Great Teachers for STEM

MANY COUNTRIES ARE STRIVING TO DEVELOP THE HUMAN RESOURCES REQUIRED TO ADVANCE science and technology. Success requires a system of education that prepares young people for life in today’s complex societies. The Obama administration has recently stressed the need to strengthen science, technology, engineering, and mathematics (STEM) education in the United States. U.S. Secretary of Education Arne Duncan clearly understands that the quality of STEM teaching is of singular importance to the success of students, requiring “great teachers, who know the content.”* Herein lies a major challenge: How to develop and cultivate great STEM teachers?

U.S. schools currently fail to teach STEM effectively. Evidence includes the low standing of U.S. students in international comparisons; for example, in the 2006 Program for International Student Assessment (PISA, conducted by the Organization for Economic Cooperation and Development), American 15-year-olds ranked 24th out of 57 countries in science and 32nd in mathematics. Other distressing indicators are that only 40% of Americans accept the fact of biological evolution, and less than half of American adults can provide a minimal definition of DNA.† Thanks to the First Amendment to the U.S. Constitution, creationism and intelligent design may not be taught in U.S. public schools. But evolution is not generally taught adequately, even when included in school curricula.

Some scientists, nationwide, have for decades provided professional development in content and pedagogy to teachers of math and science, from early through secondary (precollege) education. But test data and experience indicate that, with some remarkable exceptions, even intensive professional development is a failed experiment that cannot make up for the poor quality of the teachers’ own STEM educations. Many elementary school teachers studied no science or math beyond high school and may remember only that they disliked the subjects. Secondary school STEM teachers who were educated decades ago are unlikely to be familiar with modern scientific knowledge. Most troubling, many secondary school classes are taught by teachers with no STEM qualifications at all. The U.S. scientific community has largely ignored the problem of ill-prepared STEM teachers, except perhaps when troubled about their own children’s school experience. Now this community must energetically engage this challenge by spearheading several initiatives.

Excellent undergraduate students who are not dedicated to research should be encouraged by their science faculty to become STEM teachers. Graduate students in a research field generally receive tuition grants and stipends; those who pursue advanced degrees and certification for STEM teaching should be offered fellowships as well. The U.S. National Science Foundation’s new Teaching Fellowships program should be expanded so that it can more widely provide funds to support tuition, stipends, and academic programs for those with undergraduate degrees in STEM subjects who commit to teaching in high-need school districts. This program can attract people with STEM skills who are now jobless into teaching careers.

The science community needs to participate directly in improving teacher education programs. Scientists should work to help develop STEM teacher education programs that are rigorous and relevant for teaching students who have grown up in the Internet era. Successful models, such as UTeach at the University of Texas, Austin, are already being replicated at 13 other universities across the United States through the National Math and Science Initiative (www.nationalmathandscience.org). But this type of program should be expanded with federal funds, as recommended in the landmark Rising Above the Gathering Storm report of 2005 from the U.S. National Academies.

Last but not least, STEM professionals must engage actively with precollege-level STEM teachers in a sustained way. In his memoirs, physicist and Nobel Peace Prize recipient Andrei Sakharov describes his father, a high-school physics teacher, as a physicist. STEM teachers must similarly be considered vital members of the professional scientific community.

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