

# National Science Board

January 11, 2009

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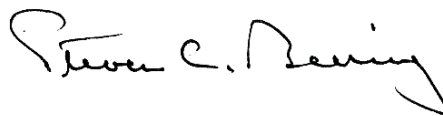
**SUBJECT: Actions to Improve Science, Technology, Engineering, and Mathematics (STEM) Education for all American Students**

On behalf of the National Science Board I wish to congratulate President-Elect Obama. The Board commends his commitment to a globally competitive education system with goals as highlighted in a recent speech: "[T]o give our children the chance to live out their dreams in a world that's never been more competitive... [and] provide new computers, new technology, and new training for teachers so that students in Chicago and Boston can compete with kids in Beijing for the high-tech, high-wage jobs of the future."

Over the last decade, the National Science Board has produced studies and sponsored broad ranging national discussions among stakeholders in STEM education to identify critical, doable actions to achieve the goals articulated so well by President-Elect Obama. The Board is composed of 25 Presidentially-appointed, Senate-confirmed Members, including the Director of the National Science Foundation, representing the broad U.S. science and engineering community. In addition to serving as the policy board of the National Science Foundation, the Board also serves as a national science and engineering policy advisory body to the President and Congress. In this latter role, the Board recommends to the new Administration a series of actions that would be especially effective in addressing critical problems of U.S. precollege STEM education.

Our national economic prosperity and security require that we remain a world leader in science and technology. Precollege STEM education is the foundation of that leadership and must be one of our highest priorities as a Nation. We urge the new Administration to seize the opportunity provided by this special moment in history and mobilize the Nation to support the development of high quality STEM knowledge and skills for all American students. It is essential that we act now to ensure all of our children and American society as a whole can continue to prosper in the 21<sup>st</sup> century technology-based economy. The Board offers our assistance in any way that will be helpful in achieving the critical objectives we outline in the attached recommendations.

Sincerely,



Steven C. Beering  
Chairman

Enclosure

## National Science Board STEM Education Recommendations for the President-Elect Obama Administration

The National Science Board (Board) recommends a set of actions for the new Administration to implement starting in early 2009 to advance STEM (science, technology, engineering, and mathematics) education for all American students, to nurture innovation, and to ensure the long-term economic prosperity of the Nation. The urgency of this task is underscored by the need to ensure that the United States continues to excel in science and technology in the 21<sup>st</sup> century. It must develop the ideas that could transform and strengthen the economy, ensure a skilled workforce for American industry, and guarantee that all American students are provided the educational resources and tools needed to participate fully in the science and technology based economy of the 21<sup>st</sup> century. The solutions we offer here are derived from studies by the Board over the past decade and reflect our continued commitment to a high quality STEM education system for America.<sup>1</sup>

### Essential Components of an Effective STEM Education System

- (1) **A motivated public, students, and their parents:** The arrival of a new Administration presents a window of opportunity to revitalize American STEM education. It requires focused national leadership.
  - The President and his Administration should emphasize to the general public, early and often, the importance of a solid education, especially in STEM, for all of our students. The need is such that it calls for a public awareness campaign similar in scale to those in the past on public health issues (e.g., the food pyramid, physical fitness, anti-smoking, etc.).
  - It is particularly important that parents understand this need. The President should issue a call to arms to all parents to use their influence at all levels—home, school and community—to bring about the changes we recommend.
  - Coalitions among parents, government, business and industry, private and corporate foundations, public figures, scientists and engineers, the media, and other stakeholders should be used to draw attention to the need and collectively develop locally relevant strategies to foster high quality STEM education for all students.
  
- (2) **Clear educational goals and assessments:** The distributed nature of America's educational system has led to great curricular variability across school districts. Although it is, on the one

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<sup>1</sup> National Science Board (NSB) studies including precollege STEM education over the last decade: *National Action Plan for Addressing the Critical Needs of the U.S. Science, Technology, Engineering, and Mathematics Education System* (NSB-07-114) (<http://www.nsf.gov/nsb/stem/index.jsp>); *America's Pressing Challenge — Building a Stronger Foundation* (NSB-06-02) (<http://www.nsf.gov/nsb/stem/index.jsp>); *The Science and Engineering Workforce – Realizing America's Potential* (NSB-03-69) (<http://www.nsf.gov/nsb/publications/reports.jsp>); *Preparing Our Children* (NSB-99-31) ([http://www.nsf.gov/publications/pub\\_summ.jsp?ods\\_key=nsb9931a](http://www.nsf.gov/publications/pub_summ.jsp?ods_key=nsb9931a)).

