BEHAVIORAL AND SOCIAL SCIENCES IN STEM (SCIENCE, TECHNOLOGY, ENGINEERING AND MATHEMATICS) EDUCATION

A WORKSHOP SUMMARY

July 13, 2010
5635 Fishers Lane
Rockville, Maryland

Sponsored by the Office of Behavioral and Social Sciences Research (OBSSR), National Institutes of Health (NIH)

CONTENTS

Meeting Report Based on Notes Prepared by:
Winfield Swanson, Consultant
The Hill Group

Welcome, Introduction, and Plans for the Day

Deborah H. Olster, PhD, Acting Director, Office of Behavioral and Social Sciences Research (OBSSR), National Institutes of Health (NIH)

Dr. Olster welcomed everyone and explained that NIH's mission is to seek fundamental knowledge about the nature and behavior of living systems and the application of that knowledge to enhance health, lengthen life, and reduce the burdens of illness and disability. OBSSR was established in 1995 in recognition of the importance of the behavioral and social sciences in this endeavor. The Office's mission is to stimulate behavioral and social sciences research and to integrate these sciences more fully into others throughout the NIH health research enterprise, thereby improving our understanding, treatment, and prevention of disease. The Office works in partnership with the NIH Institutes and Centers to develop research and training initiatives in many areas of basic and applied behavioral and social science. Current funding opportunity announcements issued under OBSSR leadership solicit research grant applications on the following topics: social network analysis and health; systems science approaches to tackle policy-resistant health problems; health literacy; community-based participatory research; methodology and measurement in the behavioral and social sciences; and behavioral and social sciences research on reducing and eliminating health disparities. OBSSR also facilitates OppNet, the NIH Basic Behavioral & Social Science Opportunity Network. OppNet is a trans-NIH activity designed to expand the agency's support of basic behavioral and social sciences research. The Office also sponsors training institutes for a variety of topics, including the design and conduct of randomized clinical trials involving behavioral interventions and systems science and health.

In addition to their critical roles in health, behavioral and social factors play a big role in inequality, poverty, education, energy, housing, the environment, climate change, and response to natural or man-made disasters. Thus, in order to tackle the problems facing our society and to improve lives, we need to understand how and why individual humans and groups of humans behave and how they interact with each other and with the environment. We are here today because that understanding of human behavior requires the development of research knowledge and education in the behavioral and social sciences.

This workshop also addresses the perception of "science" and what it includes. According to the *American Heritage Dictionary*[1], the definition of "science" is the following:

1. a) The observation, identification, description, experimental investigation, and theoretical explanation of natural phenomena; b) such activity restricted to a class of natural phenomena; c) such activity applied to any class of phenomena.
2. Methodological activity, discipline, or study.
3. An activity that appears to require study and method.
4. Knowledge, esp. knowledge gained through experience.

[1] *The American Heritage Dictionary* (second College Edition), Houghton Mifflin Company, Boston, 1982.

Today's workshop is designed to discuss opportunities for more active inclusion of the behavioral and social sciences in science, technology, engineering and mathematics (STEM) education initiatives. We hope to begin the conversation on this topic with participants who have a variety of perspectives and play different roles: behavioral and social science researchers, policy makers interested in STEM education, school curriculum and standards developers, and STEM experts from different points along the education continuum.

Framing the Issue

Elisa Klein, PhD, Society for Research in Child Development/American Association for the Advancement of Science (AAAS) Science and Technology Policy Fellow, OBSSR, NIH

Dr. Klein explained that the purpose of the day was to gather information on the current status of the behavioral and social sciences as scientific disciplines in STEM education; to understand public perceptions and attitudes; and to discuss strategies for increasing visibility of behavioral and social sciences in STEM education. The Obama Administration's interest is reflected in the large investment in STEM education in the Fiscal Year 2011 budget request. Ultimately, the goal, which has strong support from business, is to enhance economic competitiveness through improving STEM education at all levels. The America COMPETES Act recognizes that behavioral and social sciences further scientific knowledge. Yet support for undergraduate and graduate training in behavioral and social sciences disciplines is inconsistent, as is their inclusion in science education curricula (although they may be considered "social studies"). This reflects the inconsistent perceptions both within the scientific community and among the public.

