

Advancement Transcript:

Sonia Moin, *American Society of Mechanical Engineers*: I think since the world is changing, and it's changing at a rapid pace, you know you just can't have your traditional engineering student anymore in the workplace. You need a diverse workforce, and the way to get that is to attract a diverse student population. So, I think there's just a big force, big demand for it right now, big push for it.

Narrator: Whether finding new ways to generate energy, building smarter to preserve the environment, or developing more nutritious foods to feed growing populations, engineers are problem-solvers.

But, addressing society's engineering problems requires expanding and diversifying the engineering workforce. That means tapping into a greater number and variety of students.

Women are underrepresented in the field. New efforts are being made to attract female students – including women of color and women with physical disabilities – into engineering study and to help them advance. Engineering needs the diverse ideas and perspectives women have to offer.

Educators hold the reins to helping students advance in academic programs that provide foundations for engineering careers. Helping them complete engineering studies isn't enough – young women must see the career opportunities ahead to stay on the path to success.

Too often, talented women leave engineering schools or simply do not see engineering as a possible career choice. The problem is not academic achievement.

On average, women transferring out of engineering school have better GPAs than men who leave. The problem lies in a culture of misconceptions – misconceptions about the engineering profession and stereotypes about women's abilities to excel.

So, helping students thrive academically and succeed in engineering requires creative approaches.

Putting students on the pathway to becoming engineers begins by engaging their interests and then imparting the necessary skills in math, science, and technology.

But, as educators know, success depends on more than these basic tools; it requires motivation and commitment. These attributes are more likely to emerge if students can see the relevance of their school-work to real-world problems.

Susan Metz, *Stevens Institute of Technology*: Well, you know it makes it relevant, it makes it current, and I think this is politically too, kids are so much more involved with

what's going on now and want to be a part of those kinds of activities that improve the world for all people. The thing is you have to bring the word engineering into that.

Narrator: A particularly important form of support comes from building students' self-confidence. Expectations are a powerful factor in determining students' success. Girls need academic resilience.

Best practices for building resilience include making students aware of their achievements, encouraging persistence, and counteracting stereotypes about women's abilities in engineering, math, and science.

Educators can have profound impacts on their students' readiness to learn, academic achievement, and personal development. A single positive experience or attitude, nurtured by an educator, can help a student in many ways.

Instructors have many opportunities to connect with their students outside of classes, during office hours, and in-class.

As a result, educators also have the opportunity to direct students, give them needed encouragement, and help them find opportunities to further their learning.

There are many pathways that lead to becoming an engineer. Helping students understand the relevance of their own experiences is vital to helping them succeed.

Office hours provide an opportunity for quality, one-on-one interaction with students. Keeping office and classroom doors open encourages students to drop in for conversation. Students also need the opportunity to express their interests or frustrations away from the pressures of their peers. Requiring teacher-student meetings throughout the school-year is a good way to help students become comfortable coming for advice.

Using various approaches enables educators to reach more students by supporting them in different ways. But fostering excellence requires more. Sponsoring and encouraging activities that counteract societal and institutional barriers also fosters achievement.

Inviting female guest speakers to the classroom can help young women envision themselves in similar roles. Highlighting the accomplishments of women engineers can provide a similar effect.

Study groups offer another good way to support students that help them learn to support each other. Mentors and role models can also assist students.

Stephanie Adams, Virginia Commonwealth University School of Engineering: Most faculty went to graduate school with other people, so start with who you know. If you were in college with a woman whose project was about women in engineering, so if you're a male professor and you were in college with some women graduate students and you had a relationship of some sort with them, invite them to come and talk to your students and put a face with a body of work that relates to your subject matter. That would be one thing.

I think as faculty go to conferences and interact with other people, same deal, extend an invitation for folks to come and be in your classroom. I think part of the mentoring relationship is you can mentor by design or you can mentor by connection. So, I tend to think the more people you put in front of people who look like them and speak their language, the people are going to find a connection.