hand, a strength of the U.S. educational system, this lack of consistency can also lead to great inequalities across locales and disruptive set-backs for those students who move into and out of multiple school districts.<sup>2</sup>

- The Administration should lead the process of articulating the core concepts and skills that all students should master and how to respond to individual differences in the ways in which students learn. State and local school districts can then adapt detailed curricula to best reflect the local context and individual student needs but ensure that their students have mastered the core skills and concepts.
  - The Federal Government should help develop assessments that promote student learning in STEM and encourage critical thinking, communication, and problem-solving skills. They should include enough challenging questions that they also can measure learning among highly able students. These STEM assessment tools can be used to assist state and local educational agencies in measuring progress in student learning.
  - The Federal Government should ensure that we are developing the talents of all children who have the potential to become STEM innovators or excellent STEM professionals.
- (3) **High quality teachers:** Dedicated, high quality teachers are central to ensuring high quality STEM education for all students. We will continue to lose the best and brightest potential STEM teachers from our schools until we pay them at a level more closely aligned with salaries available to them in STEM areas. The labor market provides those with STEM training greater compensation in occupations other than teaching—a fact that is driving STEM teachers out of teaching.<sup>3</sup>
- Innovative mechanisms must be developed by the Administration, working with Congress and states, to allocate resources for appropriate pay for STEM teachers in response to the labor market for STEM professionals.
  - Stable support should continue for programs such as NSF’s Robert Noyce Teacher Scholarship program that help prepare STEM undergraduate majors and STEM professionals to become K-12 science and mathematics teachers in the neediest schools.
- (4) **World-class resources and assistance for teachers:** Even the best teachers need instructional materials, technology, and resource specialists to assist them. A teacher should not have to develop all of his or her own tools for teaching STEM.
- Advanced technologies offer many tools that can augment the classroom experience. A Federal initiative should be mounted to examine the best ways to use technology in education.

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<sup>2</sup> The 2004 Annual Social and Economic Supplement to the U.S. Census found that 15 to 20 percent of school-aged children moved in the previous year. Bureau of the Census of the Bureau of Labor Statistics, *Current Population Survey, 2004 Annual Social and Economic Supplement* (Washington DC: Bureau of Census, 2004)

(<http://www.census.gov/apsd/techdoc/cps/cpsmar04.pdf>). Cited in *National Action Plan* (NSB-07-114), 24.

<sup>3</sup> NSB, *Science and Engineering Indicators 2008* (NSB-08-1) (<http://www.nsf.gov/statistics/seind08/>), 1-37.

- A “Science Corps” should be established, of active and retired STEM professionals, to assist teachers in classrooms, schools, and at district levels. Summer and after-school programs that reinforce classroom learning might also utilize this supporting Science Corps.
  - A web-accessible resource of peer-evaluated STEM instructional materials and best practices should be developed that identifies those materials and best practices that have been proven to be valuable and effective. This resource could include those materials and best practices developed in other countries that have been shown to be effective.
  - A web resource that compiles research from the cognitive sciences and STEM education fields that is relevant to educational practice should be developed to inform educators and policy-makers.
  - Research on how children learn and on good teaching has yielded many insights. However, as with other critical issues, much more is needed. Therefore, funding for peer-reviewed and competitively-funded research on both learning and STEM teaching must be increased.
- (5) **An early start in science:** The earlier children are exposed to STEM concepts, the more likely they are to be comfortable with them later in life.
- STEM core concepts and ideas should be included in Head Start and other early education programs.
  - Improving the extent and quality of elementary school STEM education should become a priority.
  - The President should exercise his leadership often and intensely to motivate parents and other members of the community to support these goals.
- (6) **Communication, coordination, and collaboration:** Local excellence, national coherence, and global relevance in STEM education can only be achieved if all relevant stakeholders—including, most importantly, parents—are involved in achieving these goals.
- Coalitions, like some of the state P-16 councils that have effectively addressed STEM education issues, should be encouraged and funded everywhere. Such coalitions should promote interactions among K-12 school systems; 2- and 4-year colleges and universities; informal science education organizations; and business and industry to promote learning and the development of the STEM skills needed for the 21<sup>st</sup> century.
  - Mechanisms should be strengthened and expanded for the Federal Government to coordinate STEM education research and scale-up successful STEM educational activities for dissemination to state and local educational agencies.

The Board—representing the broad science, engineering, and education communities and appointed by the President and confirmed by the Senate—stands ready to work with the new Administration to, as Congress has statutorily defined our mission, promote the progress of science and to advance the national health, prosperity, and welfare.