In 2003, the National Science Foundation (NSF) sponsored a workshop, which resulted in the report, *Education and Training in the Social, Behavioral, and Economic Sciences: A Plan of Action*[2]. A point raised at that workshop was that, nationally and internationally the social and behavioral sciences are recognized as essential science disciplines. This conclusion is echoed in reports from the National Science and Technology Council's (NSTC's) Social, Behavioral, and Economic Sciences Subcommittee (*Social, Behavioral, and Economic Research in the Federal Context*[3]), and UNESCO and the International Social Sciences Council (*World Social Science Report 2010*[4]). The latter states that "social sciences are needed to understand and influence how humans act" and describes problems social sciences face that "hamper the accumulation, transmission, and use of knowledge in different societies" (2010, p. 2). Today's workshop agenda focuses on identifying ways to embed behavioral and social sciences as core components of STEM education; defining strategies to increase public understanding of behavioral and social sciences; enhancing awareness of the value of these sciences; discussing strategies for creating a stronger pipeline for behavioral and social scientists; and brainstorming research priorities.

---

[2] Levine, F. J., Abler, R. F., & Rosich, K. J. *Education and Training in the Social, Behavioral, and Economic Sciences: A Plan of Action*. Report to the National Science Foundation. Washington, D.C., 2004.
[3] *Social, Behavioral, and Economic Research in the Federal Context*. Report of the National Science and Technology Council, Subcommittee on Social, Behavioral and Economic Sciences. Washington, D.C., 2009.
[4] *World Social Science Report 2010*. Joint publication of the International Social Science Council (ISSC) and United Nations Education, Scientific and Cultural Organization (UNESCO). Paris, France, 2010.

Federal Perspectives on the Social and Behavioral Sciences and STEM Education and STEM Education Reform

Steven J. Robinson, PhD, White House Domestic Policy Council

Dr. Robinson focused on the K-12 level of STEM education, particularly reauthorization of the Elementary and Secondary Education Act (ESEA) — also known as the No Child Left Behind Act of 2001 (NCLB). STEM education is a presidential priority, specifically identified in February 2009 as one of President Obama's overarching goals: "By 2020, America will once again have the highest proportion of college graduates in the world." Therefore everyone must have the opportunity to attend high school and college, and all graduates must be career-ready.

Achieving these goals rests on several overarching principles: raise the achievement bar for all students, tighten goals and loosen means of achieving them, foster innovation, and reward success. These principles are built on four assurances: raise standards and improve assessments; recruit, retain, and support effective educators and ensure equitable distribution; build robust data systems that track student progress and improve practice; and turn around low-performing schools, focusing on "dropout factories" and their feeder schools. Core areas for ESEA reauthorization are: producing college- and career-ready students; meeting needs of diverse learners; having successful, safe, and healthy students; attracting great teachers and leaders; providing a complete education; and fostering innovation and excellence. To produce college- and career-ready students, we must set standards, assess progress, and assert accountability. Currently, there is no alignment between school standards and standards for entering college. A related need is for better measures of student learning; there are no common standards across states, although there is federal encouragement for states to work together. The accountability system must include English and math. Moreover, one consequence of NCLB was a narrowed curriculum. The Domestic Policy Council proposes that the way to success involves: raising the bar, ensuring greater flexibility, recognizing success, ensuring a well-rounded education, and focusing on gaps and equity.

Michael Lach, Special Assistant for STEM Education, US Department of Education

President Obama is excited about STEM education, and more money than ever before is being directed to it. Multiple STEM standards guides are available. The American Association for the Advancement of Science (AAAS) issued one[5], the National Academies issued one[6], and the National Research Council's Committee on Conceptual Framework for New Science Education Standards just issued a draft framework[7]. Implementation of these reports' recommendations and changing curriculum content, however, are difficult. For example, experts often propose the addition of new subjects without deleting anything, while the amount of time to teach remains

[5] American Association for the Advancement of Science. *Benchmarks for Science Literacy*. New York: Oxford University Press, 1993.

[6] National Research Council. *National Science Education Standards*. Washington DC: National Academy Press, 1996.

