

Enabling the U.S. Engineering Workforce to Perform: Recognizing the Importance of Industrial Engagement In Professional Graduate Engineering Education

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Abstract

This is the first paper in the panel session of the National Collaborative Task Force for reform of professionally oriented engineering graduate education to make it more relevant to the needs of industry to ensure a strong U.S. engineering workforce for competitiveness. Because the practice of engineering for technological innovation is changing and because engineering education cannot meet all of the requirements relevant to the needs and skill sets required for career-long growth of engineers in industry, within the standard four-year baccalaureate curriculum, there is a heightened sense of urgency that major educational reform is needed at the graduate level. The demand for a strong U.S. engineering workforce with advanced technical skills, practical engineering experience, and progressive professional skills from entry-level through executive engineering leadership levels of technological innovation in industry is forcing sweeping reform in engineering graduate education. This paper represents the work of the newly established National Collaborative for Engineering Graduate Education Reform, which is taking a key leadership role with industry to enact purposeful reform in engineering education at the graduate professional level in order to continue the career-long growth process of working engineering professionals in industry to spur innovation, unleash creativity, and enhance U.S. competitiveness. The paper addresses the national importance of this reform, including the role of U.S. engineering graduate education in supporting the growth of the nation's engineers who lead the continuous development of technology for the competitive advantage of technology-based U.S. industries in the global economy; the vital role of industry's capacity to sustain world-class technology development and innovation for the nation's economic growth and national security; and the important role that engineers play throughout their professional industrial careers in conceptualizing, designing, developing, innovating, and leading the systematic process of engineering for continual improvements, developments, and breakthrough of new technologies for corporate competitive advantage.

Professional Education for Engineers - The New Challenge

If the U.S. is to remain preeminent in creating new innovative technologies through engineering to enhance its economic prosperity and national defense, the U.S. system of engineering graduate education must remain the world's leader - and new models for professionally oriented graduate education must be created and implemented that better support the lifelong development needs of the graduate engineering workforce in industry.

America's advanced engineering talent in industry has become the nation's most underdeveloped resource for innovation and substantial changes need to be made in U.S. engineering graduate education to better meet the graduate needs of this national resource. As the Committee on Science, Engineering, and Public

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Policy (COSEPUP) has pointed out: graduate education in engineering has evolved primarily in the United States as a byproduct of a national science policy for research.¹ The United States does not have a definite coherent policy for the graduate development of the vast majority of its domestic graduate engineering workforce whose professional careers are centered on the generation, development and leadership of new and improve technology in industry.²

Advanced Professional Development Costs

Industry requires a workforce with skills capable of meeting dynamic requirements. Today's workforce is primarily engaged in creative development and leadership. While our domestic graduate level academic product is primarily taught to perform in a research capacity, industry needs a workforce capable of performing as creative engineers. This disparity is typically resolved during the new employee's induction. Essentially, the academic product is a rough casting which is finished machined by industry. This approach is costly and inefficient for academia, industry, and the individual. Consider that roughly 32,000 domestic graduate degrees were awarded in 2002.³ The expense associated with additional training from industry is significant. An estimate can be realized by considering a conservative industrial cost of \$100/hour for individual training. If only 50% of the 32,000 individuals achieving graduate degrees join the domestic workforce and need the equivalent of an additional year of leadership training and development over the life of their career, we can quickly see costs in excess of 3 billion dollars, year after year [(16,000)(2080 hours)(\$100 / hour)].

It is widely recognized that industry must continue the training and development of its engineering workforce. It is also recognized that the costs are staggering. In addition to the costs associated with training an individual employee, industry must also consider the capital investments required for such efforts. For example, Rolls-Royce Corporation's training facility in Indianapolis is a 6.5 million dollar, 68,000 square-foot capital investment. With 24 state of the art class and meeting rooms and an expansive 6,000 square-foot auditorium capable of seating up to 500 people, the center accommodates practically any meeting or training program available today.⁴ Such investments by industry are intended to provide opportunities to strengthen the skills of its workforce and a serious example of commitment to education.

Training Importance from an Industry Perspective

Industry requires a skilled workforce to be competitive in today's global environment. "Ensuring that all of our employees are fully competent to perform their jobs is key to our success" says Jim Guyette, President and Chief Executive Officer of Rolls-Royce North America, Inc. Guyette points out that we must support the career development of our people to maximize their potential.⁵ For this to thrive, individuals must embrace the challenges and opportunities associated with lifelong learning and partner with industry, education, and government to master needed skills. The sum of knowledge within an industry or profession continues to grow on a daily basis. This dynamic condition is a reality of the pace of our nation and must be reflected in a proactive fashion with our approach to learning.

Meeting the Challenge - Creating a National Collaborative

The Council on Competitiveness has pointed out, "The United States could lose its preeminence in technology unless a new national innovation agenda is developed."⁶

To initiate these necessary broad sweeping changes, the ASEE Corporate Members Council and the Graduate Studies Division have established a National Collaborative, comprised of members from industry, academia and government, to serve as a catalyst for action. Major systemic reform in graduate

engineering education across the nation must begin by establishing new innovative graduate programs in professional engineering practice and leadership of technology development in industry.

This is a bold initiative and an exciting new advancement in partnering professionally oriented graduate engineering education with the practicing profession in American industry that will stimulate technological innovation and regional economic growth across the country. Without continuous technological advancements through creative engineering practice in regional industry across the nation, no amount of achievement in fundamental scientific progress can assure our economic prosperity and national security in the modern world.

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Biography

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