

Action Required

Grow STEM opportunities through active industry involvement

IN ITS EFFORT to advance ideas, research and practice in science, technology, engineering and mathematics (STEM) education and workforce, ASQ's Education Division co-sponsored the third annual Advancing the STEM Agenda Conference in June.

The conference theme—collaboration with industry—grew out of the success of our 2012 STEM Agenda Conference panel keynote led by Paul D. Plotkowski, dean of the Seymour and Esther Padnos College of Engineering and Computing at Grand Valley State University in Michigan.

While we were pleased with the success of the conference, more ASQ members from industry could have attended and learned about the STEM agenda and how their companies can reach out to schools and universities in their communities through successful collaborations. Our conclusion is that there is insufficient awareness in the ASQ community of the need for industry's involvement in supporting the STEM agenda.

As ASQ members, we must do more than work on getting certified and providing quality products to our customers;

we must actively support our education system from which future employees come, and recognize that we definitely can help improve education through our professional knowledge of continuous improvement and our personal volunteer efforts.

We have a projected serious shortage of STEM professionals, and the ASQ community must get involved with STEM education activities in their communities to ensure we are developing the knowledge and skill sets needed.

STEM shortfall in the U.S.

Here are some STEM education facts:

- If the United States continues with the same STEM graduation rates in our colleges and universities, we should expect a shortage of 1 million STEM graduates in the next 10 years.¹
- Some organizations already are having difficulty recruiting technicians, scientists and engineers, even though we are recovering from the worldwide recession.
- We will need more quality engineers and professionals in the worldwide quality workforce as the quality effort mirrors the increase in the STEM workforce. Quality

the percentage and the number of STEM graduates entering the STEM workforce.² The situation is so critical that industry is asking for more international graduates to be allowed to live in the United States and work. Legislation in the U.S. Congress would increase the official quota of H1-B visas for highly skilled foreign workers from the current 65,000 to 110,000.³

- U.S. high school students ranked 25th in the world in their math knowledge. Other STEM education facts are presented in the ASQ Education Division's *Advancing the STEM Agenda: Quality Improvement Supports STEM*.⁴

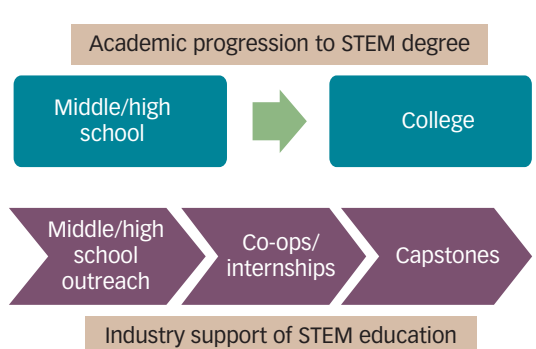
Break down silos

STEM education has many stakeholders. Often in practice, we have looked at K-12, higher education and the transition to STEM careers as separate silos. At this year's conference, Reginald McGregor, manager at Rolls-Royce Corp., led a keynote discussion on the need to bring these silos together, to talk more with one another, and to understand the other sectors' business and customer-focused challenges.

K-12 education has the challenge of students not being college-ready. Higher education has the challenge of low graduation rates. Industry has the challenge of trying to find qualified employees. Because industry is at the end of the STEM pipeline, it has the most to gain through collaboration with education.

Industry's role should be to inspire, mentor and integrate industry quality practices with education. The President's Council of Advisors on Science and Technology "Engage to Excel" report encouraged us to inspire and prepare students for

STEM conversion / FIGURE 1



STEM = science, technology, engineering and mathematics

ity engineering and advanced manufacturing are included in STEM fields.

- Science and engineering are seen as the basis for technical innovation, which improves economic global competitiveness. While the percentage of natural science and engineering degrees has remained the same in the United States during the past 10 years, other countries have developed education policies to increase

STEM careers.⁵ Both are needed throughout the education pipeline. Many teachers and faculty members have innovative programs, but they need industry's support to provide excitement and inspiration, and continuous improvement guidance for an integrated approach to collaboration.

Quality professionals from industry must bring the knowledge of process improvement, lean Six Sigma and Baldrige systems thinking to the STEM conversation on inspiring and preparing students for STEM careers. Figure 1 suggests that industry's role through K-12 outreach, co-ops and internships, and capstone projects is a process of support to develop the next generation of STEM innovators and workers in our communities.

1. Middle school/high school outreach. In inspiring middle school and high school students, we can look at industry's K-12 outreach efforts such as the For Inspiration and Recognition of Science and Technology (FIRST) robotics competition.⁶ We also can look at collaborative efforts of inviting students to a research center, sponsoring a career day or participating in classrooms as Ford Motor Co. or Raytheon Corp. explained in presentations at this year's conference.^{7,8} For example, Raytheon employees involved with the Leadership And Science Ensures Results (LASER) program have touched and inspired 6,500 students in their science classrooms in the past three years. Students will remember these STEM professionals as role models as they consider their college and career paths.

2. Co-op experiences/internships: While in college, students who participate in co-ops or internships see the excitement of engineering projects and how they can make a difference in the engineering world through hands-on experience with a quality engineering project, an engineering design or even NASA space science research.

In providing a co-op/ internship, a company is partnering with a university to mentor a student in the ways of engineer-

ing practice or science research. Research shows that the transition from student to co-op/intern to a STEM career can be viewed as a socialization process.⁹ The experience then becomes a win-win relationship: a rewarding learning experience for the student and a rewarding mentoring experience for the company. Often as graduates, these same students start their STEM careers at the company that provided the co-op/internship.

To reduce the high dropout rate of initial STEM students in college, more summer co-ops/internships could encourage students to stay in a STEM field and help reduce the high cost of college. If your company can provide more co-ops/internships, consider collaborating with a university.

3. Capstone experiences. Many STEM programs have a semester or year-long capstone project to finish a successful student career and to aid in the transition to a quality engineering or science career. These are important semesters that integrate the curriculum with the 21st century workforce skills such as teamwork, critical thinking and communication.¹⁰ Industry-sponsored capstone projects provide a significant quality learning experience to graduates as they transition to the STEM workforce.

Make a difference

The STEM education movement is about inspiring and educating students in science and engineering careers. Research suggests that we need a continuum of activities that first excite students about a STEM career and encourage them through co-ops and internship experiences.

The United States has a severe shortage of STEM professionals. We encourage you to talk with your organizations about their STEM agendas and to reach out to local school systems and universities in the community, to participate in the FIRST competition, to support career days and especially, to provide more internship experiences and co-op sponsorships.

We have STEM majors who cannot find summer jobs in their fields. College tuition is expensive. We have 80,000 ASQ members. Suppose most of us encouraged our organizations to sponsor just one internship per ASQ member. What a difference it would make! **QP**

REFERENCES AND NOTE

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4. Cindy P Veenstra, "Introduction," which appeared in Cindy P. Veenstra, Fernando F. Padró and Julie A. Furst-Bowe, eds., *Advancing the STEM Agenda: Quality Improvement Supports STEM*, ASQ Quality Press, 2012. The book is an ASQ resource to understand the major concern over the statistical facts that are often presented in the press on STEM education. The book is available at <http://asq.org/quality-press/display-item/?item=H1429>, and its first chapter is open access.
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7. Imad H. Makki, "Promoting STEM Education Through the Ford High School Science & Technology Program," Proceedings of the 2013 ASQ Advancing the STEM Agenda Conference, Grand Rapids, MI.
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