

Opening the STEM Pipeline: Every Student Can Have an Interest in STEM



Presenter: Donna Milgram, Executive Director, Institute for Women in Trades, Technology & Science

Presentation Transcript:

Donna: Hello and welcome to our final session of the STEM Success for Women Telesummit. As you know I'm your host, Donna Milgram, Executive Director of the Institute for Women in Trades, Technology and Science. I just have to say it's been such an honor to host all of our amazing experts and practitioners this week. I've gotten wonderful feedback from you, our listeners, and I want to thank all of you for being a part of this groundbreaking event. This session will take Q&A at the end by me – my favorite part.

Now I am going to get started with our session. I have a confession to make. When I was a junior in high school I got a 'D' in chemistry. This was pretty shocking because I was an honor student. In particular, I had difficulty with the labs and that's why I received such great satisfaction helping educators to help female students be successful in the lab. That is just a part of why I developed the WomenTech Educators Training because I want female students to be successful in STEM.

Now one strategy that I'll share comes from a UC Santa Cruz study on pair programming. Actually Dr. Charlie McDowell was on Tuesday. He was one of the authors of this study. It was large: 554 participants and they also had a control group. **What they found was that students that were paired chose computer science as a major and were retained at a rate of for female students 46% if they were paired chose computer science as a major. The non-pairs in a control group only 11%.** Now male pairs also chose computer science at a higher rate, 60% compared to the non-pairs at a rate of 41%. Now this is just one of many strategies that I teach on how to ensure female students are successful in the lab.

Although I, myself, have never been a STEM teacher, I've had STEM teachers who have won awards for their teaching provide me with testimonials about how the training really helped them to rethink their approach to course development and to improve their retention rates. I have the satisfaction of knowing that the work that I do has made a difference in the lives of both female and male STEM students and that I personally have made a contribution to opening the STEM pipeline up to all students.

As educators you provide an important route to ensuring that STEM is not just for the elite few who can make it through algebra, physics and calculus but that every student in the U.S. has the opportunity to learn the problem-solving skills that are the key to innovation.

My main message to you today is that every student, female and male, in the United States could have an interest in STEM if it was taught in a way that engaged them.

Now what I want to talk about in this session are:

- 1) The present-day reality, the lack of interest in STEM subjects by U.S. student and how STEM education in the U.S. has fallen behind other countries;

- 2) Why it's important to ensure our STEM workforce includes both women and men; and
- 3) How programs like our WomenTech Educators Training level the playing field for STEM students by opening access to all.

Okay, so let's look at the present-day reality. I'm sure I don't need to convince our listeners that STEM jobs are important but I thought you might be interested to know the number of STEM jobs in the United States. It's actually a fifth of all jobs and there's 26 million. This is according to *The Hidden STEM Economy*, a 2013 report published by the Brookings Institution. In spite of the intense drive to encourage students to study STEM, high school student interest levels fell between 2009 and 2013 in STEM. They're just now slightly below where they were in 2000 according to the *U.S. News and Raytheon STEM Index*. That report was published in 2014. So just now where we were in 2000.

Now if you look at female interest versus male interest, the gender gap is growing increasingly worse. But over a 20-year period, the STEM connector looked at male and female interest and female interest has hovered around the 10-15% arena and actually it's now going back down towards 10%. Male interest has peaked a bit but it's still only at around the 40% level. The gender gap, as I mentioned, is increasing.

Now even more bad news. Even when we have convinced students to pursue STEM majors, they leave at a really high rate. According to the National Center for Education Statistics, in 2013 at four-year colleges one-third of female students switch from a STEM to a non-STEM major and 26% of male students switched to a non-STEM major. That's a significant amount. It's even higher at two-year colleges: 43% of female students switch out – nearly half – and 29% of male students switch from a STEM major to a non-STEM major.

So it's not surprising but it's sad that the U.S. ranks only 51st out of 144 countries in the global competitiveness rankings for math and science education. The *2014-2015 Global Competitiveness Report* measures institutions, policies and factors such as education quality and it sets the level of economic prosperity in these countries. It's the most comprehensive assessment of national competitiveness worldwide. So in math and science education, Singapore is number one, Finland is two, China and Japan, number 14 and 21, respectively. U.S. is 51. So I ask, "How many female and male STEM innovators are we missing," because the way STEM is currently taught in most schools turns off the majority of students. My main message to you today is that every student in the United States could have an interest in STEM if it was taught in a way that engaged them.

So let's take a look at what happens when we don't have everyone represented in the STEM economy. The first place I want us to look at is cars. I'm guessing all of our listeners or almost all drive a car. Now I'm wondering if you, like me, looked at the National Highway Traffic Safety Administration Statistics on Car Safety before purchasing your car. I'm also wondering how many of you are 5'4" or under. I am 5'4", by the way. How many of you drive with someone in your car who's 5'4" or under? My guess is that's almost everyone here.

Why is this important? Well, the first generation of airbags were developed in 1998 and they disproportionately killed and injured women and children because the crash tests were done on male dummies, with an average height of 5'9" compared to women's average height, my height, of 5'4". They completely forgot the tests on children. Now, where the dashboard hits and where the seatbelt hits is totally different on 5'4" versus 5'9". Unfortunately, even today in the U.S., female drivers who wear their

seatbelts and are in actual crashes have a 47% higher chance of serious injuries than male drivers who are wearing their seatbelts.

Now this percentage goes up to 71% chance of serious injuries for belted female drivers in crashes resulting in moderate injuries. Driver seat tests are still based on the male physique in frontal crash tests and the majority of fatalities are from frontal crashes. Apparently, someone forgot to tell the engineers designing the cars and tests that most women are driving these days. Now my guess was there weren't too many women, if any, involved in the design team. This study, by the way, was done in 2011 by the University of Virginia Center for Applied Biomechanics.

