

**U.S. HOUSE OF REPRESENTATIVES
COMMITTEE ON SCIENCE, SPACE, AND TECHNOLOGY
SUBCOMMITTEE ON RESEARCH AND SCIENCE EDUCATION**

HEARING CHARTER

STEM In Action: Transferring Knowledge from the Workplace to the Classroom

**Thursday, November 3, 2011
10:00 am – 12:00 pm
2318 Rayburn House Office Building**

1. Purpose

On Thursday, November 3, 2011, the Subcommittee on Research and Science Education will hold the fourth in a series of hearings to highlight Science, Technology, Engineering, and Math (STEM) education activities across the Nation, their role in inspiring and educating future generations, and their contribution to our future economic prosperity. The purpose of this hearing is to examine approaches and programs that encourage and assist STEM professionals looking to transition their knowledge and skills from industry to a second career in teaching or to give back to classroom education as a mentor.

2. Witnesses

Dr. Michael Beeth, Professor, Department of Curriculum and Instruction, University of Wisconsin Oshkosh

Mrs. Christine Sutton, Secondary Math Teacher, Virgil I. Grissom High School, Huntsville City Schools, Alabama

Ms. Robin Willner, Vice President, Global Community Initiatives, Corporate Citizenship & Corporate Affairs, IBM Corporation

Mr. Jason Morrella, President, Robotics Education and Competition Foundation

Dr. Jennifer Jones, Principal Clinical Scientist, Abbott Vascular

3. Overview

- In the United States, student mastery of STEM subjects is essential to thrive in the 21st century economy. As other nations continue to gain ground in preparing their students in these critical fields, the U.S. must continue to explore a variety of ways to inspire future generations.

- The 2007 *Rising Above the Gathering Storm* report called for an increased emphasis on recruiting, educating, training, and increasing the skills of K-12 STEM education teachers and increasing the pipeline of American students who are prepared to enter college and graduate with a degree in STEM.
- The U.S. workforce is in a state of flux due to shifting employment demographics and continues to be aggravated by the current economic situation and the upcoming retirements of the baby-boomer generation. Many STEM industry professionals may be looking to make a career transition that could put them in a classroom by incorporating their professional experience with teaching or by mentoring students or teachers in and out of the classroom.
- Programs working to connect STEM industry professionals to the classroom and students, including alternative certification opportunities and employer driven mentor and volunteer opportunities, help to solidify the connection between class work and real-life needs for students.
- The connection between STEM industry professionals and students, in the classroom and through mentoring and volunteer opportunities, illustrates for students the opportunities and rewards associated with STEM careers and may help to prepare and inspire them to pursue STEM educational opportunities and careers.

4. Background

STEM industry professionals offer a unique perspective to students due to a combination of hands-on experience and content knowledge. Working to increase the involvement of these professionals both inside the classroom and through outside activities, as teachers, mentors or volunteers is of interest to many concerned with the need to strengthen STEM education in the U.S.

STEM Education Funding in the Federal Government

A consensus exists that improving STEM education throughout the Nation is a necessary 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 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 House Science, Space, and Technology Committee following the issuance of the report and was included in the 2007 *America COMPETES Act*, primarily through the Robert Noyce Teacher Scholarship Program. The 2010 *America COMPETES Reauthorization Act* continues this priority.

Beyond activities authorized in *America COMPETES*, President Obama has called for a new effort to prepare 100,000 science, technology, engineering, and math (STEM) teachers with

strong teaching skills and deep content knowledge over the next decade. As a component of achieving this goal, the fiscal year (FY12) Budget Request proposes an investment of \$100 million through the Department of Education and the National Science Foundation (NSF) to prepare effective STEM teachers for classrooms across America. This proposal also responds to a recommendation by the President's Council of Advisors on Science and Technology (PCAST) to prepare and inspire America's students in science, technology, engineering, and mathematics.

With specific regard to K-12 STEM education funding beyond what has already been identified, the FY12 Budget Request calls for \$206 million for the Department of Education's proposed Effective Teaching and Learning in STEM program; a \$60 million (28 percent) increase for NASA's K-12 education programs; \$300 million for an "Investing in Innovation" program (expansion of a Department of Education American Reinvestment and Recovery Act program); and \$185 million for a new Presidential Teaching Fellowship program.