[7] National Research Council, Committee on Conceptual Framework for New Science Education Standards, *A framework for science education*. http://www7.nationalacademies.org/bose/Standards_Framework_Homepage.html, accessed December 29, 2010.

the same. Moreover, questions remain: In the context of preparation for college, should students master elementary ideas/content, or should they learn to think critically, analyze data, and find patterns? Inquiry is still rare in most classrooms. The best example of change over the past 50 years is that, as a result of the civil rights movement, many schools now have a more rounded approach to studying and teaching children from the different populations living in our country.

Math education offers examples of how to change what teachers do in ways that result in improvements in student performance. Between 2002 and 2008, teachers were provided with high-quality instructional materials, the use of which improved results on state tests. But high-quality instructional materials are only one part of a comprehensive system of support for mathematics achievement. Also needed are high-quality teachers, professional development workshops, high-fidelity enactment, strategic implementation, in-school coaching, assessment data, leadership, and grade-level and department conversations. Improvement was observed when instruction was better aligned to state tests and focused on basic skills, problem solving, and algorithmic manipulation of math and math ideas (which is broader than traditional math). From these observations, one can conclude that good curriculum accompanied by expensive and hard-to-manage supports, over time, make a difference. In sum, schools and teachers need more instructional materials with supports, specialized courses and units, targeted schools, academic/ teacher/leadership involvement, network cultivation (support from other teachers), motivation, and inspiration.

Discussion

Participants discussed a number of issues, including the following:

- It is important to develop an early capacity to learn science, including behavioral and social sciences. Questions that arise from this include: How can the curriculum embrace phenomena across all the sciences? What domains must be included to enable understanding of science? For effective learning of scientific processes, what content should be included and when?
- Behavioral and social sciences are used not only to improve the teaching of science and math, but must also be recognized as core STEM sciences. What are the hurdles in conveying this message to the larger scientific community and the public?
- Any effort to make change in schools and school systems must take a highly collaborative approach, *i.e.*, partnerships that include academicians, teachers, school administrators, leaders, and policymakers. Practicality is also a consideration, given teacher capacity, levels of student performance, amount and content of material in the curriculum.
- Learning is not something that only happens in K-12, but rather across the lifespan and in multiple settings. People can be reached through institutions other than schools, *e.g.*, museums or Boy and Girl Scouts, and these broader efforts can improve the public perception and understanding of the behavioral and social sciences.

What Are the Core STEM Sciences?

A discussion led by Paula R. Skedsvold, JD, PhD, Executive Director, Federation of Associations in Behavioral and Brain Sciences; Patricia White, PhD, Acting Deputy Director, Division of Social and Economic Sciences, National Science Foundation (NSF); Susan Carey, PhD, Professor and Chair, Department of Psychology, Harvard University.

Embedded in this country's cultural understanding of science is insufficient awareness that "science" includes the behavioral and social sciences. This has implications for research funding and training opportunities, and can delay the progress of science needed to address the nation's challenges.

Despite federal funding for behavioral and social sciences research, the narrow perception of science persists, and as a result, the behavioral and social sciences often remain outside the science education curriculum. Federal agencies have a role to play in changing perceptions of what is included in "science". The National Science Foundation report, *Education and Training in the Social, Behavioral, and Economic Sciences: A Plan of Action*[2], sought to address this issue, and some progress has been made. Within the Education and Human Resources Directorate of the NSF, for example, there are funding opportunities that include the behavioral and social sciences. However, across the federal government, concerns remain because there is inconsistency in including the behavioral and social sciences in STEM initiatives, and when opportunities are available, more action is needed to galvanize the behavioral and social science research community to take advantage of those opportunities. It is also important to specifically require behavioral and social sciences in agency funding initiatives (when appropriate) and then to have agency representatives emphasize and enforce requirements when applications are received and reviewed.

