

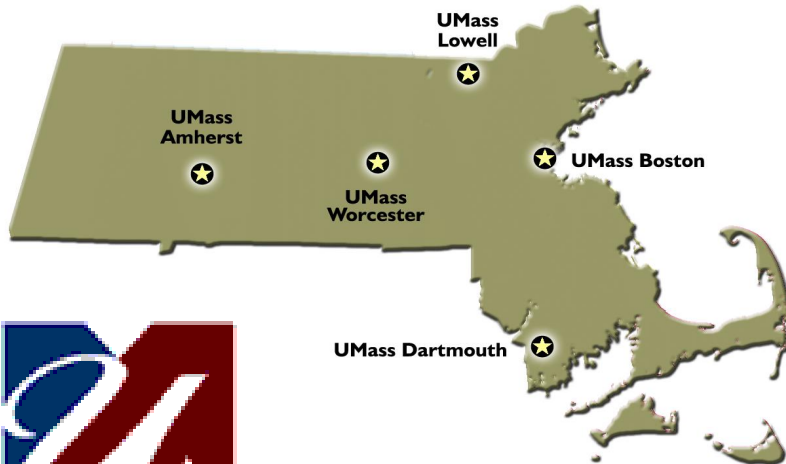


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K-12 Science, Technology, Engineering, and Mathematics Education

A Gathering Storm



By:
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October 18, 2005

Concern is growing

- Just this week I attended:
 - STEM Summit in Sturbridge, Massachusetts; Monday October 17.
 - Government-University-Industry Research Roundtable of the National Academies of Science; Monday October 17.
 - ASTRA-Alliance for Science Technology Research in America; Tuesday October 17.
- All three focused on the need for a better K-12 and Higher Education S&T Policy.
- All include CEO's of leading industries
- Discussions among industry and university leaders had a tinge of panic.

A Few Scary Facts before Halloween

- Last year more than **600,000** engineers graduated from institutions of higher education in China. In India, the figure was **350,000**. In America, it was about **70,000**.
- In 1999 only **41 percent** of U.S. eighth-graders had a math teacher who had majored in mathematics at the undergraduate or graduate level or studied the subject for teacher certification -- international average of **71 percent**.
- U.S. **12th-graders** recently performed below the international average for 21 countries on a test of general knowledge in mathematics and science. In addition, an advanced mathematics assessment was administered to students in 15 other countries who were taking or had taken advanced math courses, and to U.S. students who were taking or had taken pre-calculus, calculus, or Advanced Placement calculus. **Eleven** countries outperformed the United States, and **four** scored similarly. None scored significantly below the United States.
- For the cost of **one chemist or one engineer** in the United States, a company can hire about **five** chemists in China or **11** engineers in India.
- Last year chemical companies **shuttered 70** facilities in the United States and have tagged 40 more for closure. Of 120 chemical plants being built around the world with price tags of \$1 billion or more, **one** is in the United States and **50** are in China.
- In 2001, U.S. industry spent more on tort litigation than on research and development.

The Latest Greatest (Scariest) report:

- **Rising Above The Gathering Storm: Energizing and Employing America for a Brighter Economic Future**
 - Committee on Prospering in the Global Economy of the 21st Century: An Agenda for American Science and Technology, National Academy of Sciences, National Academy of Engineering, Institute of Medicine
- Cochairs:
 - Norman Augustine: Retired CEO of Lockheed Martin
 - Craig Barrett, CEO of Intel

The Gathering Storm- 4 Proposals

- Increase America's talent pool by vastly improving K-12 mathematics and science education.
- Sustain and strengthen the nation's commitment to long-term basic research.
- Develop, recruit, and retain top students, scientists, and engineers from both the United States and abroad. The United States should be considered the most attractive setting in the world to study and conduct research, the report says.
- Ensure that the United States is the premier place in the world for innovation. This can be accomplished by actions such as modernizing the U.S. patent system, realigning tax policies to encourage innovation, and ensuring affordable broadband Internet access, the report says.

