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U.S. could fall behind in global 'brain race'; Initiatives aim to boost science, math education

by: Dan Vergano

A chorus of scientists, politicians and business leaders has long sounded this lament: The USA is about to be deposed as the world's leader in science and technology.

And last week President Bush joined the choir, calling in his State of the Union address for a $136 billion boost in science education and research over the next 10 years. "We cannot afford to be complacent. In a dynamic world economy, we are seeing new competitors, like China and India," he said.

Such concerns are driving the biggest push to improve U.S. science competitiveness since 1957, when the Soviet Union started the space race with the launch of a basketball-size satellite called Sputnik.

While the 20th century had the arms race, the competition in this century will be a brains race, says science policy analyst Michael Lubell of the American Physical Society. "Today's Sputnik? It's a little bigger. It's called China," he says. "The projected growth in high-technology products from there is staggering."

The stakes are high. The USA now leads the world in spending on research and development -- estimated to reach $328.9 billion this year -- from both government and private sources. Innovation driven by such spending creates as much as 85% of the growth in economic productivity, according to a National Academy of Sciences report, "Rising Above the Gathering Storm."

And productivity growth determines who is the leader and who is a follower in the global economy. A 1% shortfall in British productivity from 1880 to 1990 transformed "the once proud empire into a second-rate economy in little more than a lifetime," in the words of economics writer Sylvia Nasar.

The gathering storm

The National Academies report, an effort chaired by former Lockheed Martin chief Norman Augustine and requested by Sens. Lamar Alexander, R-Tenn., and Jeff Bingaman, D-N.M., triggered congressional hearings and White House meetings after its October release.

"Although the United States continues to possess the world's strongest science and engineering enterprise, its position is jeopardized both by evolving weakness at home and

by growing strength abroad," states the report, noting:

*One U.S. chemist's or engineer's salary is enough to hire five Chinese chemists or 11 Indian engineers. Last year, China graduated 500,000 engineers; India, 200,000; and North America, 70,000.

*The U.S. trade balance in high-technology goods fell from $33 billion in the black in 1990 to $24 billion in the red in 2004.

*U.S. funding of "research in most physical sciences, mathematics, and engineering has declined or remained flat -- in real purchasing power -- for several decades."

* Leadership in high-energy physics, a U.S. franchise since the Manhattan Project built the atomic bomb, is shifting overseas. Beginning in 2007, the most powerful particle accelerator on Earth will be outside the USA for the first time in decades. The atom smasher is now under construction at Europe's CERN lab in Switzerland. Similarly, U.S. scientists complain that fusion reactor tests and underground physics labs needed to stay ahead in the most cutting-edge areas are all overseas.

Altogether, it adds up to disheartening prospects for the nation, says Augustine. His panel made 20 recommendations, including research funding increases, math and science education measures and tax-credit changes.

But many involved say the biggest change needed is a cultural one, making science and technology attractive to today's students.

"Frankly, we've lost our focus," Bingaman said at an interview last week with USA TODAY, which included Alexander and Sens. Pete Domenici, R-N.M., and Barbara Mikulski, D-Md. The four are key movers behind science-competitiveness legislation, the PACE Act, now garnering a great deal of support in the Senate. Backed by 60 senators one week after its unveiling, the act's three bills largely contain the NAS recommendations.

"My own view is that kids here, like kids everywhere, get excited by what they are exposed to," Bingaman says. "We have to expose them to exciting areas of math and science." The NAS report notes that "many adults with whom students come in contact seemingly take pride in 'never understanding' or 'never liking math.'"

"European and Asian students definitely get it," says Argonne (Ill.) National Laboratory head Robert Rosner. "I've yet to run into one in Germany who thinks science is intrinsically bad or awful."

Education gaps

In contrast, a Raytheon Corporation survey of 1,000 11-to-13-year-olds released last month found that 84% said they would "rather clean their room, eat their vegetables, go

to the dentist or take out the garbage than learn math or science."

Perhaps that explains why U.S. 12th-graders recently tested below the international average for 21 countries in mathematics and science. About one-third of the fourth-graders and one-fifth of the eighth-graders cannot perform "basic mathematical computations," according to the National Center for Education Statistics.

Many kids are taught by teachers lacking a background in science or math, Augustine says. For example, among eighth-graders in a 1999 survey, 59% had math teachers who didn't specialize in the subject. The international average was 29%.

Bush's "American Competitiveness Initiative," announced in his State of the Union speech, would train 70,000 high school teachers to lead advanced math and science courses. Another effort would encourage up to 30,000 math and science professionals to become high school teachers. Similar initiatives are proposed in the PACE Act.

Meanwhile, nations with growing economies, such as Ireland, South Korea, India and China, are bulwarking their education systems as well. In 2001, China required all students starting third grade to learn English so they can work for multinational corporations as adults.

Foreign scientists staying home is another worrisome change. The years before World War II brought geniuses such as Albert Einstein and Enrico Fermi to U.S. shores, and since then science prowess here has often rested on foreign talent.

Today in physics, engineering, mathematics and computer science, more than half of U.S. Ph.D. degrees are awarded to non-U.S. citizens, says the National Science Foundation. But restrictions on visas for foreign scientists and security concerns in the post-9/11 era are motivating more students to stay home or go elsewhere, says Lubell.

In 2004, an Iranian-born graduate student, Shahram Rahatlou, then 29, was one of the most promising young physicists in the USA. He won the American Physical Society's Tanaka Award, given to the most exceptional particle physics student that year.

Now he is at the University of Rome. "I would love to go back and work in the U.S.," he says, but because of security concerns about his Iranian nationality, the Energy Department in 2004 banned him from its basic research labs, which house the particle accelerators he needs for his research.

Noting that his research has no military ties, Rahatlou says he never received an official explanation for the ban. Neither did the federal Stanford Linear Accelerator Lab, where he worked, says lab spokesman Neil Calder. An agency spokesperson, Mike Waldron, declined to comment. "People like him we can't afford to lose," says physicist Vivek Sharma of the University of California, San Diego, Rahatlou's thesis adviser.

Aside from such extreme cases, visa worries still concern university administrators. The

NAS report called for an automatic one-year visa extension to foreign students who receive doctorates in science and technology fields to give them time to look for work here.

"The key point is that the best people have choices about what to do in life," either here or overseas, says Argonne Laboratory's Rosner, himself a German immigrant. "It is only in the interest of the U.S. to attract the best and the brightest."

Opposing views

The drive to beef up U.S. science prowess is not without its critics. Most say the U.S. lead in science is a high hurdle for other nations to overcome. Of the world's 50 leading research institutions, 38 are in the USA, states a 2004 report from Shanghai's Jiao Tong University Institute of Higher Education.

And there is no shortage of scientists and engineers, says demographer Michael Teitelbaum of the Alfred P. Sloan Foundation in New York. An over-supply of science students might simply drive wages down to overseas levels, he says.

Not every science graduate will necessarily get a great job, Alexander says, even if the U.S. boosts math and science education. "But the point is that brainpower demand can now be supplied by other countries in the world."

U.S. students may now like playing video games more than designing them, Augustine says. "But that is going to have to change."