American Society for Engineering Education -
Transforming Engineering Education

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Abstract

In this paper, a description of what the American Society for Engineering Education is doing to transform engineering education in the United States and the world is presented. With the many challenging and complex problems the world faces, it is critical that educational institutions are producing talented, innovative engineering graduates to improve the quality of life throughout the world. The paper begins with some background information on the American Society of Engineering Education and continues with a discussion of several activities aimed at transforming engineering education.

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1. The American Society for Engineering Education

Founded in 1893, the American Society for Engineering Education’s (ASEE’s) mission is to further education in engineering and engineering technology. It achieves this mission by promoting excellence in instruction, research, public service, and practice, exercising worldwide leadership, fostering the technological education of society, and providing quality products and services to its members. ASEE develops programs and policies that enhance the professional opportunities for engineering faculty and promotes that increase student enrollments in engineering and engineering technology, and collaborates with national and international organizations to further advance ASEE’s mission. ASEE has over 13,000 members including 10,000 individual members, 400 colleges of engineering and engineering technology, 700 global members, and 100 corporations, professional organizations and government agencies. As an organization, ASEE is composed of over 40 division and 12 geographic regions. Together its membership strives to achieve excellence in engineering and engineering technology education.

ASEE provides a number of services to its members including its award winning publication Prism, the highly ranked peer-reviewed Journal on Engineering Education, a new on-line journal entitled, Advances in Engineering Education, a monthly e newsletter, Engineering, Go For It!, and First Bell. Prism is the most popular, monthly magazine that covers engineering education in the United States. Prism is read by key decision makers within engineering education and reaches engineering faculty members, administrators, and students in all disciplines of engineering. The Journal of Engineering Education is an international journal that serves as an archival record of scholarly research in engineering education. Advances in Engineering Education highlights those significant advances in instruction, pedagogy, technology and assessment that substantially improve learning in the broad sense. It encourages the use, where appropriate, of various multimedia formats in order to present the material in the most informative manner. Engineering, Go For It!, is designed to attract secondary students and their parents and teachers to the wide world of engineering and technology. It does this by opening up new worlds of opportunities for teen-agers to consider as they make the decisions that will determine their future.

The ASEE Annual Conference & Exposition hosts approximately 400 technical sessions spanning all disciplines of engineering education and hundreds of vendors on the exhibit floor. In 2008, Dr. Charles Vest, President of the National Academy of Engineering, gave a visionary keynote address entitled, "Engineering Education for the 21st Century.” In 2009, ASEE will hold its 166th Annual Conference & Exposition in Austin, Texas.

ASEE has a number of ongoing initiatives that are aimed at transforming engineering education to meet the needs of our membership and to transform engineering education to ensure the production of innovative, talented engineering graduates. Some of these initiatives are focused primarily within the United States, but a growing number have an international focus.

2. International Activities

Over the past several years ASEE’s role and leadership in international activities has grown significantly. These activities provide ASEE and its membership the potential for expanding educational opportunities for our students and faculty and enhancing opportunities for collaboration on education and research initiatives. With interconnectedness of the world’s economies and complexity of the grand challenges, it is critical that engineering educators have the opportunity to learn from each other and work together to help make the world a better place.