So what does it look like when we do have women in the STEM picture? Well, a female engineer developed the Zimmer Gender Solutions Knee which is based on the female anatomy. Thus, it has a much higher medical success rate for women who need knee replacements. Two-thirds of the knee replacements in the U.S. are actually done on women; however, until a female engineer came along and developed the Zimmer Gender Solutions Knee, the implant model was based on a male knee which, of course, is much wider than a female knee. Not surprisingly, many of these knee replacements didn't work for women.

Another woman who came along and made a big difference was Dr. Bernadine Healey. In 1991, she was the first woman to direct the National Institutes of Health, NIH. She established a policy where NIH would only fund medical clinical trials if they included both women and men when the condition being studied affected both genders and that's most conditions. Prior to this, NIH had done a huge study on aspirin preventing heart attacks. There were 22,000 participants. It's a long-term study. All 22,000 study participants were male. Women have reproductive systems which makes them clearly physiologically different than men so it's not a given that research on men applies to women.

Now I'm sad to tell you that in 2015, not including women or many women still exists in clinical trials. One example of this is cardiovascular disease which actually more women die of than men. So only one-third of cardiovascular clinical trial subjects are female and less than one-third of the actual trials report outcomes by sex. This is according to the Connor Center for Women's Health which is housed in the Brigham and Women's Hospital in Boston and the Jacobs Institute of Women's Health at G.W. in Washington, D.C. Clearly making sure everyone is represented in all areas of the STEM workforce is a life or death matter.

So are you ready for some good news? Female students and male students can do well in STEM programs when they're taught differently. Nationally, the number of female graduates receiving bachelors in engineering is 18% in the United States. However, every year, the American Society for Engineering Education comes out with the top ten schools for women in terms of awards of engineering degrees. I'm just going to give you a few examples.

MIT, 42% of those receiving engineering degrees are female; Rice University in Texas, 41%; California Institute of Technology, 40% and so forth and so on. This compares again to 18% nationally. After-school program Girlstart, Project IT Girl out of Austin, Texas is a non-profit after-school program. They use collaborative technology, hands-on projects. Eighty-seven percent of participants in Project IT Girl enrolled in a four-year university and 80% of those stated they'll pursue a STEM major.

Manor High School in Manor, Texas in 2007 decided to create an inclusive STEM focused high school within their high school. It was for grades 10 and 11. It still exists. The students were chosen by a lottery. So they were the same as the students who were in the regular high school, side by side. The emphasis on the STEM-focused high school was project-based learning and it also includes a blend of formal and informal STEM learning such as after-school programs for additional support, a robotics club and lots of hands-on work.

Well in the statewide testing that Texas does in science, the regular Manor High School students had on average a 69% grade from the test. The Manor New Technical High School students chosen by lottery had 94%. In math, the Manor High School students in the regular school had 65% as their average score from the statewide assessment. The Technical High School had 92%.

So I ask, "Why do these colleges, schools, programs do so well in STEM? What secrets to success do these successful schools and programs have that the others don't?" First of all, they connect academic learning to the real world beyond the classroom. They also have their students conduct inquiries and solve problems like real scientists and engineers. They do project-based learning. They also apply how the STEM area helps others and helps the community. They also blend formal and informal learning beyond the typical class and they make STEM fun. Can you imagine the impact on test scores if all students had access to this type of STEM education? In two years, the United States could be number 1 instead of number 51 in STEM education. Every student in the United States could have an interest in STEM if it was taught in a way that engaged them.

When you leave the STEM Success for Women Telesummit today, I want to ask you to do three things:

- 1) First, because I want you to remember the importance and the power that every educator has in leveling the playing field for all students.
- 2) Two, I want you to commit to implementing 3 of the recruitment strategies that you've heard to recruit more female students in your STEM classes. I also want you to commit to implementing 3 of the retention strategies that will help both your female and your male students.
- 3) The third thing that I want to ask you to do is I want you to celebrate yourself because you've attended the STEM Success for Women Telesummit because you care so much about female and male students in STEM and you're part of the women in STEM solution. Remember each and every one of you here today is part of the STEM solution.

Now I'm going to take your questions live and I see our first question is actually from Laurel in Manitoba, Canada. She asks, "Where does Canada fall on the list of nations in the Global Competitiveness Study?" Ah, that is a good question. I don't know offhand but I'm going to give you the website where you can go find that out. It's www.weforum.org/reports/global-competitiveness-report-2014-2015. Sort of a long URL. I apologize for that. I wish I remembered where Canada was but now you and anyone else listening from another country can look that up as well.

So Susan from New York asks, "You mentioned the importance of doing hands-on work to keep students engaged. I teach a community college mathematics class. What are some ideas for incorporating hands-on work into our class?" So it's very interesting. Really, all of the same kinds of things that apply for hands-on in STEM classes in general also apply for mathematics. You want to do things that the students can relate to. You want to do project-based learning. You want to have context first. So all the same kinds of things have applied to math. I actually have a number of testimonials on

our website that I'm very proud of including from some math chairs that found our training very helpful from the math standpoint.

Okay, well, I have to tell you that I so appreciate everyone's participation in our first telesummit. It has just been so wonderful for me in this week to have the opportunity to do interviews with many people whose work I have been talking about for so many years. To have the opportunity to share with all of you listeners their important, important contributions it has really been a privilege. I'm so excited that over 1,000 of you have been attending our STEM Success for Women Telesummit. Again, I know how committed all of you are and I so appreciate your efforts in the field, in the classrooms, in your educational institutions.

Thank you so much for your participation in the STEM Success for Women Telesummit; Empowering Educators to Recruit and Retain More Women in STEM. With that, I'm going to sign off.