

Education And Dominance

Not since Sputnik have so many U.S. leaders pushed for paying more attention to science, but is the competitiveness crisis real?



1.2 million Asian students graduated with science and engineering degrees in 2000, three times as many as in the United States.

The side walls of the Commerce Department's auditorium in downtown Washington are, oddly enough, decorated with faux stone bricks, fake windows, and pretend balconies. The impression conveyed is of a residential city street, but more in the vague style of a downtown-themed strip mall than of a real urban block. ■ Otherwise, the room looks like an auditorium, and one afternoon in early December, its stage was ringed with plastic chairs for the smattering of reporters attending a press conference. Before them stood a lectern, and behind that hung a massive blue backdrop with "INVESTING in U.S. INNOVATION" printed in large white letters across its top. On the rest of the backdrop, "Innovation = Competitiveness" was repeated 14 times in much smaller type, like a subliminal message.

Two rows of university presidents, corporate leaders, and trade association bosses entered from stage left, lined up, straightened their blazers, and smiled into the bright lights glaring down on them. From stage right, several lawmakers entered and joined the group, which by that point resembled a choir ready to break into song—or at least be preached to. If the gathering seemed rather put-on—and it did—that was probably because the all-day meeting of the captains of America at the National Summit on Competitiveness had a preordained message grounded in a pair of foregone conclusions: America's economy faces a grave threat

ing more of their national treasuries into research and development as we're spending less. To reverse our backsliding and to maintain our competitiveness in the global economy, the new mantra says, the U.S. must improve its math and science education, must graduate more engineers, and must spend more federal dollars on research.

"We've got the crisis on our hands right now," House Science Committee Chairman Sherwood Boehlert, R-N.Y., said in an interview. "Corporate America is saying we don't have the qualified people we need to fill the jobs that are vacant now and to

The Science Scare

By Brian Friel

from overseas, and the federal government needs to spend billions of dollars to counter that threat.

Participants did not discuss the possibility that those conclusions might be wrong. Instead, the summit of leaders cemented more firmly into conventional wisdom the already strong notion that America's perch atop the global economy is in jeopardy. According to a variety of indicators, numerous reports, many experts, and at least one best-selling book, the United States is losing its competitive edges in science, technology, and innovation—advantages that were critical in the nation's achieving its primacy.

In earlier centuries, America gave to the world the telephone, the lightbulb, the airplane, the automobile, the refrigerator, the television, the personal computer, the Internet, the Global Positioning System, and thousands of other inventions, to the country's great profit. But in the 21st century, China and India have entered the world economic race and are aiming to overtake us in scientific advances and inventions.

Those two Asian giants and other nations are, according to the new conventional wisdom, educating their children in science and math more effectively than we are, graduating a growing number of scientists and engineers as we are graduating fewer, and pour-

ing more of their national treasuries into research and development as we're spending less. If that doesn't qualify as a 'crisis,' then I better look at a new dictionary and get a new definition for the word."

Not since the Soviets jolted America in 1957 by launching the world's first man-made satellite, Sputnik, have so many American leaders pushed for a concerted national effort on science. Politicians from both major parties are on board with Microsoft's Bill Gates and a raft of other CEOs, heads of universities, and chieftains of trade groups. In 2006, this supposed overseas threat will be the rallying cry behind the push to spend billions of additional taxpayer dollars on science-related initiatives—and to promote a variety of federal policy changes in areas as diverse as immigration, tort reform,

and patent regulation. Yet some observers think that the competitiveness crisis might be as artificial as the auditorium setting of the competitiveness summit.

Flat-Out Fearful

Three Republican lawmakers organized the Commerce Department summit: Boehlert; Rep. Vernon Ehlers of Michigan, who is a physicist; and Rep. Frank Wolf, an appropriator whose Northern Virginia district is a technology hotbed. Ehlers says that until recently

“Corporate America is saying we don't have the qualified people we need to fill the jobs that are vacant now.”

