

Society of Women Engineers General Position Statement on Science, Technology, Engineering, and Mathematics (STEM) Education and the Need for a U.S. Technologically-Literate Workforce

In the last 50 years, more than half of America's sustained economic growth was created by the five percent of the workforce who create, manage, and maintain the processes and products of innovation: engineers, scientists, and advanced-degree technologists.¹ However, as the number of jobs requiring engineering and scientific training grows, the number of students preparing for those careers remains level, with women and minorities severely underrepresented.

The recent National Academies report, "Rising Above the Gathering Storm: Energizing and Employing America for a Brighter Economic Future," states, "The United States takes deserved pride in the vitality of its economy, which forms the foundation of our quality of life, our national security, and our hope that our children and grandchildren will inherit ever-greater opportunities. That vitality is derived in large part from the productivity of well-trained people and the steady stream of scientific and technical innovations they produce. Without high-quality, knowledge-intensive jobs and the innovative enterprises that lead to discovery and new technology, our economy will suffer and our people will face a lower standard of living."²

Introduction

Engineering and technology are losing the battle for the hearts and minds of tomorrow's U.S. workforce. We must refuel our science, technology, engineering and mathematics talent, or America could face losing its economic engine, the base of its prosperity and security.

Innovation capacity depends, in no small part, on the cadre of scientists and engineers who produce and deploy ideas. However, jobs requiring technical training are beginning to grow at five times the rate of other occupations, while the average age of America's Science, Technology, Engineering, and Mathematics (STEM) workforce is rising and the supply of new STEM workers is struggling to keep up with demand (outside of the biological and social sciences).

At the junior high school level, studies have shown that students begin to lose interest in STEM subjects. U.S. high school students are outperformed on international math and science tests, while most U.S. students show little interest in pursuing scientific fields.

¹ *The Talent Imperative: Meeting America's Challenge in Science and Engineering*, ASAP.

² *Rising Above the Gathering Storm: Energizing and Employing America for a Brighter Economic Future*.

Less than 15 percent of U.S. students possess the prerequisites to pursue scientific/technical degrees in college. Only 5.5 percent of the 1.1 million high school seniors who took the college entrance exam in 2002 planned to pursue an engineering degree.³

Many of the best and brightest schoolchildren are eliminated from the ranks of future scientists and engineers by the United States' poor performance in teaching STEM subjects. Since 1996, the demand for high-level math and science courses has increased while the percentage of qualified math and science teachers certified to teach these subjects has remained level.⁴ In school, not all students learn how STEM skills translate into professionally useful knowledge or interesting and satisfying careers, and are then unable to make informed choices about further education and work options. As a result, many students enrolled in science and engineering studies in college are unprepared and drop out in frustration; other potentially capable students never even consider these subjects.

Some of the aforementioned trends are also being felt at the undergraduate level. The number of degrees granted in every field of science and engineering, other than the biological and social sciences, have not seen the robust growth they once had in the early to mid-1980s. The number of engineering degrees, for example, peaked in 1986, has remained in a state of fluctuation since that time, and has not again reached that peak. The number has risen steadily since 1999, but current enrollments predict that engineering degrees may decline slightly in the coming years.⁵

Of the college-age population earning science and engineering degrees, the United States currently ranks seventeenth, down from third place several decades ago.⁶ Many other industrialized nations now have a higher fraction of all 24-year-olds with science or engineering degrees than the United States. Further, females and minorities are underrepresented in both our college-level engineering programs and in the national engineering workforce.

One of the most daunting challenges facing engineering education today is attracting students from the entire spectrum of American society to the field. "Female students make up 20 percent of engineering undergraduates, but 55 percent of all undergraduates; African-Americans, 5.3 percent in engineering, 10.8 percent overall; and Latinos, 5.4 percent, compared to 6.4 percent overall. Worse, the percentages of these groups represented in engineering have been decreasing in recent years, while overall participation in higher education has increased considerably."⁷

³ *Innovate America: National Innovation Initiative Report.*

⁴ State Indicators of Math and Science Education 2005.

⁵ Engineering and Technology Degrees 2005.

