

Teaching science beyond the facts

With debates on climate change, evolution and stem cells constantly in the newspapers, never has the ability of the layperson to assess scientific issues been so important. But how well is the general public equipped to do just that? This depends on whether they received a solid science education, and thus it is not surprising that the quality of science and math teaching are once again the subject of intense scrutiny.

The most recent Trends in International Math and Science Study (2003) compared the science ability of 4th and 8th grade students in 45 participating countries, using questions that tested grasp of basic scientific concepts. This revealed that US 4th graders ranked behind Singapore, Taiwan and Japan, with US 8th graders lagging behind Taiwan, Hong Kong, Japan, Korea, Singapore, Estonia and Hungary. Furthermore, US students ranked 19th in the last Program for International Student Assessment survey (2003), which tested the scientific ability of 15-year-olds in 41 countries. Given the current leading role of the US in scientific research, this lag in science education in schools is worrying. Everyone agrees that something has to be done to improve science and math teaching in schools. The question is what.

Ever since his State of the Union address in 2004, the US President has made it clear in speeches that his administration intends to improve science and math education. As part of this strategy, he intends to create the 'Adjunct Teacher Corps,' an army of science and math professionals who will march, with their subject knowledge, into classrooms. This would involve the very people who rely on the recruitment of well-trained students into undergraduate and graduate programs in helping to improve science education. This seems like an interesting idea, but is it feasible?

In fact, this idea has already been tested on a small scale, as innovative teachers and universities have realized that bringing scientists into classrooms can bring cutting-edge science into schools. One example is Tommie Hata's high school biology class at The Pingry School in New Jersey. Scientists from local universities come to Hata's classroom to lead lab activities such as protein crystallization. The basic concepts of protein structure are then used to drive discussions of medically relevant issues. For example antibiotic resistance is approached through structural comparisons of resistant polymerases, something undreamed of in many high school classrooms. Hata has even taken students on field trips to the hallowed halls of the Protein Data Bank.

This constant reinforcement of deeper concepts teaches beyond the facts that are required to pass tests, and it has been made possible thanks to university departments getting involved, through grants and volunteerism, with local high school teaching.¹ Such exposure to scientists and their research is a sound basis for developing scientific

inquiry in students, an attribute useful for assessing issues beyond topics in structural and molecular biology.

Examining such a program suggests that the Adjunct Teacher Corps is a worthy goal, yet the idea has already been met with resistance. The National Education Association (NEA) is opposed to the program. They point out that recruited science professionals may lack teaching skills and pedagogical training. This ignores the idea that professional scientists can coteach classes with high school teachers. Indeed, the NEA's opposition seems more concerned with turf protection, without acknowledging that professional scientists bring subject enthusiasm and up-to-the-minute expertise to the table. The NEA is also worried about the administration of the program, the details of which are currently unclear, though this problem is not insurmountable.

The bigger threat to the program may come from the government itself. Recent developments seem to undercut establishment of any plan, showing dithering as well as dilution of the program goals. In fiscal year (FY) 2004, the recently established Math and Science Partnership (MSP) program at the US National Science Foundation (NSF) received \$139 million to fund programs that included those that brought scientists into classrooms. In FY 2005, the NSF received no funds for new MSP projects. This cut will remove funding from an agency that is well placed to rigorously peer-review proposed local programs. For FY 2007, \$25 million is now promised to the Education Department specifically for the Adjunct Teacher Corps. Such a 'passing of the buck' around federal departments can only delay widespread implementation of any program at all. Furthermore, the Education Department has announced that the Adjunct Teacher Corps will also recruit foreign-language professionals. This aims to increase international US competitiveness, but dilutes promised resources for science education when the international language of science and technology is, for better or worse, English. Finally, the goals set are far removed from the magnitude of the problem, with the Adjunct Teacher Corps envisioned to comprise 30,000 scientists, mathematicians and, now, foreign-language experts by 2015. Such a long-term commitment is lofty. However, this goal is too far off, and although 30,000 may seem like a large number, it pales in the face of the number of schools and students that need help. This worthwhile program must be refocused and allotted the required resources if we are not to fail entire generations of high school graduates. Students must be given the best possible science and math teachers, as well as the opportunity to connect with real science firsthand.

1. Hata, for example, has been aided by the Science Outreach program at Rockefeller University as well as the Center for Biomolecular modeling at the Milwaukee School of Engineering, which runs SMART Team, a program that brings scientists, schoolteachers and students together on molecular modeling projects.