In total, the FY12 Budget Request devotes \$3.4 billion to STEM education programs across the federal government.¹ The 2010 *America COMPETES Reauthorization Act* called for the creation of a National Science Technology Council (NSTC) Committee on STEM Education to coordinate federal STEM investments. The first-year tasks of the Committee are to create an inventory of federal STEM education activities and develop a 5-year strategic Federal STEM education plan. The inventory, as well as a similar Government Accountability Office (GAO) survey requested by the Committee on Education and Workforce, is currently underway and results are expected in early 2012.

In the 112th Congress, the Science, Space, and Technology Committee will continue to hold oversight hearings and briefings on STEM education activities across the federal government and will closely monitor the scope and findings of both the NSTC and the GAO federal STEM education inventories.

The Robert Noyce Teacher Scholarship Program

The National Science Foundation's Robert Noyce Teacher Scholarship (Noyce) Program is one of the cornerstones of the federal government's efforts to increase the number of highly qualified STEM teachers. Originally authorized in the 2002 National Science Foundation Authorization Act (P.L. 107-368), expanded under the 2007 *America COMPETES Act*, and reauthorized in the *America COMPETES Reauthorization Act of 2010*, the Noyce program provides funding to institutions of higher education to provide scholarships, fellowships, stipends, and programmatic support to recruit and prepare STEM majors and professionals to become K-12 teachers. In FY11 Noyce programs were funded at nearly \$55 million dollars. The FY12 budget request is \$45 million, a \$10 million reduction.²

The Noyce program encourages talented STEM students and professionals to pursue teaching careers in elementary and secondary schools in an effort to respond to the critical need for K-12 STEM teachers. One goal of the program is to recruit individuals with strong STEM

¹ White House Office of Science and Technology Policy, *Innovation, Education, and Infrastructure: Science, Technology, STEM Education, and 21st Century Infrastructure in the 2012 Budget*, p. 2.

² FY2012 NSF Budget Request to Congress, p. EHR-19

backgrounds who might otherwise not have considered a career in K-12 teaching. The program works to increase the number of K-12 teachers with strong STEM content knowledge who teach in high-need school districts. The Noyce program consists of two different tracks: the Robert Noyce Teacher Scholarship track, and the NSF Teaching Fellowship and Master Teaching Fellowship track.

The Teacher Scholarship track provides funding to colleges and universities to offer scholarships and programs for undergraduate students majoring in STEM disciplines and stipends for STEM professionals seeking to become teachers. Teacher Scholarship projects include partnerships with school districts, recruitment strategies, and activities to enable scholarship recipients to become successful elementary or secondary math and science teachers. Teacher Scholarship grantees administer scholarships and stipends; offer academic courses and clinical teaching experiences to prepare scholarship recipients to teach in elementary and secondary schools; and offer programs during and after program matriculation to help scholarship recipients become better math and science teachers and exchange ideas with others in the field.

Through the Teacher Scholarship program, scholarships of at least \$10,000 per year are available to juniors and seniors majoring in a STEM discipline. Scholarships may be awarded for up to three years to include a fifth year of study in a post-baccalaureate teacher-credentialing program. Stipends of at least \$10,000 are available for a maximum of one year for STEM professionals who hold a baccalaureate, masters, or doctoral degree in science, mathematics, or engineering and enroll in a teacher certification program. Teacher Scholarship projects include program development and enhancement as well as programmatic support for students. Program components are designed to attract students into teaching, provide high quality preparation for their success as teachers, and to retain them in the teaching workforce. These activities may include early field experiences, academic courses in content and pedagogy, and professional development and mentoring support for new teachers.

The NSF Teaching Fellowship track supports STEM professionals (recent STEM graduates and STEM career-changers) who enroll as NSF Teaching Fellows in master's degree programs leading to teacher certification, and the development of exemplary math and science teachers to become NSF Master Teaching Fellows. The Teaching Fellowship track requires cost-sharing, through which grantees provide between 30 and 50 percent of the amount of the Noyce grant from non-federal sources, depending on the total award amount.