Ten Thousand Teachers, Ten Million Minds

- Increase America's talent pool by vastly improving K-12 mathematics and science education.
 - Among the recommended implementation steps is the creation of a merit-based scholarship program to attract 10,000 exceptional students to math and science teaching careers each year. Four-year scholarships, worth up to \$20,000 annually, should be designed to help some of the nation's top students obtain bachelor's degrees in physical or life sciences, engineering, or mathematics -- with concurrent certification as K-12 math and science teachers. After graduation, they would be required to work for at least five years in public schools. Participants who teach in disadvantaged inner-city or rural areas would receive a \$10,000 annual bonus. Each of the 10,000 teachers would serve about 1,000 students over the course of a teaching career, having an impact on 10 million minds, the report says.

Sowing the Seeds

- Sustain and strengthen the nation's commitment to long-term basic research.
 - Policy-makers should increase the national investment in basic research by 10 percent each year over the next seven years. Special attention should be paid to the physical sciences, engineering, mathematics, and information sciences, and to basic research funding for the U.S. Department of Defense, the report says.
 - Policy-makers also should establish within the U.S. Department of Energy an organization called the Advanced Research Project Agency -- Energy (ARPA-E) that reports to the undersecretary for science and sponsors "out-of-the-box" energy research to meet the nation's long-term energy challenges.
 - Authorities should make 200 new research grants annually -- worth \$500,000 each, payable over five years -- to the nation's most outstanding early-career researchers.

Best and Brightest

- Develop, recruit, and retain top students, scientists, and engineers from both the United States and abroad. The United States should be considered the most attractive setting in the world to study and conduct research, the report says.
 - Each year, policy-makers should provide 25,000 new, competitive four-year undergraduate scholarships and 5,000 new graduate fellowships to U.S. citizens enrolled in physical science, life science, engineering, and mathematics programs at U.S. colleges and universities.
 - Policy-makers should provide a one-year automatic visa extension that allows international students to remain in the United States to seek employment if they have received doctorates or the equivalent in science, technology, engineering, mathematics, or other fields of national need from qualified U.S. institutions. If these students then receive job offers from employers that are based in the United States and pass a security screening test, they should automatically get work permits and expedited residence status. If they cannot obtain employment within one year, their visas should expire.

Incentives for Innovation

- Ensure that the United States is the premier place in the world for innovation. This can be accomplished by actions such as modernizing the U.S. patent system, realigning tax policies to encourage innovation, and ensuring affordable broadband Internet access, the report says.
 - Policy-makers should provide tax incentives for innovation that is based in the United States. The Council of Economic Advisers and the Congressional Budget Office should conduct a comprehensive analysis to examine how the United States compares with other nations as a location for innovation and related activities, with the goal of ensuring that the nation is one of the most attractive places in the world for long-term investment in such efforts.
 - The Research and Experimentation Tax Credit is currently for companies that increase their R&D spending above a predetermined level. To encourage private investment in innovation, this credit, which is scheduled to expire in December, should be made permanent. And Congress and the administration should increase the allowable credit from 20 percent to 40 percent of qualifying R&D investments.

What is UMass Doing?

- Launched a \$12.5 million partnership with the Boston Public Schools, funded by the National Science Foundation, to create new opportunities for students in the minority majority Boston Schools.
- Created STEM initiative with UMass Amherst and Lowell. Partners include: Raytheon, EMC, Analog Devices, FLIR, Genzyme, Millipore, Bose, etc.
- Nellie Mae Foundation enables UMass-Boston to work with the Dorchester Education Complex, help inform and prepare students for college, letting them know what courses they need to take and assisting them in making the grade.
- UMassOnline Science Teaching Courses
- Co-chaired the Massachusetts Great Schools Campaign with Blenda Wilson of Nellie Mae. The Governor, Speaker, and Senate President all took part in the launch of the effort.

What next?

- We should create AP Math and Science, particularly, Physics, Calculus, Chemistry, and Engineering courses for delivery into schools that do not have teachers able to offer AP course.
- I did this in New York State in partnership with Lucent, AT&T, and Verizon. Great success.
- Creating many more teacher programs for existing teachers.

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Thank You

