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# Science Learning, Science Opportunity

**Rita R. Colwell and Eamon M. Kelly**

It is the paradox of our time. In an economy driven by knowledge, the United States leads the world in innovation and discovery but lags in K-12 science and mathematics. The strain of this dichotomy is already becoming apparent to businesses dependent on an educated workforce, policy-makers weighing complex technical issues, and parents concerned about their children's opportunities. The scope of the task before us was shown by the National Science Board's (NSB's) recent summary of the data from the Third International Mathematics and Science Study: "U.S. students are not taught what they need to know." This summer's Kansas State Board of Education decision to omit testing on biological evolution in public schools is but one example of additional serious challenges for U.S. science education.

The National Science Foundation's (NSF's) initiatives in systemic reform have shown that improvements in science and mathematics learning can be achieved on a large scale. NSF's fiscal year 1999 budget included just over $100 million for systemic reform programs. Over the past 8 years, students in some of America's largest urban school districts were given the benefit of high-quality teaching materials, best teaching practices, and uniformly high expectations. Their scores on standardized assessments went up, enrollments in advanced courses increased, and disparities in attainment declined. In Chicago, student performance in mathematics increased in 61 out of 62 high schools. In Dallas, the number of students passing science and mathematics Advanced Placement tests tripled.

**"Expanded emphasis on the science of learning..."**

The March 1999 NSB report on mathematics and science achievement offers a road map for building on these accomplishments. NSB identified four key areas for action: (i) increased research on learning, leading to more effective educational practices; (ii) coordinated K-12 and college-level academic requirements to create a seamless education system; (iii) better teacher preparation and professional development; and (iv) improved instructional materials.

In each of these areas, active contributions by the scientific community are essential for success. Until the learning process is better understood, it will be difficult for teachers, parents, and the public to make informed choices about the curricula, technologies, and practices that could make K-12 education more effective for all students. Until our universities and colleges engage in effective equal partnerships with K-12 schools, they will inherit and perpetuate the shortcomings of the systems that feed into them. Until our future K-12 teachers receive first-rate instruction in all of their undergraduate science courses, their knowledge of the sciences will be second-rate. Finally, until our instructional materials incorporate up-to-date content, scientific reasoning, and pedagogically sound design, they will continue to serve our students poorly at best.

NSF is committed to advancing each of these goals and is making opportunities available to scientists and engineers in all disciplines. Expanded emphasis on the science of learning will build on recent advances in neuroscience, psychology, computing, and numerous other fields, stimulating fundamental research driven by educational needs and connected to educational practice. Fellowships and awards are supporting faculty, postdoctoral scholars, and graduate students who are pursuing educational interests alongside their research interests from the earliest stages of their careers. Graduate K-12 teaching fellowships and K-12 teacher preparation programs are strengthening relationships among K-12 schools, colleges of education, and university science faculties. Top-rated teaching materials, developed with NSF support, are already having an impact in K-12 schools across the country.

However, excellence in education ultimately requires commitment from every part of the scientific community itself. We have to recognize that our educational roles are no less important than our other responsibilities as scientists and citizens. The world of future opportunities and economic leadership will depend on broadly educated people who can understand complex problems and learn new things. Scientists who contribute to education today have the power to open those doors for everyone.

R. R. Colwell is director of NSF and was recently appointed to the National Commission on Mathematics and Science Teaching for the 21st Century. E. M. Kelly is chairman of NSB and president emeritus of Tulane University.