As New England develops a STEM agenda, public broadcasting should be an active partner in helping to spark a passion for the field among what is inarguably our region’s most valuable resource: the boys—and girls—who will make up the STEM workforce of tomorrow.

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Colby-Sawyer is among New England colleges where the liberal arts curriculum has traditionally required only one course in math, and no academic major or minor in math is offered. Recently the New London, N.H., school received a three-year $149,290 grant from the National Science Foundation to incorporate teaching of basic math and reasoning skills across its liberal arts curriculum. One of 100 programs funded under the NSF’s Course, Curriculum and Laboratory Improvement program, the Colby-Sawyer initiative’s goal is to ensure that students can routinely use basic math concepts and skills considered critical in an information-centered global society. For more, visit: http://www.colby-sawyer.edu/news/nsf.html

Engineering Education Must Get Real

BERNARD M. GORDON

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 any-
one’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 per-
spective 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 pre-
sentation, to those deemed worthy, of
a ring made in part from steel recovered
from the Quebec Bridge, which col-
lapsed 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 correct-
ness. 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 mes-
sage 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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