Does Engineering Have To Be Boring?

By C.L. Max Nikias

Educators, government and media are growing more concerned about the erosion of the long-standing U.S. edge in science and engineering. Undergraduate university engineering education, in particular, is in trouble, threatening our nation's wealth and prosperity.

In 1985, more than 76,000 engineering degrees were awarded in the U.S. Since then, the number of graduating engineers in America has declined by 20%. China, Japan, India, Russia and Europe now graduate substantially more engineers than we do. China and India produce almost 320,000 engineers annually. This year, U.S. universities will graduate less than 60,000.

Losing Product

Many observers propose relaxing visa restrictions so that more foreign students can enter the U.S. and stay here after completing advanced degrees. There is merit to this argument.

I believe we should immediately give a green card to any foreign national who earns an advanced engineering degree at an American university. This would amount to only a fraction of the 140,000 green cards issued annually. But there is another way to address the engineering skills shortage, one that is frequently overlooked.

In 2001, 120,000 eager students entered American engineering schools. This year, at the other end of the four-year engineering education pipeline, fewer than 50% are still in it and will receive engineering degrees. This is a national disgrace. We would immediately fix any
other system that lost half the product it was supposed to deliver. It's in our power to fix this one.

The competition for available slots in engineering schools has never been more intense. At my university, and at most other schools, the average SAT scores of new engineering freshmen are the highest on campus. But almost as soon as they arrive, these students begin migrating to other majors, especially business.

Why is this? There is no doubt that engineering is a demanding curriculum, but the students are more than bright enough to handle it. The answer lies in the engineering schools' educational approach.

We have forgotten why these students wanted to become engineers in the first place. Engineering is enormously creative. If science is all about understanding nature, then engineering is about applying that understanding to create new technologies that profoundly affect our lives. What could be more exciting?

But the traditional approach to engineering education--a heavy dose of rigorous math and science during freshman and sophomore years--does not engage students' vision of an engineering career. Freshmen students are suddenly confronted with classes that seem to have little relevance to the discipline. Mathematics faculty members, rather than those in engineering, usually teach math classes.

Broader Skills

We demand so much of engineering students that they often don't have time for so-called "frivolous" non-engineering courses or to pursue minors in different subjects. Yet these courses give them the skills that industry leaders tell me new engineers often lack.

At the University of Southern California, we have been revamping the curriculum, paying particular attention to the freshman and sophomore years. Here, it's the engineering faculty who now often teach mathematics, giving the subject more relevance. We also are increasing opportunities for students to take non-engineering courses to round out their education.

We also are bringing in more guest lecturers from industry--successful engineers to remind our students how exciting the discipline really is. And we're not watering down the curriculum. It's actually the opposite. For example, we've developed an engineering biology course as one of the core science courses.

Technology Immersion

At upper undergraduate and graduate levels, we are increasingly immersing our students in the process that ultimately determines engineering success--research and commercialization of new technologies. This is a logical extension of the push toward technology transfer by the National Science Foundation and other funding agencies. Technology transfer has become a major enterprise at practically all research universities, but it is an integral part of the overall learning experience at only a few.

In addition to persuading talented foreign students to stay in America, a successful effort on the part of all universities to keep our brightest undergraduates in engineering is the most effective way to solve the skills shortage that threatens our economy and security.

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