—Rep. Sherwood Boehlert

LEFT: REUTERS/CHINA NEWS/PHOTO/LANDOV; RIGHT: LANDOV/PA/MICHAEL REYNOLDS

he was a "lone voice in the wilderness" on what he calls a looming threat. "Someone has to be a leader and the prophet," Ehlers said in an interview. "I saw the problem coming and began talking about it." The three lawmakers talked up the issue throughout 2005 and made certain that federal money was set aside for the December summit.

Meanwhile, Sen. Lamar Alexander, R-Tenn., a former Education secretary, asked the National Academy of Sciences to study the competitiveness issue. In August, the academy convened a large panel of experts who, in just 10 weeks, produced a 500-page report explaining America's weakening innovation infrastructure. Their report, "Rising Above the Gathering Storm," confirmed for Alexander that national leaders believe America's capacity to be on the cutting edge of science and engineering is declining.

Alexander, who was joined by Sen. Jeff Bingaman, D-N.M., and Sen. Pete Domenici, R-N.M., met with President Bush on December 15 to discuss the academy's findings. Those senators, along with Sen. Barbara Mikulski, D-Md., are also pushing a multibillion-dollar legislative package based on the academy's report. The report called on Congress to create scholarships for future math and science teachers—as well as for science, engineering, and math majors generally; to expand Advanced Placement science and math courses; to add billions of dollars to the federal research budget; to provide tax incentives for nongovernmental research and development; and to boost broadband Internet access.

Just before Christmas, another bipartisan group of senators—George Allen, R-Va.; John Ensign, R-Nev.; Joe Lieberman, D-Conn.; Richard Lugar, R-Ind.; and Bill Nelson, D-Fla.—proposed a different multibillion-dollar legislative package intended to ensure that the U.S. doesn't fall hopelessly behind in science. Their legislation is based largely on a report issued in late 2004 by the Council on Competitiveness, a Washington-based think tank started in 1986 by business and university leaders. Ensign said that "a yearlong process" resulted in the package, which calls for scholarships to encourage college students to major in science or engineering, or to become science and math teachers in elementary or high schools. The measure would nearly double the National Science Foundation's research budget and provide tax breaks for innovations in manufacturing and technology.

"We are falling farther and farther behind in a lot of areas," Ensign declared at a news conference.

The near-panic over America's standing in science and technology was driven in large measure by the publication last year of *The World Is Flat: A Brief History of the 21st Century*. Its author, *New York Times* columnist Thomas Friedman, visited innovation centers in India and China and concluded that globalization has leveled the corporate playing field and allowed those countries, as well as Russia and the former Eastern Bloc, to threaten U.S. pre-eminence. Friedman, whose book is mentioned by virtually everyone pushing science initiatives, argued for a greater U.S. focus on science and math education and for more research and development.

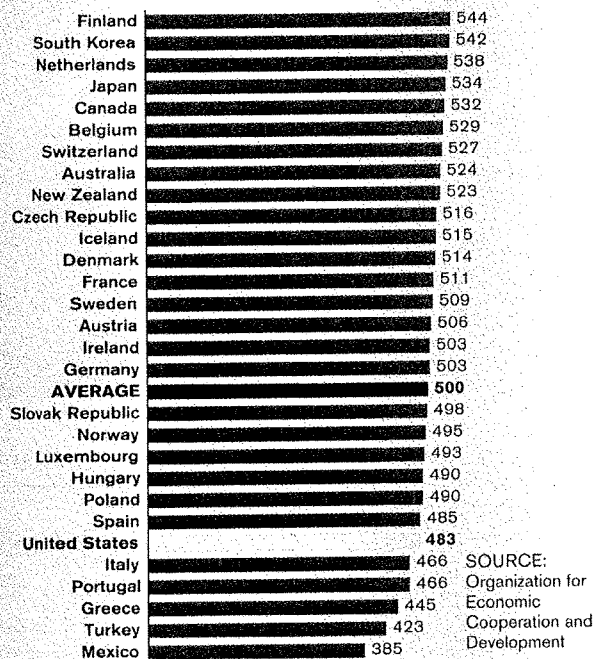
On the morning of the innovation summit, Boehlert, Ehlers, and Wolf had breakfast at the White House with Office of Management and Budget Director Josh Bolten. The lawmakers encouraged him and Cabinet officials they met with later that day to include a science initiative in the 2007 budget that will be released in February and in this year's State of the Union address. Administration officials are not yet showing their cards, but a spokesman for Education Secretary Margaret Spellings said that her department this year will address how to enhance education so that the United States remains competitive worldwide.

