embarked on efforts to improve pre-college education by requiring more emphasis on STEM curriculum. The 2001 Massachusetts Science and Technology/Engineering Curriculum Framework is an example.

Higher education must also be an active partner in efforts to ensure proper preparation for rigorous STEM curricula. At a recent summit organized by Wentworth for 10 high school headmasters from the Boston Public Schools, the message I heard repeatedly from administrators was clear: schools are looking to build long-term sustainable partnerships with institutions of higher education to help address the challenges faced by students.

Partnerships can identify and develop innovative ways to pair resources, funds, materials, expertise and support to provide enrichment experiences that expose students to STEM fields, strengthen skills in specific subjects and preview the college experience for students who may be the first in their family to consider college.

Partnerships with other public- and private-sector organizations will be another key factor in recruiting and retaining students in STEM programs. A good example is the Texas Engineering and Technology Consortium, a public/private partnership of companies, higher education and the state of Texas formed to increase the number of engineering and computer science graduates through outreach and retention programs. The state appropriates up to $5 million annually to match contributions from industry, the federal government and other non-state sources.

To preserve U.S. economic competitiveness, educational institutions at all levels, the government, professional societies and the private sector have to come together to share best practices and support outreach activities for all, but particularly for underrepresented students. We must identify local high schools to build lasting relationships with and enable our college students to serve as mentors and tutors. We must encourage opportunities to share and leverage faculty resources for teacher training and course development support. And we must partner with industry to build financial support for STEM education, demonstrate the excitement and possibilities the field offers and arm our students with the tools for academic, personal and professional success.

Zorica Pantic is president of Wentworth Institute of Technology. She also serves on the National Academy of Engineering’s Engineering Equity Extension Service Advisory Committee. Email: panticz@wit.edu.

Closing the Engineering Gender Gap: Viewers Like You

BRIGID SULLIVAN

Giselle Eng was a high school junior with a penchant for the performing arts when she first learned about auditions for a new children’s television series to air nationwide on PBS. Her interest wavered, however, when she learned the focus of the new series: engineering. “I definitely had a lot of misconceptions about engineering,” says Eng, who recently graduated from Boston Latin High School. “I thought it was all technical and computers and programming. I never really imagined myself doing anything related to engineering.”

Despite her misgivings, she went through with the audition, and eventually was selected from hundreds of high school students to appear in the first season of Design Squad, a new PBS reality series from Boston public broadcaster WGBH that follows two teams of high-schoolers as they solve a series of engineering challenges.

Eng’s initial hesitation about engineering is symptomatic of a longstanding problem in America’s innovation-based economy: women pursue college degrees and professional jobs in engineering at much lower levels than men. According to the National Science Foundation, just 16 percent of the 2005 college...
Newly minted engineers are women, but from an unremarkable 20 percent a decade earlier.

What’s behind this gender gap? A study published in the Journal of Women and Minorities in Science and Engineering found that girls are completing high school science and math courses at the same rate as boys: 94 percent of girls took biology (compared with 91 percent of boys), 64 percent took chemistry (57 percent for boys) and 26 percent studied physics (32 percent of boys). Yet despite similar rates of participation and achievement in high school science and math courses, young women continue to lag behind their male peers in pursuing degrees in many science, technology, engineering and math (STEM) fields.

Thea Sahr, who heads WGBH’s Extraordinary Women in Engineering initiative aimed at changing the way high school girls view the engineering profession and the way the profession positions itself before this potential workforce, attributes the gender gap to perceptions. “Our research found that high school girls don’t really have an understanding of what engineering is,” says Sahr, whose team interviewed college-bound high school girls as well as science and math teachers, guidance counselors, college engineering students and engineers.

Among all the audiences involved in our research, we found that engineering was perceived to be a ‘man’s profession’ and that there is little or no encouragement for girls to consider engineering.

Of particular note was the perception among high school girls and their teachers and counselors that engineering was a less “people-oriented” profession that had less direct impact on people’s lives than other scientific fields such as medicine or biology.

“Girls and their educators did not have a clear picture of engineering,” Sahr says. “We learned they believe that, to be a successful engineer, you must be highly superior in both math and science, a message that does not resonate with them.

“We also were surprised to learn,” she says, “that the engineering community is spreading this message, focusing on the process of becoming an engineer rather than the societal value and rewards of being an engineer.”

Changing perceptions
Changing these perceptions is the focus of the Extraordinary Women in Engineering initiative. Working in collaboration with nearly 50 professional engineering associations, universities and corporations, WGBH is developing an extensive multimedia campaign emphasizing ways the engineering field helps improve people’s lives.

Sponsored by the National Science Foundation and Northrop Grumman, the project is developing an interactive web site that will use streaming video portraits of successful female engineers to combat the misperceptions many girls have about the profession. Outreach materials will enable science and math teachers and school counselors to guide girls who may be interested in engineering. And resources for engineers will be used to launch a dialogue on the need to redefine the profession as a desirable career option for high school girls. The initiative will also give America’s more than 1 million engineers new tools to reach out to high schools, teachers, counselors and high school girls to encourage interest in pursuing a degree in engineering.

On the national level, a flurry of STEM-related bills in Congress would provide everything from scholarships and loan forgiveness to tax incentives and teacher training grants aimed at encouraging students to pursue degrees and consider teaching in STEM fields.