Narrator: Educators can also foster relationships with local engineering and technology firms. They can help open the door to role models and guest speakers who can provide students with information on what it is like to be a practicing engineer.

Sometimes educators find classroom mentors in the most unlikely places. For example, local manufacturers – from agricultural products to cosmetic companies – may hire chemical engineers to develop their products. Introducing young women to engineers that represent the variety of career choices in their own backyard offers a good way to build understanding and enthusiasm.

Mentoring and role models present effective support tools throughout a student's career. Mentors help students explore what naturally interests them, identify how engineering applies to those interests, and answer questions about the profession. Role models allow young students to visualize themselves as future professionals.

Whether through direct contact or online interaction, mentors provide support and encouragement that students soak up. And just as online interaction with a mentor can support academic achievement, the inclusion of technology in the classroom has become an integral component of education.

Technology makes resources accessible in the environment in new and exciting ways. New applications and technologies provide for ever-changing and creative classroom uses. And, incorporating technology into instruction helps prepare students for the virtual tools needed to succeed in the engineering workforce.

Extracurricular activities also provide additional learning opportunities for students. A variety of extracurricular activities tend to provide flexibility in showing how math and science is applied to engineering in everyday life. Many students don't make the connection between math and science concepts and the engineering knowledge required to construct a bridge or to make a plane fly.

Karen Tonso, Wayne State University: Out-of-school learning is absolutely essential for students to have an appreciation of the world in the way that math and science and engineering principles are in the world. They come from the world, they're not just in the vapor or something, they're really there and really good engineers can see them. They can look at a situation and they see piping in terms of how the elbows change the flow, and how it reduces the velocity, and how it changes forces, and how nozzles and wedges and things change, and how the principles go together with the physical apparatus. Superficial engineers who can get really high grades but can't apply it in the field are not going to turn out to be very good engineers. They may get all the awards at graduation, but they're going to have a problem when they go to work.

Narrator: Inquisitive students often ask for opportunities to explore their interests outside of the classroom. Extracurricular activities can be a great resource for students.

Educators refer students to programs that reinforce engineering concepts with hands-on activities and that show engineering's real-world applications.

Professional societies can help educators provide motivated students with extra learning opportunities. These groups typically offer a variety of resources for students. Magazines, student competitions, student chapters, scholarships, mentoring programs, and workshops are just a few of the resources groups, like the American Association of Engineering Societies, have available.

Discipline-specific professional societies are helpful resources for educators, parents, and students. Chemical, mechanical, electrical, biomedical – these are just a few of the specialized engineering fields students may explore.

There are many different career paths in engineering, covering a wide range of interests, from designing life-saving medical equipment, to developing cell phones and creating Hollywood special effects.

There are many ways to support students on their path towards a career in engineering, and assessing what works and refining what isn't working is an important part of any approach.

Sometimes educators find success reaching students, but may not know exactly what factors contributed to the achievement. These are opportunities for program assessment efforts to identify and sustain or amplify successful activities.

Too often, evaluation is thought of just in terms of students' grades and learning measurements. Educators maximize their efforts by including evaluation of their own teaching styles, instructional materials, and classroom environments. Special attention to gender inclusion can help reveal ways to improve the learning experiences of young women.

Taking the time to evaluate extracurricular efforts, enrichment programs, mentoring, and career activities can also be helpful.

Evaluation is part of an ongoing commitment to improving efforts in supporting young women to achieve great things in engineering. In this regard, there is no beginning or end, but a cycle of continuous evaluation and improvement.

Marie-Elena Reyes, *Frida Kahlo Institute*: Well, that's what I'm talking about. It's like all this time the focus has really been on all of the things that engineering can do for women of color, or for populations of color, or for all the other groups that are underrepresented. From my perspective, it's what those individuals, as a diverse group of people with life experiences that is very different than the dominant culture and questions it, brings to the field that is absolutely vital for the field to grow, for the United States to be competitive, and for the discoveries that will come. I mean, that's what I think is important, it's what they bring to the field.