⁶ *Innovate America: National Innovation Initiative Report*

⁷ *Engineering in the K-12 Classroom: An Analysis of Current Practices and Guidelines for the Future*

In the workforce, a similar story can be told. According to the National Science Foundation, women occupy only 24 percent of jobs in technical fields but comprise 46 percent of the total workforce. African-Americans and Latinos are also underrepresented in technical fields as only 3 percent of this workforce, while registering at 13 percent each of the total workforce. During a period when these groups are continuing to their increase their shares of the total workforce, these numbers are especially troublesome.⁸

Recommendations

The Society of Women Engineers strongly supports the following recommendations put forth in the Gathering Storm report for improving STEM educational performance and the U.S. STEM workforce and expands upon these recommendations in the below commentary:

- Enlarge America's talent pool by greatly improving K-12 STEM education through the recruitment, training, and retention of STEM teachers;
- Expand the STEM pipeline, especially targeting women and minorities, by increasing the number of students who pursue STEM coursework; and
- Make the United States the most appealing setting for study and research to cultivate, recruit, and retain top quality students, scientists, and engineers from within the United States and throughout the world.⁹

Enlarge America's talent pool by greatly improving K-12 STEM education through the recruitment, training, and retention of STEM teachers.

Experts say that recruitment, training, and retention of qualified STEM teachers is a key element to improving student performance.¹⁰ To this end, policymakers should create programs which:

- attract STEM teachers via scholarships, student loan forgiveness, bonuses, and tax incentives;
- include/increase STEM coursework in pre-service/university teacher training,
- allow for differential pay scales to help attract and retain qualified STEM educators;
- improve in-service professional development focusing on STEM curricula;
- facilitate alternative certification and transition-to-teaching programs for engineers and other technical professionals; and
- institute mentoring programs for STEM personnel in schools.

⁸ *The Science and Engineering Workforce: Realizing America's Potential*

⁹ *Rising Above the Gathering Storm: Energizing and Employing America for a Brighter Economic Future.*

¹⁰ *Engineering in the K-12 Classroom: An Analysis of Current Practices and Guidelines for the Future*

Expand the STEM pipeline, especially targeting women and minorities, by increasing the number of students who pursue STEM coursework.

The development of technological literacy, talent, and expertise across all sectors of society is needed to remain competitive in a global economy. Efforts should be made to attract greater participation of significantly underrepresented women and minorities into STEM fields of study and careers. Policymakers should:

- provide incentives and mentoring for students, including women and minorities, to pursue K-12 STEM coursework;
- foster outreach and provide STEM career materials to K-12 guidance counselors, teachers, and parents;
- support STEM magnet schools in school districts with large minority enrollments; and
- foster public-private partnerships to ensure those schools serving large minority enrollments have the materials and equipment needed to support the delivery of high-quality STEM education.

Make the United States the most appealing setting for study and research to cultivate, recruit, and retain top quality students, scientists, and engineers from within the United States and throughout the world.

With the current shrinking size of the U.S. technological workforce, policymakers should:

- provide incentives and mentoring for students, including women and minorities, to increase the number and proportion of U.S. citizens who earn STEM degrees and pursue STEM careers;
- provide incentives to increase the number of U.S. citizens pursuing graduate study in STEM fields;
- increase the federal investment in U.S. research and development, as a means to support the training of the aforementioned students; and
- provide federal tax credits to encourage employers to make continuing education available (either internally or through colleges and universities) to practicing scientists and engineers.¹¹

¹¹ *Rising Above the Gathering Storm: Energizing and Employing America for a Brighter Economic Future.*

REFERENCED PUBLICATIONS

Engineering and Technology Degrees 2005. Engineering Workforce Commission of the American Association of Engineering Societies.

Engineering in the K-12 Classroom: An Analysis of Current Practices & Guidelines for the Future. November 2004. A production of the American Society for Engineering Education Engineering K12 Center. Written and produced by Josh Douglas, Eric Iversen, and Chitra Kalyandurg.

[www.engineeringk12.org/Engineering in the K-12 Classroom.pdf](http://www.engineeringk12.org/Engineering_in_the_K-12_Classroom.pdf)

Innovate America: National Innovation Initiative Report. Council on Competitiveness. December 2004. www.compete.org

Rising Above the Gathering Storm: Energizing and Employing America for a Brighter Economic Future. National Academies, October 2005.

<http://books.nap.edu/catalog/11463.html>

State Indicators of Math and Science Education 2005, Council of Chief State School Officers, 2005.

The Science and Engineering Workforce: Realizing America's Potential, National Science Board, August 2003.

The Talent Imperative: Meeting America's Challenge in Science and Engineering, ASAP, Building Engineering and Science Talent, www.bestworkforce.org