Before tomorrow’s high school students can start taking advantage of such incentives, however, we must find new ways of engaging even younger students in math, science and engineering.

Public television reaches 98 percent of all U.S. households and is uniquely positioned to help create the STEM pipeline.

In the past year, WGBH has debuted three new television series that focus on STEM-related content: Fetch!, a reality/game show for kids ages 9 to 13 with a focus on math and science; Curious George, a half-hour animated series that uses the misadventures of everyone’s favorite little monkey to teach preschoolers basic concepts in math, science and engineering; and Design Squad, with its focus on engineering.

The common thread running through these programs is the presentation of STEM content in unexpected and entertaining formats that engage and excite young viewers. “Design Squad is targeting 9- to 12-year-olds because we want to show them what engineering is really about—how creative and exciting it is—before they decide that math and science are ‘boring,’” says senior executive producer Kate Taylor.

“Our target audience loves reality shows, so we’ve taken what’s best about them—the competition, the intensity, the people you start to care about—and married it to serious content,” adds executive producer Marisa Wolsky. “Our goal is to break down negative stereotypes—that engineers are nerdy, or that it’s too difficult, or for boys only—and expose young people, especially girls, to the idea that engineering is something they might want to consider as a career.”

When male scientists marry and have children, their chances of landing tenure-track positions in the sciences increase, but when women do the same, their chances of moving up the academic ladder decrease, according to a study by economists Donna Ginther of the University of Kansas and Shulamit Kahn of Boston University. Having a child under age 5 lowers the probability of a tenure track appointment by 8 percent for women scientists. For more, download: http://www.nber.org/~sewp/Ginther_Kahn_revised8-06.pdf
As New England develops a STEM agenda, public broadcasting should be an active partner in helping to spark a passion for the field among what is inarguably our region’s most valuable resource: the boys—and girls—who will make up the STEM workforce of tomorrow.

Brigid Sullivan is vice president of Children’s, Educational and Interactive Programming at Boston public broadcaster WGBH. Email: brigid_sullivan@wgbh.org.

Colby-Sawyer is among New England colleges where the liberal arts curriculum has traditionally required only one course in math, and no academic major or minor in math is offered. Recently the New London, N.H., school received a three-year $149,290 grant from the National Science Foundation to incorporate teaching of basic math and reasoning skills across its liberal arts curriculum. One of 100 programs funded under the NSF’s Course, Curriculum and Laboratory Improvement program, the Colby-Sawyer initiative’s goal is to ensure that students can routinely use basic math concepts and skills considered critical in an information-centered global society. For more, visit: http://www.colby-sawyer.edu/news/nsf.html

Engineering Education Must Get Real

BERNARD M. GORDON

Private industry lives and sometimes dies by a demanding credo that honors results and constantly tests people and ideas against a public that can vote with its economic might. Academia, on the other hand, insulated by a steady, if sometimes unpredictable, flow of cash from government programs and endowment funds, has learned to be slower and more methodical. This can certainly produce reflective, careful thinking and sometimes deep analysis—results that are rare in the private sector and usually regarded as a luxury good. But far too often, the output is not what it should be. It really does seem that academics are altogether too happy to inhabit those fabled Ivory Towers. These habits of mind are further hardened by an inward-looking system of promotion and management that places academic achievement—study and research—on a plane above actual accomplishment in the non-academic world. Thus, too often what passes for innovation and forward thinking in an academic program turns out to be merely a trimming of the sails to catch the breeze of a new fashion or nostrum, rather than an act of real commitment and innovation. This is a particularly pernicious problem with regard to fields of study that are often accurately and sometimes disparagingly referred to as “practical.”

My own profession, engineering—a field that should always be rooted in pragmatism even as it reaches to stretch the limits of what is possible—is a case in point. Recently, at one of the region’s engineering colleges, I encountered an example of academic fashion that simply missed the boat. The president of the school told me with pride of the college’s new, multidisciplinary teaching methods, and then confessed that half or more of his graduates would probably end up in other careers, such as marketing—implying that the changes in the classroom had little to do with creating better engineers.

Today, academics spend a great deal of time—and money—fretting over the state of “STEM” education. STEM—a clever acronym for science, technology, engineering and mathematics—attempts, wrongly in my view, to tightly associate educational enterprises that should be distinctly delineated. To be sure, STEM aims to promote study in areas that share similarities and are sometimes interdependent. However, the fact that engineering—a critically important profession—is thereby lumped with three very broad subject areas is troubling and indeed symptomatic of all that is wrong with engineering education today.

In fact, the history of engineering education since World War II is, by and large, a chronicle of retreat—with experienced, hard-nosed practitioners, who used to comprise a significant element of the engineering faculty, gradually banished from sight. Moreover, a growing emphasis on science and research rather than on, say, a hands-on familiarity with machine tools or the ability to rapidly and intuitively compute, with reasonable accuracy, the impedance of an electronic circuit (without the help of a machine), has in most engineering programs led to the production of cadres of young engineers whose skills are fatally limited.

In addition to failing to adequately teach solid engineering skills, there has been an even more precipitous retreat from the inculcation of values such as determination, resourcefulness and integrity that are essential to economically successful engineering. In fact, values are almost as crucial to a successful engineer as specific technical training. For instance, it takes deep wellsprings of determination and tenacity to pursue a project