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VIEWPOINT
By Greg Blonder

Scientists Are Born, Not Made

Correcting the shortage of U.S. engineers means rethinking the way schools teach science, not just increasing funding for classes and teachers

Take a simple, one-word test. Say this word aloud: UNIONIZED. O.K. Test over. How did you pronounce the word? Was it a synonym for organized labor, or were you describing a neutrally charged atom?

Your answer says a lot about you. Select the first pronunciation, and you're likely part of the vast majority of people not pursuing a career in science. Select the latter, you may be among the scientific minority, someone who always felt impelled to discover those few simple laws responsible for our complex and fascinating natural world. My little test is also an illustration, admittedly unscientific, of a fundamental error underpinning our national debate over the impending shortage of U.S. scientists and engineers.

Numerous blue ribbon commissions, such as the one put together by the **National Academies**, lament this growing shortfall. Their core recommendation is to vastly increase funding for teaching junior and senior high school math, biology, chemistry, and physics. Essentially, this conventional approach maintains our standard science curricula, but advocates smaller classes and more and better-trained teachers.

VICIOUS CYCLE. Unfortunately, conventional wisdom also incorporates a hidden assumption: that if more kids are exposed to better quality courses, more kids will end up choosing science or engineering as a career. It's a peculiar version of demand-side economics (that "guns can be converted to butter," if the price is right) and one that's palpably false.

Actually we live in a supply-constrained world, where the pool of real scientists and engineers is relatively small and most people, no matter how bright, aren't destined for careers in science and engineering. Worse yet, these few naturally-inclined technologists are being discouraged from following their dream and so switch to other fields, while most other students are bored out of their minds in conventional courses, transferring their academic discouragement to a bias against science as irrelevant to their lives.

As a technologist growing up in a family of engineers, and one who has taught science to students from second grade through graduate school, I know this from personal experience. All children are naturally inquisitive, but only some are driven to discover scientific facts and to passionately pursue technology as a career.

EARLY CHOICES. It was fascinating to watch a class of 20 second graders, boys and girls with eyes aglow, constructing batteries from pennies and nickels and salt water. But only a small group stayed after class peppering me with questions.

By fifth grade, the scientists, engineers, poets, basketball players, and beauty queens had all sorted themselves out, some by natural inclination, and some by peer pressure. And it's the same few kids from second grade who stayed after class, that now, as adults, are out in the world building our technology future.

If we recognize that technologists are born and not made, then the solution becomes radically different. We must "hunt and gather" the few natural technologists, rather than try to "sow and reap" a new crop from seed. Such a reorientation in our thinking means a more liberal immigration policy to attract the best and brightest to our shores, and a political and moral environment which embraces, rather than discourages, other cultures and religions.

TURNING THE TABLES. It also means we have to root out those aspects of poverty and (often unconscious) discrimination that repel naturally inclined minorities and women from staying with science. And we must separate moral and public policy issues from scientific fact. (Nothing is more discouraging to a scientist than spending a career discovering an important truth about nature, only to have a 25-year-old political appointee twist those facts to further a partisan agenda.)

But most important, it means we must fundamentally change the way we teach science. Change starts with the recognition that, while all of us need to be scientifically literate both for our own welfare and the nation's technological progress, we can't all be scientists. That requires teaching scientific literacy generally, while reserving the tools of the trade for those pursuing scientific careers—the exact opposite of the approach academics now take.

I love chemistry as much as the next guy, but asking general students to solve redox equations represents the same pedagogical fallacy as teaching set theory did for "the new math" or diagramming sentences does for the teaching of English. Leave the advanced topics for people who are going to use them later in their careers. We're prone to confusing the teaching of a subject with the teaching of a skill.

TECHNOLOGICAL LITERACY. So stop teaching chemistry, physics, or biology classes as separate subjects where memorizing nomenclature is the first order of business. Instead, invest a year of classes in experimenting with the world—making batteries, growing algae, for example. Then spend another year learning how to build scientific intuition through estimation, asking such questions as how long the air will last for a person in a sealed room or whether there's enough solar energy for mankind's needs.

Then devote another year to "case studies," comparing, say, risks to costs of building a bridge with ever-decreasing safety margins. Students could even learn how to distinguish between a successful scientific law (such as Darwinism), a failed scientific hypothesis (such as astrology), and a pseudo-scientific fairy tale (such as Intelligent Design).

Such an approach would not only engage most students but create a technologically literate population. Imagine the progress our country could make with citizens undistracted by the impractical or irrational—no longer wasting society's time and money denying AIDS is caused by a virus, or pretending a "50-year storm" will never happen. It's about squandering less, and achieving more. It's the foundation for a society that's more empathetic to—and more willing to fund—scientific research.

NEW PARADIGM. Those students destined to become technologists could either stay on the general track until college or segue to courses with more rigor and specialization in high school. With science beginning in first grade, and now as mainstream as basketball or business school, fewer "born scientists" would drop out due to peer pressure driving them toward other more socially acceptable pursuits.

With courses separated into the general and the professional, fewer expert teachers and labs would be needed, freeing funds for the nascent technologists. Yet we would all share a common language and appreciation for the vast promise, and limits, of technology. Such a reorientation of scientific education would constitute a major step toward increasing our supply of homegrown scientists. And you would no longer have to try to COAX someone to be what they're not.

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