A Size That Fits All for the Science-and-Technology Pipeline

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The strength and size of the nation's science-and-engineering work force are the subject of much concern, following the Obama administration's education initiatives; international testing that shows students in Shanghai at the top of the world; and, last year, an update of the influential report "Rising Above the Gathering Storm." That report finds the deterioration of America's competitiveness so severe that it is likened to a Category 5 hurricane. It calls for the United States to create a "New Sputnik" education initiative and expand our science-and-engineering work force. It reinforces a common worry over American students' lackluster international standing compared with those in several Asian nations and in a handful of small European nations.

We believe that those concerns are overstating and misidentifying America's challenges in science and engineering, and that they are missing the real opportunities for improving the nation's education and work force. As we examined the evidence, several points became clear: The United States needs to improve education broadly rather than expand particular fields of study; look inward rather than abroad for exemplary educational models, in light of the limits of international comparisons; and focus on the core lessons about improving the lowest-performing group of students.

There is actually no compelling evidence that, over all, the educational pipeline is failing to meet demand.

Our recent analysis of Department of Education data for three decades followed students from high school to the job market. We found little in the way of overall change in students' pursuit of science-and-engineering studies or their entry into those careers over the past 30 years. We found that while a steady proportion of college students graduated in science and engineering, no more than half of them landed jobs in a formally defined core science or engineering occupation.

So, given a steady supply, why do companies report difficulty in finding ideal workers? Listen carefully and it sounds as if the employers would like entry-level workers to have skills not typical of newly graduated students. Leading engineering companies seek technologists with a depth of skill in a technical area combined with a broad education across technical fields, business, and the social sciences. Colleges find it difficult to develop all of that in only four years. So the hiring difficulty may reflect problems with pedagogy, the structure of higher education, the unwillingness of some employers to train new workers, and a lack of collaboration between academe and industry. It does not, however, indicate a loss of student interest or a shrinking pool of science-and-engineering graduates.

Nevertheless, some policy makers and industry leaders believe that to meet the demands of our knowledge economy, more such education is needed. They even think it is preferable to other fields of study. While acknowledging the value of science-and-engineering knowledge, we find that it is but one of many forms of valuable knowledge. Moreover, the

science-and-engineering managers we interviewed expressed dissatisfaction with the "soft" communication, or teamwork, skills of their new engineers. And changes in hiring patterns suggest that the nation's economic future depends on developing a balanced portfolio of well-educated workers across the spectrum of skills, knowledge, and disciplines.

Finally, some industry lobbying groups and high-tech companies seek to augment the supply of domestic workers by importing foreign labor on temporary visas. But this confuses the purpose of those programs with the country's immigration policy for citizens-in-waiting. Immigration policy is driven by a long-term vision and a wide range of social and political objectives. The original intent of temporary-visa programs, on the other hand, was to meet short-term, not structural, labor shortages. Ensuring that labor markets are not distorted by short-term visas, which in their current form lead to a number of labor-market and social problems, is not anti-immigrant, and does not undermine the strength of U.S. science and engineering. In fact, raising the numbers of temporary visas for foreign workers during cyclical talent shortages can distort labor markets and discourage domestic students from careers in engineering and the sciences.

While we do not maintain that our study, or any one study, is definitive, we do believe that influential groups should consider new evidence in their quest to advance science, technology, and economic growth. When we look at the past three decades, the data support a far more favorable set of conclusions on student performance and supply than those promulgated by critics of the so-called STEM (science, technology, engineering, and math) pipeline. At the same time, our research supports the widely recognized fact that women and minorities are the most likely future source of STEM

workers, and, discouragingly, that where the education system is most clearly failing is precisely for those populations. Of course, focusing on the big picture leaves out clear-cut examples of unfilled shortages of workers in esoteric but crucial occupations.

The classic tried and true formulation is that supply follows demand or, less sanguinely, that depressed wages and discouraged workers result if supply outstrips demand. To avoid those problems, a number of demand-side policies should receive support from all quarters. These policies include stable and increasing government financing for research, reinvigoration of lagging private-sector investments in research, tax breaks and other incentives for research-and-development activities, and the creation of an environment that encourages entrepreneurship. In terms of education, however, the evidence clearly points to improving basic education for low-performing students, schools, and populations—not an attempt to artificially inflate the number of science-and-engineering degrees awarded.

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