Boehlert and the others say that more and more people are taking their concerns seriously and that substantial legislative action is likely fairly soon. Just before the Christmas break, Senate Majority Leader Bill Frist, R-Tenn., managed to include in Congress's budget-cutting measure a provision boosting spending—

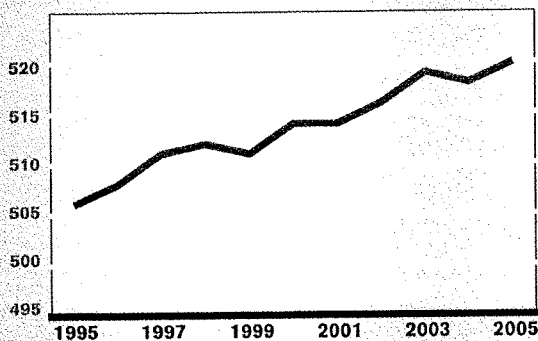
■ By the Numbers

■ Critics of America's education system say that U.S. students compare poorly with students from other countries in math and science. They cite the results of the Program for International Student Assessment's 2003 test measuring math literacy for 15-year-olds in 29 countries (see below). The U.S. ranked 24th. But average scores mask more-positive numbers for college-bound and other strong American students. For example, SAT math scores were higher in 2005 than ever before.

■ Math Literacy Scores, 15-year-olds, 2003



■ Average Math SAT Score



JOE ANDREAS

by \$3.8 billion—for science, math, and language scholarships. And in the name of national security and maintaining American dominance in the global economy, Bush early this month proposed a \$114 million federal boost to foreign-language instruction and scholarship programs.

“We are just doing our level best to spread the gospel,” Boehlert said. “You are beginning to see gathering momentum to address the gathering storm.”

How Much Does Size Matter?

The leaders at December’s innovation summit pointed to numerous indicators as evidence of America’s precarious economic position, but they cited three as key.

First is the federal commitment to research and development. As a percentage of gross domestic product, federal R&D dollars have dropped from nearly 1 percent in 1970 to less than 0.5 percent today. Meanwhile, China increased its R&D funding from 0.6 percent of GDP in 1995 to 1.2 percent in 2002, summit leaders estimated. Other nations have similarly increased their R&D investment, copying the U.S. model of public-private collaboration on innovation research.

Second is American students’ poor performance on international tests of math and science. American high school seniors’ average score is below the international average on general knowledge of math and science. In advanced mathematics, U.S. students rank behind students in 11 of 15 other industrialized nations—and tie with students from the remaining four for last place. Even when measured by U.S. tests, only about a third of American students are performing at grade level in math and science.

The third indicator—and the one most frequently cited—is that American universities are not thought to be graduating enough scientists and engineers. Only 11 percent of bachelor’s degrees in the United States are in the sciences or engineering, compared with 23 percent in the rest of the world and 50 percent in China,



the summit leaders said. A variety of sources estimate that China graduates about 500,000 engineers per year, while India produces 200,000 and the United States turns out a mere 70,000.

