

Preparing (for) the New Engineer

By David Rosowsky, July 2012



Like all professions, engineering has evolved. We have acquired new knowledge, we have better tools at our disposal, and this has enabled more creative and sophisticated solutions to increasingly challenging and complex problems. We've been evolving in this way since the first stone tools were crafted two million years ago.

The rate of knowledge creation (and its digital incarnation, information creation) is increasing exponentially. But the stakes of this evolution also are higher. As we push through technological boundaries, we create materials, mechanisms, systems and policies that challenge our environment – not just our air and water, but our societies, our economies, and our ability to sustain ourselves. We have entered a period in our history where we are permanently depleting natural resources and negatively impacting the ability of our planet to sustain us.

The world's population stands at 7 billion today and is forecasted to reach 10 billion in the next 50 years. Each person will want and expect access to clean water, food, energy, and the Internet. The phenomenon of the “shrinking world” coupled with the gap between access and expectation punctuates our collective responsibility to help lift up people and nations in the developing world, and help close the gap. To do otherwise is simply irresponsible, unethical, and creates further tensions.

This responsibility places us, as academics and citizens of the world, on a collision course with what the National Academy of Engineering (NAE) has termed the Grand Challenges – the most pressing challenges we face as a nation, a people, and a planet. These are highly complex problems requiring synergistic thinking and creative, economic, robust, and sustainable solutions (soon). Engineers will not solve these problems alone. They will be members of teams of professionals who will be needed to find solutions to the Grand Challenges. In many cases engineers will *lead* these teams.

Consider the implications of this for colleges and universities seeking to prepare the next generation of engineers. We are responsible for educating engineers who must:

- Effectively communicate their ideas and their solutions to various stakeholders
- Engage professionals from disparate fields
- Understand how large projects are planned and financed
- Be globally minded and culturally sensitive
- Understand the social and cultural impacts of their technological solutions
- Be versed in non-engineering, but highly technical topics such as risk analysis and risk communication, life-cycle analysis, and systems science
- Think integratively and synergistically
- Be both creative and entrepreneurial
- Maintain the highest standards of professional ethics

Of course, they must also be well-educated and highly trained in their field of engineering. Increasingly, new fields of engineering do not fall neatly along traditional disciplinary boundaries. Instead, they emerge and flourish in the interstitial space between the traditional disciplines and often cut across multiple fields. This is where many of the most interesting new engineering disciplines are

found today, such as biomedical engineering, transportation systems engineering, nanotechnology, advanced materials, and energy systems.

And yet civil engineering, mechanical engineering, electrical engineering, and other traditional academic programs are here to stay. These are the foundations of any engineering school. Our students gravitate toward them when choosing a university, ABET accredits these department-based programs, and employers generally seek graduates who have earned their degrees from traditional departments.

Yes, the *challenges* have changed – becoming grander, more complex, and requiring engineers with a broader skill set and a more expansive view of their roles. But the *students* choosing to study engineering are also changing. They are savvier, more mature, and in many cases more worldly.

When I went to college, engineering was very much a field chosen by many first-generation college students, many students from working class families, students who were “smart in math” and who saw engineering as a promise of a good job and steady employment – all good reasons. And these reasons hold true for many today. But we are also seeing a different type of student today. They want to change the world for the better. They think about social justice. They are opportunistic and entrepreneurial. And they recognize that an engineering degree will open doors to careers in business, law, medicine, scientific research, and public service.

Today’s students also think differently. They process differently, they triage tasks differently, they interact differently, and they communicate differently—the result of the world they grew up in. Our ways were not better than theirs. And I have never found the argument “they just don’t learn like we did” compelling. In fact, they don’t. And that is *our* challenge as educators, not *their* shortcoming as learners.

I am very proud to serve as the Dean of one of the top engineering schools in the country – the nation’s oldest technological university with a long and proud tradition of preparing engineering leaders throughout the last two centuries. But I also have responsibility for maintaining world-class engineering programs in a time of global economic stress, and ensuring our curricula and facilities are modern, relevant, forward-looking, and inspiring. The entire School of Engineering is invested in this endeavor, which requires creative thinking and new partnerships with industry, other universities and research organizations, state and federal agencies, and our alumni.

The call to address the NAE’s Grand Challenges should inspire students, motivate engineers and scientists, and guide the School of Engineering as we define our research priorities, revise our curricula, and seek these new partnerships and collaborations.

Our students are neither customers nor clients – they are stakeholders. They are the technological architects of our collective future (*their* future). They are the scientific explorers, tinkerers, designers, creators, and (if we are really lucky) the problem solvers and the leaders of tomorrow.

And tomorrow is here. Right now. Today. Not only do we need to meet President Obama’s call for adding 10,000 more engineering graduates each year, we need the smartest students in the country to *choose* to study engineering, to be regarded and compensated as professionals, and to create new technologies, industries, jobs, and ensure a secure future.

This is *our* Grand Challenge.

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David Rosowsky is the Dean of Engineering at Rensselaer Polytechnic Institute located in Troy, NY.