Engineering Education Must Get Real

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Private industry lives and sometimes dies by a demanding credo that honors results and constantly tests people and ideas against a public that can vote with its economic might. Academia, on the other hand, insulated by a steady, if sometimes unpredictable, flow of cash from government programs and endowment funds, has learned to be slower and more methodical. This can certainly produce reflective, careful thinking and sometimes deep analysis—results that are rare in the private sector and usually regarded as a luxury good. But far too often, the output is not what it should be. It really does seem that academics are altogether too happy to inhabit those fabled Ivory Towers. These habits of mind are further hardened by an inward-looking system of promotion and management that places academic achievement—study and research—on a plane above actual accomplishment in the non-academic world. Thus, too often what passes for innovation and forward thinking in an academic program turns out to be merely a trimming of the sails to catch the breeze of a new fashion or nostrum, rather than an act of real commitment and innovation. This is a particularly pernicious problem with regard to fields of study that are often accurately and sometimes disparagingly referred to as "practical."

My own profession, engineering—a field that should always be rooted in pragmatism even as it reaches to stretch the limits of what is possible—is a case in point. Recently, at one of the region's engineering colleges, I encountered an example of academic fashion that simply missed the boat. The president of the school told me with pride of the college's new, multidisciplinary teaching methods, and then confessed that half or more of his graduates would probably end up in other careers, such as marketing—implying that the changes in the classroom had little to do with creating better engineers.

Today, academics spend a great deal of time—and money—fretting over the state of "STEM" education. STEM—a clever acronym for science, technology, engineering and mathematics—attempts, wrongly in my view, to tightly associate educational enterprises that should be distinctly delineated. To be sure, STEM aims to promote study in areas that share similarities and are sometimes interdependent. However, the fact that engineering—a critically important profession—is thereby lumped with three very broad subject areas is troubling and indeed symptomatic of all that is wrong with engineering education today.

In fact, the history of engineering education since World War II is, by and large, a chronicle of retreat—with experienced, hard-nosed practitioners, who used to comprise a significant element of the engineering faculty, gradually banished from sight. Moreover, a growing emphasis on science and research rather than on, say, a hands-on familiarity with machine tools or the ability to rapidly and intuitively compute, with reasonable accuracy, the impedance of an electronic circuit (without the help of a machine), has in most engineering programs led to the production of cadres of young engineers whose skills are fatally limited.

In addition to failing to adequately teach solid engineering skills, there has been an even more precipitous retreat from the inculcation of values such as determination, resourcefulness and integrity that are essential to economically successful engineering. In fact, values are almost as crucial to a successful engineer as specific technical training. For instance, it takes deep wellsprings of determination and tenacity to pursue a project

through to the end, to build with careful conservatism when that's needed, and to risk thinking far out of the box when something new is required. Sadly, were one to write a very brief history of engineering education since World War II, it could be boiled down, with some notable exceptions, to the old saw about *those who can, do, and those who can't, teach.*

This is not intended to impugn anyone's good intention. The point is that in fields such as engineering, there is absolutely no substitute for the hard-edged technical and business skills that are required to bring products and projects to market. It is an unforgiving and demanding environment and, for students to succeed as engineers, they must acquire skills that go far beyond theories, simulations and exam-taking. Those best able to prepare students are those who have labored, survived and succeeded in competitive endeavors not those who have only studied and studied and studied.

Through a vague recognition that something needed to be done—or perhaps spurred by the private sector, which employs most engineers—periodic efforts have been launched at various institutions to reinvigorate and reinvent engineering education. (I have been involved with some of these, including establishing the Gordon Institute and funding the Gordon Prize for Innovation in Engineering and Technology Education.) Yet, for most in academia, the fundamental perspective has remained unchanged. Academics hire other academics, and the educational experience offered to students, instead of being a hard-edged boot camp, remains little more than a gussied-up science fair. Even when projects are assigned to students in an effort to mimic the real world, failure is often regarded as having nearly equal value to success from a didactic perspective. This is a dangerous lesson. In the real world, engineers can't fail. Lives depend upon them. To drive home this point the education of civil engineers in Canada is capped by the solemn presentation, to those deemed worthy, of a ring made in part from steel recovered from the Quebec Bridge, which collapsed in 1907, claiming dozens of lives. The message is clear: welcome to the world of engineering but don't ever forget that the lives of others depend on your judgment and correctness. Failure is not an option.

Here in the 21st century, with all the issues of global competitiveness and pressing technological challenges, it is high time for American engineering academics to recognize these issues and truly embrace change. Perhaps professors should take a sabbatical and spend it in the cutthroat world of Silicon Valley or Detroit. Or better yet, colleges should hire some star engineers fresh from a competitive, save-the-company, 24/7 product development effort. Students need to understand viscerally that all professions—but particularly those proudly called "practical"—demand real results from their practitioners. Only when we can convey that message successfully will our graduates be equipped with the drive, energy and purpose to successfully apply knowledge in today's real world.

And when academia learns to enlarge its own conception of mission to include that values message, it will have earned itself a new position of power and respect in our society.

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