The International Department at ASEE headquarters facilitates interconnectivity among stakeholders in engineering education across the globe. The department primarily focuses on three areas. The first is the implementation of an annual Global Colloquium in partnership with local universities, academia, students, multi-lateral
agencies, and industry. The global colloquium unites the diverse elements of the international engineering education world while focusing on issues of interest to the international engineering education community. The colloquium is held annually in locations such as Berlin, Beijing, Sydney and Istanbul with the assistance from engineering education organizations from the host country, links engineering educators across international borders and brings together teachers and researchers who would otherwise never have an opportunity to meet and exchange ideas and viewpoints. The next Global Colloquium will be held in Cape Town, South Africa on October 19-23, 2008. The theme of the 2008 Global Colloquium is “Excellence and Growth in Engineering Education in Resource Constrained Environments.” The Global Colloquium will have three tracks: (a) Research, Inferring and Designing Engineering Education Practice from Research and Societal Context: To what extent should engineering education collaborate globally to re-engineer their programs? (b) Practice, Successful Practices in Engineering Education and (c) Quality Assurance, Securing a Vibrant Global Economy – building Capacity through Sustainable Accreditation Policy and Practice in Developing Economies. The Colloquium will also include the third Global Engineering Faculty Leadership Institute conducted by U.S. and Indian faculty experts. Workshops were held annually in locations such as Berlin, Beijing, Sydney and Istanbul with the assistance from engineering education institutions worldwide and has quickly become an important focus of the Federation. The Global Engineering Deans Council, under the umbrella of IFEES, will provide a forum for the entire IFEES membership to interact, share best practices and challenges, learn from one another, strengthen their ties, and plan the following year’s activities. The third area of focus strives to move U.S. engineering education into a globally-oriented, culturally sensitive position, and strategic position. One initiative in this area is the Indo/U.S. Collaborative for Engineering Education (IUCEE). Given India’s strategic importance to academia and the U.S. economy, ASEE’s international department has partnered with Dr. Krishna Vedula, Dean Emeritus at University of Massachusetts, Lowell, and colleagues throughout India and the U.S. to encourage collaborative engineering education discussions between the two nations. The leaders of the initiative have raised resources from industry and foundations to support this effort. To best identify avenues for engineering education collaboration between the two nations, IUCEE put on an ASEE-supported two part Action Planning Session in the spring/summer of 2007. The first Action Planning Session, hosted by Infosys in Mysore, India, took place in June 2007, and the second Session was held at the National Academy of Sciences in Washington, D.C. from August 29-31, 2007. As a result of these meetings, it was recommended that regional Indo U.S. Engineering Faculty Institutes be created in four thrust areas: Curriculum Development, Pedagogy and Delivery, Research and Development, Quality and Accreditation and Innovation and Entrepreneurship. These regional Indo-U.S. Faculty Institutes would foster collaborative networks and exchanges through course offerings for engineering faculty. The resulting networks are expected to lead to mutual benefits to India and to the U.S., including global experiences for faculty and students, collaborative research, development and entrepreneurship in technologies of global relevance, as well as access for U.S. and Indian universities and companies to more and better prepared engineering graduates. The first Indo U.S. Engineering Faculty Leadership Institute was held in Summer 2008 with a focus on preparing engineering faculty who will lead the creation of these Regional Institutes. Scaling up of the program will be achieved by the “Facilitate the Trainer” approach. Experienced faculty from various regions of India were selected to attend the Indo U.S. Engineering Faculty Leadership Institute conducted by U.S. and Indian faculty experts. Workshops were
offered on engineering education pedagogy and various technical areas in engineering. The World Bank Institute gave a workshop on July 8 and 9 entitled Accountability and Autonomy in Engineering Education: What is Working? The workshops focused on effective methods for teaching the specific subjects and on providing links and access to resources for that purpose. The workshops were designed to ensure the creation of sustainable communities of practice and collaboration among participants. The workshops also included strategies for mentoring of the selected faculty at their home institutions. The participating faculty were encouraged and facilitated to be trainers and will be assisted in offering one-week courses to groups of faculty from engineering colleges at workshops in their regions during the following year as part of their Regional Institutes. Assessment of the outcomes from these workshops will guide development of the program.

A second initiative is the Global Student Initiative. ASEE facilitates and supports an emerging network of engineering students from across the globe. These students are deeply involved in the planning of both the Global Colloquia and IFEES meetings. Support for their involvement is expected from the U.S. National Science Foundation, industry, the World Bank Institute and civil society. ASEE will again be hosting a Global Student Forum on Engineering Education during the 2008 Global Colloquium in Cape Town in close partnership with the Student Platform for Engineering Education (SPEED), a student organization dedicated to the perpetuation of student involvement in the global dialogue on engineering education.

3. Engineering Education for the Global Economy

During 2006-2007, ASEE engaged in a Year of Dialogue to address how we can advance engineering and engineering technology education based on the collective wisdom and experience of its more than 13,000 members. The year began with a Socratic dialogue we held during the plenary session set the stage for a year of broad-based discussions within our sections and zones on the role and importance of educational scholarship as a key means for transforming engineering education. These efforts provided the foundation for an NSF-funded project to create a blueprint for transforming engineering education through educational scholarship and to initiate substantive actions to advance the proposed recommendations.

The project, entitled “Engineering Education for the Global Economy,” co-chairs are Dr. Leah Jamieson, Dean of Engineering at Purdue University, and Dr. Jack Lohmann, Vice Provost at Georgia Institute of Technology. This year six working groups will develop draft recommendations and plans for converting these recommendations into actions. Public distribution of the draft report for feedback will begin in early 2009. A final report will be ready for distribution in June 2009. During 2009-2010, the project will focus on the conversion of the recommendations into actions.