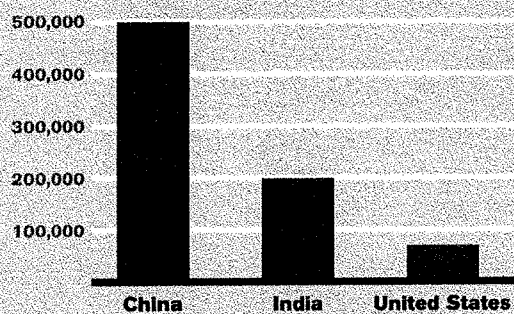
The fact that the number of new U.S. engineers is dwarfed by the number coming out of schools in China and India has underscored U.S. worries about the sheer size of the Asian behemoths. Until recently, America won size competitions: Japan, our closest economic competitor, has less than half the population that we have. The United States long enjoyed a massive scale advantage over the other prime players in the global economy, allowing it to devote more manpower to innovation.

But in the past 15 years, India, China, the countries of the former Soviet Union, and perhaps even Brazil have entered the global economy as true players. India and China have more than 1 billion people each—more than triple the U.S. population. In less than two decades, the number of workers participating in the global economy has zoomed up from 1 billion to 3 billion. And many of those new workers are trained in science and engineering. “We have scale advantages

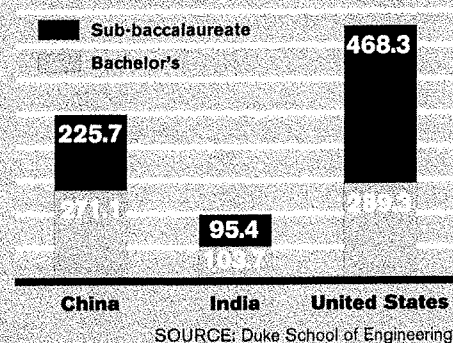
■ Churning Out Engineers

█ Frequently cited are statistics showing that China and India are graduating two to five times more engineers than the United States is, but a Duke University study found those numbers are deflated for the U.S. and inflated for China. When adjusted for population, the Duke researchers’ numbers paint a different picture.

█ Engineering graduates, 2004



█ Engineering degrees per million citizens, 2004



that won't last forever," said Anthony Carnevale, an economist at the National Center on Education and the Economy.

The competitiveness summit's concerns echoed those in the National Academy report, which came out in October and listed troubling indicators, including:

■ **The United States is no longer** a net exporter of high-technology products. That trade balance shifted from \$33 billion in the black in 1990 to \$24 billion in the red in 2004.

■ **Only three of the top 10 recipients** of U.S. patents in 2003 were American companies.

■ **U.S. companies spent more money** on tort litigation in 2003 than on R&D.

■ **Eleven engineers can be hired in India** for the price of one in the United States.

"The truth is, we are in a crisis now, but it is a crisis that is unfolding very slowly and very quietly," Friedman warned in *The World Is Flat*.

As more U.S. politicians become aware of these indicators, more are climbing aboard the innovation bandwagon and pushing for big increases in federal spending on science and math education, scholarships, and research and development. The summit leaders called for a doubling of science and engineering graduates by 2015. At least two would-be Republican presidential candidates, Massachusetts Gov. Mitt Romney and Sen. Allen, have spoken about the issue. And in November, House Minority Leader Nancy Pelosi, D-Calif., announced an "Innovation Agenda" that sounds much like the calls for more science spending made by Friedman, the summit leaders, and the National Academy of Sciences.

"The happy solution to this is education, education, education," Carnevale said, "because no one is going to disagree with you."

The Same Old Song

But some science and engineering experts actually do disagree, in part because they've heard this all before. What's more, the global-competitiveness alarms have a boy-who-cried-wolf ring to them. The nation's institutional leaders have been warning about the economic threat from abroad for decades, although in the past it was the Soviets or the Japanese or the Germans who were considered the big threat. "Look back at 'A Nation at Risk' in

“The truth is, we have plenty of people getting math and science degrees.”

—engineering professor Jim Gover

1983," Carnevale said, referring to a report largely credited with triggering huge changes in American education standards and testing. "What was at risk was global competitiveness. The rationale for education reform has always been economic."

