Guest Editorial: Reflections on Moving Forward on STEM Education

by Cindy P. Veenstra, ASQ Education Division Chair

The ASQ Education Division held a division conference last summer at the University of Wisconsin Stout that focused on science, technology, engineering and math (STEM) education. The conference networked ideas to help students succeed and transition to STEM careers. We are very thankful to UW-Stout for its partnership and support of this conference. The networking energy was real, and as a result we are sponsoring our second annual Advancing the STEM Agenda Conference at UW-Stout from July 16-17. We invite your participation.

From the 2011 conference, we are publishing a book of selected papers by 36 authors edited by the conference co-chairs, Julie Furst-Bowe, Fernando Padró and myself. The book, *Advancing the STEM Agenda: Quality Improvement Supports STEM*, will be published by ASQ Quality Press in May. Based on this experience, my reflections on STEM education are twofold:

1. Individual faculty members are very committed to ensuring their students become interested in science and technology, even if students have not been prior to their class. Within their classrooms, professors are trying new approaches to help underprepared students. These approaches include problem-based projects, linking to learning communities and linking two or three courses together.

The result is that non-STEM majors are becoming interested in STEM, underprepared students have a greater probability of completing the first year of college and enrolling for the second year of college, and more students in college are continuing their interest in STEM majors.

Current thinking is to consider the STEM pipeline as pathways. Students can leave the pipeline and then come back to a STEM interest. In this context, we are seeing professors helping students reenter the STEM pathways. This is very much needed, especially with the necessity for more scientists and engineers. Personally, I find the case studies in our book to be

very encouraging and supportive of the power of each professor to make a difference in his or her classroom.

2. School systems and universities are reaching out to others to partner with them. These include:

- School systems reaching out to local universities, the community and local industry.
- Universities serving as a center for K-12 outreach efforts.
- Engineering colleges partnering with industry to provide important first-time work experience in internships and co-op experience.
- Engineering colleges designing an engineering curriculum secondary-education teachers can use while at the same time providing accurate information about what engineers do.

In addition, we need to engage industry as a partner in STEM education. In Deborah Hopen's *Workforce Development Brief* editorial, "Closing the Gap on STEM Education," Hopen called for companies to become more engaged with STEM education. "Contact your local high schools and higher education institutions. Seek out ways to integrate your organization's training ground with their classrooms. Hardwire the relationships and programs, building a pipeline of well-developed graduates for the future."

Especially with the current high interest in advanced manufacturing, there is a strong need for partnerships between community colleges, universities and manufacturing companies. One way universities can facilitate more partnerships with industry is to implement advisory boards.

Just as Joseph Juran told us we improve quality one project at a time,[1, 2] we will improve STEM education one school system and one university at a time. Some students can only afford to attend the nearest public university. It is important then, that all universities develop an engaging and collaborative approach for improving their science, technology and engineering programs.

In our STEM Agenda conference this summer, we are following through on these ideas with keynote presentations that include:

- Jeffrey E. Froyd, Texas Engineering Experiment Station (TEES) Research Professor at Texas A&M University will open the conference with his keynote, "STEM Education Classrooms: Promising Practices for Improved Learning."
- Paul D. Plotkowski, dean of the Padnos College of Engineering and Computing at Grand Valley State University will lead a keynote panel discussion on STEM education and industry partnerships
- Julie Furst-Bowe, provost and vice chancellor for academic and student affairs at UW-Stout will discuss systems thinking and STEM activities at the university.

We invite your participation and your thoughts on networking and improving STEM education. Feel free to contact me at chair@asqedu.org.

Note

If you are interested in viewing statistics on STEM education, check out these graphs on global comparisons in STEM higher education and workforce trends published in the new *Science and Engineering Indicators 2012*.[3]

References

1. Joseph M. Juran, *Juran on Leadership for Quality: an Executive Handbook*, Simon and Schuster Inc., 1989.

2. John Dew, "Quality Issues in Higher Education," *Journal for Quality and Participation*, Vol. 32, No.1, April 2009, pp. 4-9

3. National Science Board, *Science and Engineering Indicators 2012*: *National Science Foundation (NSB 12-01), Presentation Slides,* www.nsf.gov/statistics/seind12/.

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In this concluding chapter, the importance of STEAM education in supporting the 21st century skills is again emphasized. We have analyzed three themes that emerged from the chapters included in this book: (1) different perspectives towards STEAM education and the role of Arts, (2) the role of technology in STEAM education, and (3) the pedagogy and curricula development in STEAM education. Based on our literature review and the scholarly work contributed by the authors of this book, we have identified a number of areas that need to be focused on as we move forward with research, development and