst this is effective, there are many other strategies that can really make a difference. One example is teaching

spatial reasoning, which evidence shows can significantly increase the retention of women in engineering courses. It has proven challenging to get the information out there that there is a knowledge-base specific to recruiting and retaining women and girls in STEM, and that there are strategies that will help schools to see success within the space of one year – a 10-year strategy is not necessary to increase the enrolment of females and retention.

Are there common bottlenecks for women across the different fields?

There are many different areas that one needs to pay attention to from the perspective of the educator. One is building block skills; many women and girls have not played the informal games that provide a familiarity with what I call a technology schema – how to pull things apart and put them back together again – and may not have developed spatial reasoning skills. These things make a difference when you enter STEM classrooms. However, you can provide these building block skills, either by integrating them into the course or providing them in parallel. The great news is this also helps males.

Research shows that women care about how STEM subject areas are applied to help people, in particular, eg. engineering not just for bridges, but how you can use this to develop a handicapped playground or to improve prosthetics. These are areas that have often been less acknowledged, but that women have been shown to care about the most, and are examples of the types of things that are really important to keep in mind when you want to engage and retain women and girls.

In your experience, what are the key failings in current practices for recruiting and training women in technology?

Studies show that we need to get girls engaged in STEM before middle school, yet time and time again I see middle school girls being encouraged to take up STEM, despite the fact that this is not always the best population to focus on. In my work with technical colleges, the average age of a student is 29. I recently attended the advanced technology education conference funded by the NSF while there. While there, I held a workshop and many of the attendees wanted to implement strategies at the middle or high school level, but this would lead to career awareness and not increase female enrolment.

What I see as a failing is the lack of understanding of the difference between enhancing career awareness and actual recruitment to increase female enrolment. It's not simply about having female role models as mentors, that's one element but it's not sufficient, there are many other more specific parts to it, yet I find that there's a myth surrounding what works. Another myth is that providing scholarships for women will increase their numbers – I've never seen any research which proves this.

Instead, having a targeted recruitment, focusing on your key audience and ensuring any career information/events have a close connection to actual enrolment, will lead to increases in the enrolment of female students in STEM. On the retention side, most of the programmes that exist run in parallel to STEM classes. While some of them have led to important differences, they really don't create institutional change. The classroom strategies that we advocate to improve retention of females mean they don't have to survive bad classes; instead the lessons are tweaked to better engage women. We introduce a mix of competitive and collaborative activities. These are the kinds of things that lead to retention increases, as we've seen with the schools we've worked with. This is not usually focused on, instead the focus is on having a mentor, again a good thing, but not the same as making the classes themselves more welcoming.
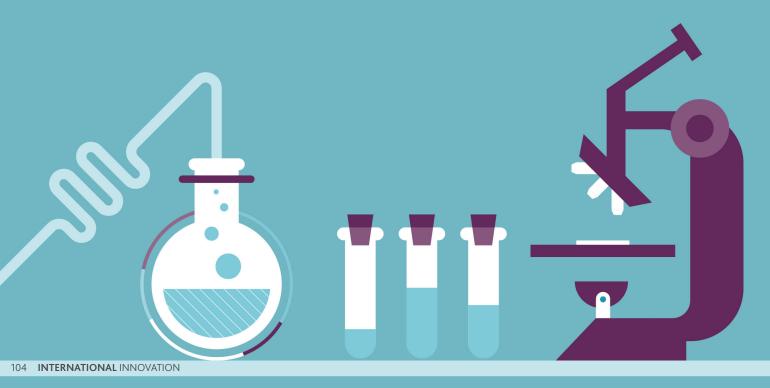
How can increasing the number of women in science and technology benefit these disciplines, in addition to the careers of the women themselves?

Women bring a different perspective to STEM. One example I love to use is Bernadine Healy, the first woman to head the National Institutes of Health (NIH – see p52) . She required that all clinical trials include women – which they didn't previously because there had been many problems with medication and pregnancies (teratogenic effects). So, major studies were conducted with no idea about the impact on women. Healy made sure that if you wanted to secure funding, you needed to have women in your studies.