In 1987, the National Science Foundation predicted a U.S. shortage of 700,000 scientists and engineers over the next two decades. That warning prompted Congress to increase scholarship funding and rewrite immigration laws to make it easier for foreign scientists and engineers to work in the United States. But four years later, graduating American engineers found themselves trying to enter a glutted labor market in the midst of a recession in which companies were laying off engineers. Many couldn't get good jobs. "I know people who are still unhappy about that," said Roman Czujko, a statistician at the American Institute of Physics.

Czujko and others who study the nation's scientific and engineering workforce say there was no shortage then and there is no shortage now. "The truth is, we have plenty of people getting math and science degrees," said Jim Gover, an engineering professor at Kettering University in Flint, Mich. "Pushing thousands more engineers out there means that those engineers are going to make a lot less money. It's going to be bad for engineers in the short term," he predicted.

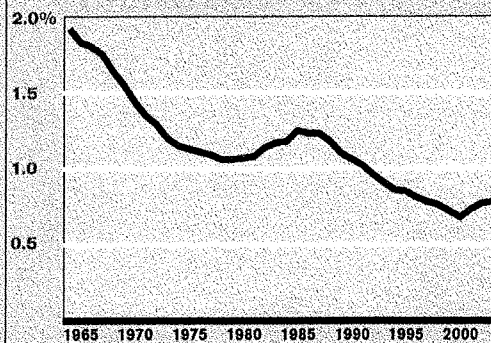
Critics of the solutions being offered by those who see a competitiveness crisis argue that too much emphasis is being put on the supply side of the equation. "In America, it is a demand-driven economy," said Michael Teitelbaum, a demographer at the Sloan Foundation, a New York City-based research foundation. "The notion of doubling everything without a notion of the demand is a strange idea."

Others who refuse to join in the chorus of alarm point to the impressive long-term resilience of the American economy. The nation still has a GDP more than two times larger than that of

■ Research and Development

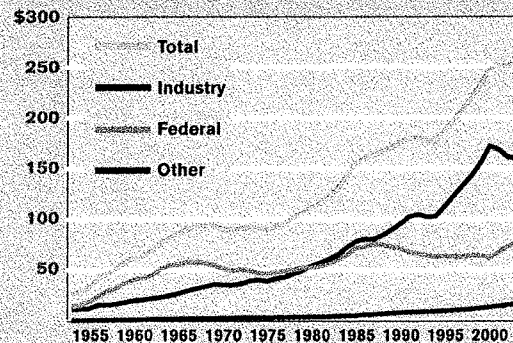
■ As a percentage of GDP, federal funding for research and development has declined over the past four decades, but the National Science Foundation also reports "largely uninterrupted growth" in research and development spending in the United States over the past 50 years, fueled by major increases in private funding. The Bush administration claims a 45 percent increase in federal R&D spending since 2001.

■ **Federal funding for R&D, as percentage of GDP**



SOURCE: American Association for the Advancement of Science

■ **U.S. R&D funding, in billions of dollars**

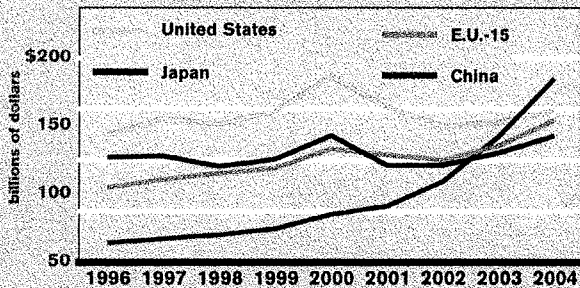


SOURCE: National Science Foundation

Leading the World

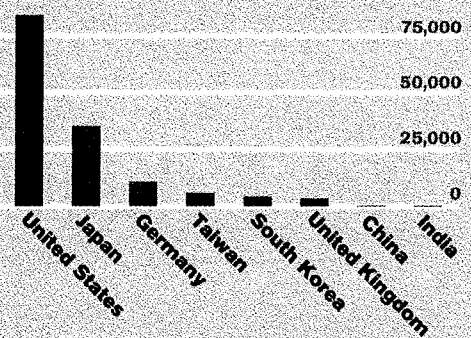
In 2004, China surpassed the United States as the leading exporter of information-technology goods, but the United States continues to dominate in innovation, as measured by the number of patents registered.

