

Science Leaders Cite a "Changed World" in Call for Bold Efforts to Improve K-12 Science and Mathematics Education

Advisors worry students will not be prepared to help U.S. keep its competitive edge

National Science Foundation

February 23, 2006

Citing a "changed world" in the global picture for science and technology (S&T), the National Science Board today publicly released its biennial report to the President, Congress and the nation, *Science and Engineering (S&E) Indicators 2006*. ([Full text](#), [excerpts](#).) In doing so, members of the board appearing in a Capitol Hill briefing said that the growing international competition in S&T, previously expressed in terms of "potential," has now become "reality." ([Fact sheet](#).) Against this backdrop, the panelists expressed concern that today's K-12 students in science and mathematics are not improving their learning relative to international peers, boding a potential loss for the United States of its global prominence in discovery and innovation.

"It's a complicated picture, with a lot of positives. But it's in the next decade that we have some real issues to confront, especially in our education system, if we are to maintain our world leadership in discovery, innovation and national security," said Steven C. Beering, Ph.D., who heads the Science Board's Subcommittee on Science and Engineering Indicators. "We also cannot neglect the importance of these education issues if our country is to maintain a strong, literate work force for the production of goods and services."

Addressing a gathering of the media, congressional staff and other interested individuals at the Longworth House Office Building, Beering said that while the new *S&E Indicators* concludes that the United States still maintains its very strong global position in research and innovation, he was also concerned over the nation's future ability to keep up with the global enterprise because of continued inconsistency in the performance of U.S. students in K-12 science and mathematics.

Board members, 24 in all, consisting of some of the nation's preeminent scientists, engineers and educators, were especially vocal in their policy report, *America's Pressing Challenge – Building a Stronger Foundation* ([full text](#), [fact sheet](#)), released simultaneously with *S&E Indicators*. This second report, also directed to the President and Congress, was aimed, too, at the general public.

Jo Anne Vasquez, the board's lead author of the new education policy report, took issue with a recent parental survey, reported nationally, that expressed overwhelmingly parents' views that their children already receive enough science and math instruction in their schools.

"Our nation's pre-college students still continue to slip further behind in science achievement, and are just near average in mathematics compared to international peers. And our very best 15-year-olds are near the bottom internationally on a test of practical applications of science and mathematical skills," Vasquez said. Vasquez was referring to the Program for International Student Assessment (PISA), in which U.S. advanced students scored near the bottom among more average students of other nations taking the same test.

In recent years, mathematics scores have been rising slowly for U.S. students on national assessments, but they have not been doing the same in science. And internationally, U.S. students in both science and math still perform near the middle of the pack among industrial nations on the Trends in Mathematics and Science Study (TIMSS).

Board chairman Warren W. Washington, a leading meteorologist who was not at the Capitol Hill briefing, stated in a cover letter to the *America's Pressing Challenge* document that "the intractability of this widely recognized (U.S.) system failure is alarming," and that "we must recognize the existing crisis and take necessary action."

The recommendations of the board's report were numerous, but a few directed emphasis to specific areas, such as encouraging higher education leaders to strengthen K-8 teacher education programs to reach the youngest students with enhanced content knowledge to keep students' interest. Board members also said that equal time, in K-8 classrooms especially, should be devoted to science, math and reading during the school day.

On teachers, Vasquez said that as of 2002, almost one fourth of science teachers and a fifth of mathematics teachers lacked full certification in their teaching field. Teacher education programs lack rigor. Low pay and job dissatisfaction are driving teachers from their profession. And there seems to be little momentum toward change that will attract future science teaching professionals.

The board recommends that resources be used to properly compensate teachers comparably to similarly trained science and engineering professionals in other sectors. Teachers also need to have many more opportunities for summertime experiences working with scientists on inquiry-based projects that will help teachers transfer practical knowledge of the scientific process to their students, it said.

The board also felt that public support for science and mathematics needs a boost, by reaching "gatekeepers" involved in science and math education, among them school administrators and guidance counselors. At the administrator level, it's subject emphasis and content that's at stake. At the counselor level, it's influence over choosing careers or collegiate studies.

"We also have to raise parents' awareness of the importance of science education because their children, 10 years from now, will be asked to take on jobs in an economy that will likely look much different from today's, with much more competition globally, and an increased need for a science-literate workforce," Vasquez said.

On the topic of new international capabilities seen around the world, Beerling stated that the rising influence of some Asian nations outside Japan, especially China, by virtue of their growing S&T investments and focus on innovation, have changed the competitive international landscape. While heightening the U.S. need to meet its educational challenges, it also can be a positive step, he indicated, toward increased opportunities for international collaboration and cooperation in science and engineering research that will bring future innovations benefiting peoples around the world.

Much of the new data on Asia was described cautiously in the *Indicators'* overview chapter. It said that much of the new data may not be strictly comparable in a statistical sense, and that some metrics and models may be open for wider interpretation. Yet, board members expressed no doubt that the rise in the competitive positions of China, South Korea and other Asian countries has been significant in the science and technology arena, in some cases growing at a faster pace than anticipated.

In other findings of *S&E Indicators*, U.S. national research and development declined in 2002 for the first time in 50 years, but rebounded in 2003. The 2002 slowdown had some impact on unemployment among scientists and engineers, which reached 4.6 percent in 2003, but economic recovery brought that number back down significantly in 2004.

Indicators 2006 also reports that the number of science and engineering degrees awarded at all levels is rising, especially bachelor's and master's degrees. Graduate enrollments also are on an upward course across all major U.S. demographic groups, and this occurred despite lowering enrollment numbers of foreign-born students.

The National Science Board is an independent 24-member body of advisors to the President and Congress on matters of national science and engineering policy. *S&E Indicators* is updated every two years so that the NSB can advise the President on the current status of the nation's science and engineering enterprise. The board is also the policy making and oversight body for the National Science Foundation (NSF), the independent federal agency that supports almost all areas of fundamental research conducted nationwide.