The Teaching Fellowship track provides stipends of at least \$10,000 and programmatic support to STEM professionals who enroll in a one-year master's degree program leading to teacher certification or licensing. Institutions provide academic courses, activities, and clinical teaching experiences for the NSF Teaching Fellows. Projects provide mentoring and professional development while the Teaching Fellows are fulfilling their four-year teaching requirement in a high need school district. The Fellows receive a salary supplement of at least \$10,000 per year while they are fulfilling the four-year teaching commitment. Through NSF Master Teaching Fellowships, institutions offer academic courses, professional development, and leadership training to prepare participants to become Master Teachers in elementary and secondary schools.

Master teaching fellows receive salary supplements of at least \$10,000 for each year of the five-year teaching requirement.³

Alternative Teacher Certification

Pursuing teaching as a second career may be challenging for current STEM industry professionals who must consider numerous issues from monetary concerns to certification and licensure requirements. Alternative certification routes have become more promising for these transitioning professionals as they may provide more opportunities to have previous work experience count toward licensure, certification or degree requirements.

According to the Secretary's Seventh Annual Report on Teacher Quality, "In 2007, alternative route programs to teacher certification were approved in 48 states, Puerto Rico and the Northern Mariana Islands, an increase of two since 2006 (Rhode Island and Northern Mariana Islands)."⁴ Many STEM industry professionals already have a bachelor's degree in a core competency, but are missing the required teacher-education courses for certification. Alternative teacher certification requirements differ by state but often include an accelerated post-baccalaureate program, a student-teaching component and the successful completion of certain tests or interviews. In some cities and states, one can pursue a provisional teacher license that allows second-career teachers to begin teaching immediately. After completing required education courses and working under the supervision of experienced educators for one or two years, those who initially received provisional licenses can receive a full teaching credential. Other states offer programs that allow college graduates who do not meet licensure requirements to take only those courses they lack in order to become licensed. Additionally, teacher shortages in some areas and subject matters have prompted many states to offer temporary emergency licenses to prospective teachers who hold bachelor's degrees.⁵

Alternative routes to teacher certification are impacting the way teachers are educated and brought into the profession. It is estimated that more than 200,000 persons have been licensed through these programs.⁶ Not only have more states instituted legislation for alternative teacher certification, but institutions of higher education have initiated their own alternative programs for the preparation of teachers leading to a license to teach. "California, New Jersey and Texas have been developing and aggressively utilizing alternative routes for licensing teachers since the mid-1980s."⁷

Alternative certification programs often involve collaboration between states and schools offering certification programs. For example, in Virginia, the Career Switcher Alternative Route to Licensure Program was established in 2000 by the General Assembly. Initially for military personnel interested in becoming teachers, the program has been expanded to include individuals in other professions interested in pursuing a career in education. Institutions of higher education, school divisions, and private organizations can develop proposals to act as program providers for

³ <http://www.aps.org/units/fed/newsletters/spring2009/prival.cfm>

⁴ https://title2.ed.gov/TitleIIReport10_508.pdf, p.5

⁵ <http://www.alleducationschools.com/education-careers/article/teaching-as-second-career>

⁶ <http://www.teach-now.org/overview.html>

⁷ <http://www.teach-now.org/overview.html>

the VA Career Switcher Program. Program providers are responsible for recruiting, screening, and selecting applicants. Providers must also document that individuals accepted into Career Switcher Programs meet all Board of Education requirements. Virginia institutions of higher education serving as program providers include, George Mason University, Old Dominion University, Regent University, Shenandoah University, and Virginia Community College System.⁸

In Wisconsin, the Alternative Careers in Teaching (*act!*) program is an individually tailored, alternative pathway to initial Wisconsin licensure as a secondary mathematics or science teacher. The program is customized to adult career-changers looking for an alternative path to licensure. Participants must hold a Bachelor's degree from a regionally accredited institution and must also have five or more years of work experience. The *act!* program is a cooperative program between the University of Wisconsin Colleges and the University of Wisconsin Oshkosh.⁹

STEM Industry: Teachers, Mentors and Volunteers

The looming retirements of the baby-boomer generation and current unemployment rates have exacerbated a U.S. workforce in flux for many generations. According to a 2007 report from the U.S. Department of Labor, "Industries and firms dependent upon a strong science and math workforce pipeline have launched a variety of programs that target K-12 students and undergraduate and graduate students in STEM fields."¹⁰ STEM industry professionals looking to give back to their communities or to make a career transition to the classroom by incorporating their professional experience with teaching or by mentoring students or teachers in and out of the classroom are encouraged by those organizations launching programs to support STEM education. These programs often provide the venue for industry professionals to help students in their communities connect to STEM fields.

