What Is STEM Education?

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THE UNITED STATES NEEDS A BROADER, MORE COORDINATED STRATEGY FOR PRECOLLEGE EDUCATION in science, technology, engineering, and mathematics (STEM). That strategy should include all the STEM disciplines and address the need for greater diversity in the STEM professions, for a workforce with deep technical and personal skills, and for a STEM-literate citizenry prepared to address the grand challenges of the 21st century. There have been repeated efforts to produce major improvements in such education, including the production of voluntary national education standards for science and for mathematics in the 1990s. But as a battle-scarred veteran of those efforts, I view the next decade as the time when real progress might finally be made.

The term "STEM education" is now widely used, but what does it mean and how might it influence American education?

For most, it means only science and mathematics, even though the products of technology and engineering have so greatly influenced everyday life. A true STEM education should increase students' understanding of how things work and improve their use of technologies. STEM education should also introduce more engineering during precollege education. Engineering is directly involved in problem solving and innovation, two themes with high priorities on every nation's agenda. Given its economic importance to society, students should learn about engineering and develop some of the skills and abilities associated with the design process. The good news is that the National Assessment Governing Board has recognized the importance of this issue and recently approved the evaluation of technology and engineering education through examinations that will be given to U.S. students in 2014. Likewise, the draft Framework for Science Education released last month by the U.S. National Academies includes technology and engineering among four targeted disciplines.

To succeed in this new round of education reforms, the United States will need equal treatment for science—broadly defined to include technology and engineering—in the reauthorization of the Elementary and Secondary Education Act (currently referred to as No Child Left Behind). For the past 8 years, this legislation has had the unintentional result of reducing or eliminating science from school programs, especially at the elementary level, by not including science test scores as a significant part of the calculation for measuring Adequate Yearly Progress. The current blueprint of the U.S. Department of Education for the reauthorization fails to remedy this situation; the final legislation could and should.

As stressed in the National Academies report *Rising Above the Gathering Storm*, students must acquire such skills as adaptability, complex communication, social skills, nonroutine problem solving, self-management, and systems thinking to compete in the modern economy. To the degree that STEM curricula incorporate group activities, laboratory investigations, and projects, they afford the opportunity for students to develop these essential 21st-century skills and prepare them to become citizens who are better able to make decisions about personal health, energy efficiency, environmental quality, resource use, and national security. Indeed, the competencies that citizens need to understand and address such issues, from the personal to global perspectives, are as clearly linked to knowledge in the STEM disciplines as they are to economics, politics, and cultural values.

The STEM community responded vigorously to produce the Sputnik-spurred education reforms of the 1960s. Likewise, the United States needs a bold new federal strategy for improving education that includes the creation of high-quality, integrated instruction and materials, as well as the placement of problems associated with grand challenges of society at the center of study. It is time to move beyond slogans and make STEM literacy a reality for all students.

– Rodger W. Bybee

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