Building a 21st Century Workforce

Summary

If an unfriendly foreign power had attempted to impose on America the mediocre educational performance that exists today, we might well have viewed it as an act of war. As it stands, we have allowed this to happen to ourselves. We have even squandered the gains in student achievement made in the wake of the Sputnik challenge. Moreover, we have dismantled essential support systems that helped make those gains possible. We have, in effect, been committing an act of unthinking, unilateral educational disarmament.

¾ *A Nation at Risk, 1983*

It is more than unfortunate that these alarming words of 20 years ago still hold true. Our Nation is failing to produce both a scientifically literate citizenry and the kind of workforce we will need in the 21st Century. Consider the following: Test scores from the Third International Mathematics and Science Study (TIMSS) placed the U.S. participants near the bottom of the 16 countries that administered the physics and advanced mathematics tests; engineering majors in the U.S. declined by 35% between 1975 and 1998; and in 1999, while U.S. colleges granted over 125,000 social science undergraduate degrees, it granted a mere 19,000 in the physical sciences. Echoing "A Nation at Risk," the U.S. Commission on National Security in the 21st Century reported, "inadequacies of our systems of research and education pose a greater threat to U.S. national security over the next quarter century than any potential conventional war that we might imagine."

The standard of living we enjoy and the security of our Nation rests in no small degree on the quality of science and technology education we provide our Nation's students from elementary through graduate school. Everyone is aware that student performance on achievement tests is very troubling. What's more, both the TIMSS and the National Assessment of Educational Progress indicate that as our students move from primary through secondary schools, their academic performance steadily *declines* in comparison to most developed nations.

There are many reasons for America's failure in science education, but as the National Commission on Science and Mathematics teaching pointed out, teacher preparation stands out as both a major contributing factor and something for which all scientific institutions can play a role in solving. Teachers who have strong content knowledge and experience in teaching science and math produce students who perform better on standardized tests and take more science and math courses. Their students are also more excited about science and technology in general. Consequently, most efforts to improve science, math, and technology education place the teacher as the central factor in the formula for a solution.

The view of higher post-secondary education presents a different but no less challenging landscape. Over the last 20 years, there has been a sharp decline in U.S. students choosing majors in engineering and physical sciences. While our students are showing less inclination toward these careers, other nations' students are taking increasing advantage of our country's premier educational and training institutions. From 1986-1999, 120,000 foreign students made up about 45% of the U.S. doctoral degree recipients in science and engineering with China the leading

country at 24,000 recipients. The prospects of this trend on the playing field of global competition are not encouraging.

The National Laboratories: A Resource for Mentoring Teachers and Students

Our country has thrived because of the diversity in its people, and the presence of foreign students should not be seen as a threat but a message. The message is not found in the presence of foreign students but the absence of Americans. We are failing to attract our own homegrown talent into science and engineering careers. In response, colleges and universities have begun to revitalize science, engineering, and teacher undergraduate education through comprehensive, interdisciplinary approaches. These efforts increasingly include research or internship experiences.

The U.S. has a history of successfully marshalling its powerful resources to solve our most challenging problems. The scientists and engineers at our national laboratories represent just such a unique resource and operate on the principal that complex problems are best solved by the power of many minds working as one. These highly trained scientists and engineers learned their craft under the closely mentored supervision of the teams of scientists that came before them. This mentor-intensive approach is one of the most distinguishing characteristics of advanced science education at a national laboratory. To fail to use this enormous national asset in scientific and technical talent as mentors for our teachers would be to neglect an extraordinarily promising path to boosting teacher classroom performance.

Our national labs have, for many years, accepted K-12 school teachers and college students in fellowship and internship research positions. They have welcomed these participants into a scientifically and technically advanced environment, where multidisciplinary teams are the rule and where many of the world's best minds work cooperatively. Our scientists sincerely feel that the presence of teachers and college students has been professionally and personally rewarding, has contributed positively to their research, and has enriched the scientific culture at the laboratories.

A common lament of science teachers is that professional development programs seldom had any lasting impact since they did not establish long-term interactions between scientists or their institutions and the teachers they served. Our goal is to direct the well-developed mentoring capacity of our national labs at establishing a lasting collaborative relationship with the Nation’s teachers to increase their scientific skills, technical awareness, and content knowledge. When this approach was used in the early 1990’s, our national labs created a cadre of some of the Nation’s most outstanding teachers.

The multidisciplinary, team-centered, scientific culture of the national laboratories is an ideal setting for teachers to make the connections between the science and technology principles they are asked to teach. More importantly, the extensive mentoring power of our laboratory scientists is an excellent vehicle to establish lasting relationships that would allow teachers to remain connected to the scientific community once they return to the classroom. Armed with this knowledge and experience, each teacher could enter the classroom as an effective representative of the exciting world of science and technology.

For further information on this subject contact:
Dr. Peter Faletra
Office of the Director
Office of Science
202-586-6549
peter.faletra@science.doe.gov