

**U.S. HOUSE OF REPRESENTATIVES
COMMITTEE ON SCIENCE AND TECHNOLOGY**

HEARING CHARTER

Assessment of the National Science Board's Action Plan for STEM Education

**Wednesday, October 10, 2007
10:00 a.m. - 12:00 p.m.
2318 Rayburn House Office Building**

1. Purpose

On Wednesday, October 10, 2007, the Research and Science Education Subcommittee will hold a hearing to receive testimony related to a proposal from the National Science Board (NSB): "A National Action Plan for Addressing the Critical Needs of the U.S. Science, Technology, Engineering, and Mathematics Education System". This plan, which was released by the NSB on October 3, proposes a series of steps that the Board believes will bring greater coherence to the nation's science, technology, engineering and mathematics (STEM) education system and ensure that students are taught by highly effective STEM teachers.

2. Witnesses

- **Dr. Steven Beering**, Chairman, National Science Board.
- **Ms Judy A. Jeffrey**, Director, Iowa Department of Education and Representing the Council of Chief State School Officers.
- **Dr. Francis (Skip) Fennell**, President, National Council of Teachers of Mathematics and Professor of Education at McDaniel College.
- **Ms Chrisanne Gayl**, Director of Federal Programs, National School Boards Association.
- **Dr. Robert Semper**, Executive Associate Director, The Exploratorium and Representing the Association of Science-Technology Centers.
- **Ms Susan L. Traiman**, Director, Education and Workforce Policy Business Roundtable.

3. Overarching Questions

- Does the NSB action plan address the key issues for improving STEM education: effective coordination of STEM education reform activities, nationally applied STEM content guidelines, horizontal and vertical alignment and coherence of STEM education, and

populating classrooms with well qualified and highly effective STEM teachers? What are the principal barriers to achieving the recommended changes to the STEM education system?

- Is the proposed National STEM Education Council needed in order to implement the NSB's recommendations; can it be made to work as envisioned; will the principal stakeholders, who must be engaged in order for it to function, embrace the concept; and can it become self-sustaining?
- What are the key issues in attracting STEM majors to teaching careers; educating them to be effective teachers; and retaining them in these careers?
- What is the federal role in carrying out the recommendations of the NSB action plan?

4. Brief Overview

- A consensus now exists that improving STEM education throughout the nation is a necessary, if not sufficient, condition for preserving our capacity for innovation and discovery and for ensuring U.S. economic strength and competitiveness in the international marketplace of the 21st century. The National Academies *Rising Above the Gathering Storm* report placed a major emphasis on the need to improve STEM education and made its top priority increasing the number of highly qualified STEM teachers. This recommendation was embraced by the COMPETES bill developed by the Committee, which was recently enacted.
- In the same period that the *Gathering Storm* report was being developed, the NSB initiated a process to explore how to improve STEM education throughout the nation. As part of this effort, the Board established a STEM education commission to advise it on how to accomplish this goal. The action plan that is the subject of this hearing grew out of these activities.
- The NSB action plan focuses on coordinating what, when, and to whom STEM subjects are taught among states (horizontally) and across grade levels (vertically) and on ensuring students are taught by highly effective STEM teachers.
- At present, there are no consistent STEM content standards in use among the states and no consistency in the sequence in which STEM courses are taught. In a highly mobile society, this causes students who move from one state to another often to miss exposure to important concepts which they may not have a later opportunity to master. No formal mechanisms now exist to foster coordination regarding content and course sequence among states. Vertical integration of course sequence and content at different grade levels within states is beginning to be addressed through P-16 Councils that several states have initiated.
- A chronic shortage of highly qualified STEM teachers is a major impediment to improved student performance in STEM subjects. A high proportion of STEM teachers have neither an undergraduate major nor certificate to teach STEM subjects. There is a lack of uniformity and rigor in the requirements for certification of STEM teachers. Individuals

with an interest and capability to pursue STEM degrees have many opportunities for careers in professions offering higher salaries and better working conditions.

- A central recommendation of the NSB report is to establish an independent, non-federal congressionally chartered National Council for STEM Education. This Council, which would have representation from all the major public and private stakeholder groups, would coordinate and facilitate STEM education initiatives across the nation. The NSB sees the Council as having an important role in facilitating a strategy to define voluntary STEM content guidelines, in developing consensus-based metrics for assessing student performance, in serving as a forum on best practices in STEM teaching and learning, in assisting the states in creating new and strengthening existing P-16 councils, in developing strategies to overcome barriers to increasing the compensation for STEM teachers, in coordinating and disseminating information on models to attract and support talented students in pursuing STEM teaching careers, and in fostering the development of national STEM teacher certification guidelines.

5. NSB Action Plan

Beginning in 2005 the NSB held a series of hearings in different regions of the U.S. to gather a range of views about how to improve STEM education. This led to the Board convening a national commission on STEM education to advise it on specific actions that could be taken to implement the many recommendations of previous reports, panels, task forces, and commissions that have called for major reforms of STEM education. The NSB commission presented their findings and recommendations to the Board in March 2007 (included as an appendix to the NSB action plan).