Women are concentrated in a small number of career pathways in the US, though they could really make more of a difference if they were spread out among a greater variety of areas. Unfortunately, here we are in 2013 and the leading occupation for women in the US is still secretary. Among the top 10 for women is cashier, maid and nurse. Although there is nothing wrong with any of these careers, there should be an opportunity for women to not only occupy traditional roles if they so choose, but actually have access to all STEM career pathways, which would not only benefit the women themselves, both economically and also in career fulfilment, but would also be advantageous for the fields.

Could you discuss your time as a congressional fellow on Women and Public Policy?

This was so much fun! I actually did this before I founded IWITTS. I learned so much and was so fortunate during that time. I was a congressional

fellow on Women and Public Policy for Connie Morella, a Congresswoman from Maryland. She mentored me and taught me how you go about getting things done in Congress. I decided that I wanted to draft several bills on behalf of a Member of Congress. This is not how it normally works, but I didn't know better. I had just turned 30 and I went with this agenda to different offices. I initially met with Morella's legislative director who suggested I work on bills for domestic violence. I had a background in it, and agreed to do it, but also really wanted to work on workforce development bills. I felt if women have more economic empowerment, they're less likely to stay in situations where they face domestic violence.

I developed two bills, which Morella introduced, and two more on domestic violence. I lobbied before Congress and testified as an expert on the workforce development legislation. It was a lot of fun, Congresswoman Morella showed me how to get things introduced and moved through quickly. It was an educational experience.

IWITTS has developed many multi-site national demonstration and research projects to achieve gender equity in technology classrooms and the workplace. You are currently PI of the 'CalWomenTech Scale Up' project. What are the goals and could you provide an update on progress so far?

We seek to disseminate our strategies to as wide an audience as possible, despite limited funds. With that in mind, for the first time we took our WomenTech educators training and made it into online training. I'm happy to say we have received great evaluations from those who completed the training. We found that there are some additional things people can do online, eg. see and share each other's plans. We're also able to provide additional resources in an online learning community. The online training

was one of the big deliverables for the project. It's going very well, and we now have upcoming online training via the project next January. I'm having the participants attend in teams from their schools, and we're hoping they'll decide to form leadership teams. That's actually one of the things that we teach in the training – although one individual teacher can make a big difference, lasting institutional change comes from a campaign involving all the key stakeholders. So, we're now going to have participation via schools as opposed to individuals, which I'm really excited about.

Also, I have been speaking around the country at different conferences. I spoke at a STEM think tank international conference this summer and have been published in a number of periodicals. I won an award for an article I wrote on recruiting women and girls to engineering for the International Technology and Engineering Educators Association (ITEEA). Our goal is to bring these strategies to as many as possible, and also to provide them with the same kinds of feedback as our more intensive projects, which is really the scale-up part.

www.iwitts.org

WomenTech Hall of Fame

IWITTS recognises those educators who have successfully increased the recruitment and retention of female students in their STEM courses, inducting them into the WomenTech Hall of Fame

WomenTech Educators Leadership Team, San Diego Mesa College

The first to be inducted into the WomenTech Hall of Fame in 2009 for increasing the percentage of female students in their targeted Geographic Information Systems (GIS) courses from **35%** to **53%** in just one year, with an average enrolment rate of **40%** over the entire CalWomenTech Project.

Barbara DuFrain, Del Mar College

An associate professor in Computer Science, Engineering and Advanced Technology (CSE& AT), DuFrain increased the completion rate of female students from a baseline of **0%** to **86%** and male retention from **70%** to **93%** in her required introductory programming courses.

WomenTech Educators Leadership Team, Evergreen Valley College (EVC)

EVC's Automotive Technology programme increased female completion rate from **69%** to **100%** in six months. EVC also successfully increased the recruitment of female students in introductory automotive courses by **45%**.

WomenTech Educators Leadership Team, City College of San Francisco (CCSF)

CCSF's CalWomenTech Leadership Team worked to increase the recruitment of female students in a Computer Networking and IT (CNIT) programme from **18%** to a high of **30%** in 15 months. Furthermore, female retention increased by **23%**.