Beginning a second-career as a STEM teacher is a noble endeavor, but not the only way to give back to a community. A number of STEM industry professionals prefer to use their capabilities as volunteers or mentors to help inspire the next generation of STEM professionals. Programs that encourage employees to volunteer in the classroom and through on-line mechanisms, or those that highlight industry work through community events are vital to encouraging students to follow STEM academic and career paths. Teaching, mentoring, and volunteering help to illustrate to students the opportunities and rewards associated with STEM careers and may help to prepare and inspire them to pursue STEM educational opportunities and careers.

The IBM Corporation: IBM promotes community engagement and corporate service programs on specific societal issues, including education. IBM utilizes its technology and talent to solve problems through direct action and collaboration. Since 2006, IBM has enabled its employees to become fully accredited teachers in their local communities by supporting mature workers who are interested in a second career in teaching. IBM's *Transition to Teaching* program is an effort to help address the shortage of math and science teachers by leveraging the expertise and

⁸ http://www.doe.virginia.gov/teaching/educator_preparation/career_switcher/index.shtml

⁹ <http://www.uwfox.uwc.edu/academics/act2teach/>

¹⁰ http://www.doleta.gov/Youth_services/pdf/STEM_Report_4%2007.pdf, p. 6

backgrounds of IBM's employees. The Transition to Teaching initiative helps underwrite the costs while employees pursue the education and training experiences required for teacher certification - combining traditional coursework, online courses, and practice teaching. The participants can choose from the existing array of traditional education and alternative certification programs. IBM also provides up to one year leave of absence to facilitate student teaching experience in order to meet state certification requirements and prepare them with quality experiences. Employees are eligible for a total of \$15,000 for tuition reimbursement and leave-of-absence stipend.¹¹

The Robotics Education and Competition (REC) Foundation: The Robotics Education and Competition (REC) Foundation is a non-profit organization, supporting robotics and technology events and programs that aim to inspire and motivate students to advance in STEM education. The REC Foundation also provides program support and workshops focused on technology and professional development for educators. It works to connect students, mentors, and schools in every community to a variety of technology-based programs. Students and mentors work inside and out of the classroom through competitive events, workshops, camps, or conferences. In addition, the Foundation provides those programs with services, solutions, and a community that allows them to foster the technical and interpersonal skills necessary for students to succeed. It is committed to promoting technology and related student and professional advancement so that one day these programs become accessible to all students and all schools in all communities.¹²

Abbott: Abbott is a health care company working on products from nutritional products and laboratory diagnostics to medical devices and pharmaceutical therapies.¹³ Established in 1951, the Abbott Fund is a philanthropic organization working in science education, engaging students, families, and teachers in scientific exploration in out-of-school informal settings; encouraging young people to be more proficient in science and attract more scientists to the field; and building strong partnerships that are systemic, replicable, and sustainable for multiple years and multiple locations.¹⁴ Through the Abbott Family Science program students and families are actively engaged in learning about science and innovation through experiments and related activities led by Abbott scientists and volunteers. Children aged 6 to 10, parents, and teachers participate in evenings packed with exciting, hands-on experiments in fundamental science. Family Science nights are held in China, Germany, Ireland, Singapore, South Korea and the U.K., as well as California, Illinois, Massachusetts, Ohio, Texas, and Puerto Rico.¹⁵

¹¹ IBM Transition to Teaching one-pager

¹² <http://robotevents.com/>

¹³ http://www.abbott.com/global/url/content/en_US/10:10/general_content/General_Content_00004.htm

¹⁴ <http://www.abbottfund.org/about/science>

¹⁵ <http://abbottfund.org/project/11/22/Making-Science-Fun-for-the-Whole-Family>