The NSB then prepared its STEM education action plan, released it for public comment in August, and then released the final version last week. The executive summary of the report, as released for public comment, is in the appendix to this memo, and the full report is available at http://www.nsf.gov/nsb/edu_com/draft_stem_report.pdf

6. Questions for the Witnesses

In the invitation letter for the hearing, Dr. Beerling was asked to provide an overview of the NSB's recommendations and the findings that led to these recommendations. He was also asked to describe the process used by the Board that led to the priorities reflected in the action plan, including the degree and nature of consultation with STEM education leaders throughout the nation, and a description of the reaction the Board received to the recommendations of the action plan after it was released for public comment.

The other witnesses, who represent various stakeholder communities engaged in STEM education improvement, were asked to give their views on the NSB recommendations and to respond to the following questions:

- Does the NSB action plan address what you see as the key issues for improving STEM education? Are there specific actions or policies that you believe are important to improvement of STEM education that are not included? What are the principal barriers to achieving the recommended changes to the STEM education system?
- Is the proposed national STEM education council needed in order to implement the NSB's recommendations; can it be made to work as envisioned; and can it become self-sustaining? Do you support establishing this council? Do you have recommendations for changing the proposed structure or functions of the council? Furthermore, what role do you envision for the council in defining the recommended "national content guidelines"?
- What is the appropriate federal role in carrying out the recommendations of the NSB action plan?

**A NATIONAL ACTION PLAN
FOR ADDRESSING THE CRITICAL NEEDS OF THE
U.S. SCIENCE, TECHNOLOGY, ENGINEERING, AND MATHEMATICS
EDUCATION SYSTEM**

EXECUTIVE SUMMARY

The United States possesses the most innovative, technologically capable economy in the world, and yet its science, technology, engineering, and mathematics (STEM) education system is failing to ensure that all American students receive the skills and knowledge required for success in the 21st century workforce. The Nation faces two central challenges to constructing a strong, coordinated STEM education system:

- Ensuring coherence in STEM learning, and
- Ensuring an adequate supply of well-prepared and highly effective STEM teachers.

In order to direct attention to pressing issues and concerns in STEM education and to coordinate and enhance STEM education across local, state, and Federal programs, the National Science Board (Board) recommends the following:

- The U.S. Congress should pass and the President should sign into law an act chartering a new, independent, non-Federal *National Council for STEM Education* to coordinate and facilitate STEM programs and initiatives throughout the Nation, as well as to inform policymakers and the public on the state of STEM education in the United States.
- The President's Office of Science and Technology Policy should create a standing Committee on STEM Education within the *National Science and Technology Council* with the responsibility to coordinate all Federal STEM education programs.
- The *Department of Education* should create a new Assistant Secretary of Education position charged with coordinating the Department's efforts in STEM education and interacting with stakeholders outside the Department.
- The *National Science Foundation* should lead an effort to create a national roadmap to improve pre-kindergarten to college and beyond (P-16/P-20) STEM education, drawing on its national standing in the science and engineering communities and its expertise in science and engineering research and education.

In recognition of the lead role of local and state jurisdictions in the Nation's P-12 education system, the Board recommends that all stakeholders work together, using the National Council for STEM Education as the focal point, to provide *horizontal* coordination of STEM education among states by:

- Facilitating a strategy to define national STEM content guidelines that would outline the essential knowledge and skills needed at each grade level;
- Developing metrics to assess student performance that are aligned with national content guidelines;
- Ensuring that assessments under No Child Left Behind promote STEM learning; and
- Providing a forum to share and disseminate information on best practices in STEM teaching and learning.

The Board also recommends that all stakeholders promote *vertical* alignment of STEM education across grade levels – from pre-K through the first years of higher education by:

- Improving the linkage between high school and higher education and/or the workforce; and
- Creating or strengthening STEM education-focused P-16 or P-20 councils in each state; and
- Encouraging alignment of STEM education content throughout the P-12 education system.

Finally, the Board recommends actions that ensure students are taught by well-qualified and highly effective STEM teachers. These include strategies for increasing the numbers of such teachers and improving the quality of their preparation by:

- Developing strategies for compensating STEM teachers at market rates;
- Providing resources for the preparation of future STEM teachers;
- Increasing STEM teacher mobility between districts by creating national STEM teacher certification standards; and
- Preparing STEM teachers to teach STEM content effectively.

This action plan lays out a structure that will allow stakeholders from local, state, and Federal governments, as well as nongovernmental STEM education stakeholder groups, to work together to coordinate and enhance the Nation's ability to produce a numerate and scientifically and technologically literate society and to increase and improve the current STEM education workforce. Strategies for producing the next generation of innovators are not explicitly addressed in this action plan and will require subsequent study. A coherent system of STEM education is essential to the Nation's economy and well-being.