

Why is STEM Education Important? ¹

- We live in an increasingly “Flat World” where data is transferred across oceans almost instantaneously and business takes place around the clock. A more integrated global economy offers both new challenges and opportunities to the United States and its workforce. To succeed, it is essential that the U.S. maintain its position as the world’s leading innovator.
- Looking back over the 20th century, American ingenuity has been truly incredible. From Ford’s Model T in 1908 and on to the washing machine (1911), refrigerator (1924), microwave oven (1953), modem (1958), hand-held calculator (1967) and the personal computer (1981), American innovations have transformed our nation, again and again, creating whole new industries and occupations. Going forward, new innovations will continue to be critical, both in maintaining a solid industrial base and increasing our standard of living.
- In short: Innovation leads to new products and processes that sustain our industrial base; innovation depends on a solid knowledge base in math, science and engineering; without this knowledge base, innovation as well as our industrial base will erode.
- Along those lines, all jobs of the future will require a basic understanding of math and science. The most recent ten year employment projections by the U.S. Labor Department show that of the 20 fastest growing occupations projected for 2014, 15 of them require significant mathematics or science preparation to successfully compete for a job²
- Even the requirements for occupations that historically did not require a high school education have dramatically shifted. In the last 30 years, the share of factory workers without a high school degree fell from more than half to just one in five (21%). At the same time, those with a post-secondary education had reached 31 percent. If current trends continue, over 40 percent of factory jobs will require post-secondary education by 2012³.

Isn’t Our Current Educational System Working Well?

- Most Americans feel that they received a good education and that their children will as well. Unfortunately, not many are aware our country has been falling

¹ Source: NSTA Website (www.nsta.org) December 09

² Bureau of Labor and Statistics, Fastest growing occupations, 2004-14, <http://www.bls.gov/emp/emptab21.htm>

³ Standards for What? Educational Testing Service, 2003

behind, particularly in the areas of math and science, when compared with our international competitors. Independent of other countries, our students are on average getting worse in these subjects and not pursuing them in college.

- According to the National Center for Education Statistics, about one-third of the fourth-graders and one-fifth of eighth-graders cannot perform basic mathematical computations, and U.S. high school seniors recently tested below the international average for 21 countries in mathematics and science.⁴ As a result, fewer American students than ever are graduating from college with math and science degrees.
- When compared with our international competitors, we are not performing well. In 1995, U.S. fourth graders ranked 12th against other nations when it came to mathematics competency⁵. By the 8th grade their ranking dropped to 19th, below not only Asian students in countries such as Korea, Japan and Taiwan, but also below students in many Eastern European nations such as Bulgaria, the Czech Republic and Slovenia.
- A similar deterioration has occurred in science. In 1995, U.S. fourth graders ranked 6th in science competency. By the 8th grade their ranking dropped to 18th, below many of the same countries cited above. More recent rankings of U.S. students relative to their counterparts around the globe have been no more encouraging with respect to America's future ability to compete.
- Countries outperforming the U.S. in science and math, on average, spend 10 percent less of their respective GDPs on primary and secondary education than we do.⁶ Obviously, there are other important educational elements that go beyond funding, such as the fact that nearly 70 percent of U.S. middle school students are taught math by teachers with neither a major nor certification in this critical subject. Internationally, the average is 29 percent.⁷
- The story is not much better at the higher educational levels. The interest of young Americans' in science and technology has eroded over time. In 1960, one out of every six (17 percent) U.S. bachelor or graduate degrees was awarded in engineering, mathematics or the physical sciences but by 2001, that number had dropped to less than one in 10 (just 8 percent) of all degrees awarded in the U.S.⁸. This constitutes more than a 50 percent decline from 1960. In terms of actual numbers of graduates in these critical areas, the U.S. produced just 148,000 in

⁴ National Center for Education Statistics

⁵ International Association for the Evaluation of Educational Achievement

⁶ OECD, 2000.

⁷ U.S. Department of Education, Qualifications of the Public School Teacher Workforce: Prevalence of Out-of-field Teaching 1987-88 to 1999-00. Statistical Analysis Report, Table 1.

⁸ National Science Foundation. Science and Engineering Indicators, 2004

2001 — the smallest number in two decades.⁹ At this rate, our educational system will fail to meet our economy's workforce demands by the end of this decade.

- American students' disinterest in math and science continues at the graduate-level, too, where less than 10 percent of degrees are conferred in engineering, mathematics and computer science. This places our country 20th internationally in terms of the share of graduate degrees in these critical areas.¹⁰ Furthermore, more than 40% of U.S. doctoral students in engineering, mathematics and computer science are foreign nationals. In several fields it is more than half¹¹.
- Despite these dire numbers, a majority of parents think their kids are getting plenty of math and science education. We need to recognize the importance of these subjects and encourage our children to study math and science!

What Can We Do to Improve STEM Education?

- There is a strong and growing consensus in the business, scientific, and education community that we must revitalize our commitment to strengthen the pillars of American innovation and competitiveness – basic research in the physical sciences and math and science education
- Investment in basic research in the physical sciences (chemistry, physics, materials, etc) is an essential element in assuring our future economic prosperity, homeland security, and leadership in a rapidly evolving world
- America's global competitiveness will increasingly depend on our ability to better educate our young people in math and science and to attract more of our best and brightest students into technological careers
- Developing and retaining a high quality mathematics and science teaching workforce is key, and Congress has focused funding on loan forgiveness for teachers and is considering several proposals that would provide scholarships for students to become teachers in science and math fields.
- Projections indicate over the next decade for the need of over 2 million teachers, of which 240,000 will be middle and high school mathematics and science

⁹ U.S. Department of Education, National Center for Education Statistics, Higher Education

¹⁰ Ibid

¹¹ A Commitment to America's Future: Responding to a Crisis in Mathematics and Science Education, January 2005; National Science Foundation, *Science & Engineering Indicators - 2004*

specialists¹² Coordinated efforts must be made to recruit pre-service teachers to enter mathematics and science studies, and gain certification.

- Also, the retiring workforce of baby boomers in science, mathematics and engineering over the next decade must be encouraged and offered pathways to enter teaching upon retirement.
- Studies show that many teachers leave the profession after 5 years or less, so we need to provide beginning math and science teachers with induction programs for retention and development – and make sure that is sustained support.
- To attract and retain precollege science and mathematics teachers, we must provide quality, sustained professional development experiences for all K–12 science and mathematics teachers that will increase and deepen content knowledge, promote a variety of pedagogical approaches and develop questioning strategies, which will advance higher order thinking of all their students.
- Encourage higher education leaders to strengthen K–8 teacher education programs to provide a deeper understanding of the content knowledge necessary to teach mathematics and science.
- Invest in research on teaching and learning that will better inform development of science and mathematics curricula and pedagogical approaches.
- Review teacher education programs focusing on the extent to which prospective teachers are grounded in academic content in the subjects they will teach.

¹² National Center for Education Statistics, National Commission on Mathematics, and Science Teaching for the 21st Century