Exports of information-technology goods



SOURCE: Organization for Economic Cooperation and Development

Patents granted by country, 2004



SOURCE: U.S. Patent Office

the No. 2 country (Japan); still produces the most patents; still has the highest per capita income of any major nation; and still has a growing economy. The U.S. education system also compares favorably to those of other major countries in some ways: America's per student expenditures are the highest in the world, and its adult population is the most educated. Top American universities are still considered the best in the world.

Carnevale, the economist, said that global competitiveness depends on many things, and education is only one of them. The United States has the world's most flexible economy and workforce. That flexibility allows companies to adapt quickly to changing circumstances. Countries with more-formal and more-stringent education and labor rules find it harder to adjust. The World Economic Forum ranked the United States as having the second-most-competitive economy in the world for 2005, behind only Finland. The forum pointed to America's innovativeness, professionalism, quality of management, competitive business climate, and free flow of capital as reasons for its continued economic dominance.

"The U.S. is second to none in terms of innovation and an innovative environment," said Michael Porter, a Harvard Business School professor who helped with the rankings. "What's remarkable about the U.S. is that it's not just science, but it's also commercialization. The U.S. combines both parts in one location."

Andy Rotherham, co-director of Education Sector, a Washington think tank, said that American politicians must be careful not to overemphasize competitiveness at the expense of other challenges facing the nation's education system—even though there's no harm in improving students' understanding of math and science. The focus, he said, needs to stay on the achievement gaps in this country between rich and poor, black and white—the focus of the 2002 No Child Left Behind Act, Bush's signature first-term domestic program that aims to boost achievement in math, science, and reading for poor and minority students.

"For my money, the bigger problem the country faces—to the extent it's a more immediate problem—is the systemic inequities in educational outcomes. You have to look at the horrific numbers of minorities that fall through the cracks in our education system now. I would argue that's a greater threat to the social contract in the country than the Chinese and the Indians," Rotherham said.

The Intangibles

One difference between now and the late 1980s, when policy changes inadvertently led to a glut of engineers, is that more U.S. leaders are talking about addressing the demand side, not just the supply side. An increase in federal R&D funds would help increase demand. The Council on Competitiveness has offered several proposals aimed at encouraging companies and individuals to innovate.

But the council itself is wary of painting a doom-and-gloom portrait of the nation's economic situation. Deborah Wince-Smith, president of the council, said she does not think that the world is flat, nor does she see the competitiveness issue as a zero-sum game. "That's the scarcity model, not the abundance model," she said. In her view, foreign innovations will not only help spur competition and improve the lives of foreigners, but also improve the lives of Americans. She said momentum is building to recognize that the world is getting more competitive, so education systems need to keep up and Washington needs to think about economic policies in the context of a larger global economy.

Even people wary of jumping on the competitiveness bandwagon acknowledge that America does indeed face increased competition from countries whose size erases a traditional U.S. advantage. These countries might eventually improve their business environments to foster more innovation, thus eliminating America's flexibility advantage. And virtually everyone agrees with Sen. Allen's declaration that it will take real work for the United States to remain "the world capital of innovation."

For now, though, the United States seems still to be the world leader in what Wince-Smith calls "knowledge creation and the deployment of that knowledge."

Carnevale said that observers from other countries come to America and say that their own students are better at math and science but don't think as creatively or as independently. Somehow Americans, despite lagging test scores, enter the global workforce unusually skilled at solving problems, juggling tasks, and taking initiative.

"We have to build on our strengths and assets," Wince-Smith said. "We've got such an incredible platform to build from." ■

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