The effort will be supported and strongly informed by research in engineering education published in the Journal of Engineering Education and with research and best practices that appear in the on-line journal Advances in Engineering Education. Of critical importance to the long term success and impact of this project will be the initiation of actions that will allow us to produce engineers who will be tomorrow’s leaders.

4. Enhancing the Image of Engineering

With the many challenges we face today, it is not surprising that in the U.S. National Academy of Engineering’s new round of grand challenges there is significant focus on reducing vulnerability to human and natural threats, expanding and enhancing human capability, and creating new innovations in medicine and healthcare. These are all incredibly complex problems and none of them will be solved without talented engineering and engineering technology professionals. At the same time, the economic competitiveness of nations around the world, including the United States, is being challenged by shortages in the engineering and technology workforce. The U.S. Department of Labor projects an 11% increase in engineering and technology employment opportunities during the decade from 2006-2016. In addition, 25% of the U.S. engineering workforce is eligible for retirement in the next five years. To make the situation worse, the graduation rate of qualified individuals in the U.S. is not projected to come close to meeting this demand. Although the exact numbers are under debate, there appears to be a continuing need for more engineering and engineering technology graduates and this need is not restricted to the United States. Demand for engineering and engineering technology talent appears to be worldwide.

So what can be done? ASEE is in a unique position to make a significant difference. It is the one professional organization in the United States that encompasses all disciplines of engineering and engineering technology. It is a leader in engineering education not only here in the U.S., but throughout the world. Unfortunately, young people’s interest in engineering has been declining and the traditional sector (white males) from which engineering colleges in the U.S. has traditionally been successful in attracting into engineering is projected to grow by only 1% by 2015. If we are going to meet the demands for technically educated graduates, we must find ways to expand opportunities especially for women and people of color, those communities in the U.S. that are historically underrepresented in engineering and engineering technology.

ASEE has a number of programmatic efforts aimed at broadening participation in engineering and engineering technology and for improving the public understanding of engineering. Efforts include: the K-12 and Pre-College Division and the K-12 Center, production of Engineering Go For It magazine, a pre-Conference Workshop for K-12 Engineering Education, the Women in Engineering Division, and the Minorities in Engineering Division. K-12 and Pre-College Division – The goals of the K-12 Division are to provide a focus for the development of innovative pre-college engineering curricula and delivery approaches, create a vital community engaged in pre-college engineering initiatives, encourage the professional development of teachers in pre-college engineering education methodologies,
and increase awareness and participation of university faculty and industrial educators/partners in pre-college engineering initiatives. Women in Engineering Division – The goals of the Women in Engineering Division are to increase the participation of women in engineering, address all matters which affect the recruitment and retention of women students in engineering and the re-entry of women into the profession, sponsors sessions, workshops, and distinguished speakers at the annual conference, and address policy issues impacting women in engineering. Minorities in Engineering Division – The goals of the Minorities in Engineering Division are to increase the participation of Black/African, Hispanic/Latino, and Native/Pacific Islander Americans, to encourage the development of programs to improve preparation, recruitment and retention of students at all levels, and to increase the number and the professional development of minority faculty.

5. Conclusions

Engineering education in the United States and many parts of the world is facing many challenges, including the decreasing interest by pre-college students in engineering and engineering technology, the limited number of women and underrepresented minorities attending engineering colleges and universities, the rapidly changing needs of industry, the quality and preparation of pre-college students, and the need for change in engineering education to address the complexity of the world problems. ASEE has a number of ongoing programs to address these issues and welcomes the partnership of other professional societies to address challenges of common interest.

References

2. ASEE Global Colloquium, http://www.asee.org/conferences/international/2008/index.cfm

Biography

Sarah A. Rajala is the 2008-2009 President of the American Society for Engineering Education and the Dean and Professor of the Bagley College of Engineering at Mississippi State University. Previously, she was Professor and held numerous leadership positions at North Carolina State University. During her career she conducted significant research on the analysis and process of images and image sequences with application to the areas of color imaging, image coding/compression, motion estimation, target acquisition and tracking, and engineering education. She has directed 17 master's theses and 16 Ph.D. dissertations and authored or co-authored over 100 papers in these areas and has had contributions published in thirteen books.