There is considerable activity on STEM education, and this presents an opportunity for improving recognition of the behavioral and social sciences as "science". There is a large effort to reform K-12 STEM education (*e.g.,* through ESEA reauthorization, development of science education standards, and state partnerships). In addition, there are efforts to coordinate the work of the multiple, relevant federal agencies, and activities such as the *Education for Innovation* initiative from the Department of Education, an effort to dramatically improve student learning in science, math, and reading. Additionally, in November, President Obama announced public/private partnerships to spur further activity, and in January, the White House held an event to recognize excellent teachers. Further, in May, federal agencies supported National Lab Day, an online resource for connecting teachers, scientists, and engineers. In general, interest in STEM education has increased. For example, 15 years ago, there was debate as to whether NIH had any role in K-12 science education, but the current NIH Director has been interested in STEM education from the earliest days of his appointment to that position. In addition, the NIH Curriculum Supplements Series offers, at no cost, 17 science teaching units for K-12 teachers, including one entitled, *The Science of Healthy Behaviors* (available at http://science.education.nih.gov). Efforts such as these to improve STEM education are opportunities to ensure that STEM education represents all of the sciences.

Another exciting initiative is the joint effort of the National Governors' Association (NGA) and the Council of Chief State School Officers (CCSSO) to create common standards for reading, math, and science across the states. Currently there is no single standard in science; rather, there are 50 state standards. The development of math standards offers a rich literature and research base that could be incorporated into efforts to create standards for the sciences. The behavioral and social sciences community recognizes the need to be a part of activities to develop science standards and could look to this literature to inform their efforts. In addition, the development of science standards that include the behavioral and social sciences would address the gap that currently exists between primary, secondary, and post-secondary education in these disciplines. It would ameliorate the current situation of students' leaving high school lacking the foundational behavioral and social science knowledge that prepares them for college level work.

Recently, environmental education has become incorporated into STEM education and has been positioned as important in the context of national and international policy. The behavioral and social sciences community must also convey the importance of our sciences as critical for U.S. competitiveness in the global economy. It is important to build on success stories and develop examples of cases in which behavioral and social science contributions can answer questions of interest to policymakers and the general public, *e.g*., responses to disasters such as Hurricane Katrina.

Finally, it is important to continue to support behavioral and social sciences research to inform education. The *Eunice Kennedy Shriver* National Institute of Child Health and Human Development (NICHD) is strongly interested in the science of learning. Learning is a multi-level process of developing the capacity to grasp and reason about the physical world. Research investment in this basic science of learning is critical so that education is grounded in how individuals learn and process information.

Cultural, Social, and Institutional Forces Shaping Views of Behavioral and Social Science

A Discussion led by Martha Zaslow, PhD, Director, Office for Policy and Communications, Society for Research in Child Development; Felice Levine, PhD, Executive Director, American Educational Research Association.

Leadership is important for shaping views of science. At the national level, the Office of Science and Technology Policy (OSTP), the National Institutes of Health (NIH), the National Science Foundation (NSF), the National Academies (NAS), and the American Association for the Advancement of Science (AAAS) all have the capacity to leverage leadership in the development of STEM education. Yet questions remain: How can standards that integrate behavioral and social sciences into STEM education be developed? The NSF report[2] is a work in

progress; another model can be found in the National Academies report, *From Neurons to Neighborhoods*.[8]

The Division of Social and Economic Sciences of the NSF became the separate Directorate for Social, Behavioral and Economic Sciences (SBE) in the early 1990s; it has reached out and formed partnerships with other directorates. Because SBE has permanent staff, relationships can be developed, and gradual but persistent progress is evident. Behavioral and social sciences at NIH, in contrast, are more distributed throughout the Institutes and Centers. There are multiple avenues to be pursued to strengthen these disciplines within a science funding agency. First, advocacy for the sciences by agency leadership is critically important. Second, concepts from the behavioral and social sciences should be integrated as appropriate when research and training initiatives are being developed. Once introduced and understood and their value accepted, these concepts become part of the standard language upon which future efforts can be built. Third, certain topics demand the inclusion of behavioral and social sciences research. For example, science to inform the successful implementation of health care reform, an issue of increasing importance to the NIH, includes health economics — and recognition of the importance of this social science discipline then becomes a catalyzing issue for its inclusion in research initiatives. Structure at funding agencies is also important.

Consideration of non-school settings as venues in which the view of behavioral and social sciences as "science" can be shaped is also important. The movement in the out-of-school arena is in part led by the NSF's Division of Research on Formal and Informal Learning (DRL) within the Directorate for Education and Human Resources. Public engagement in science can be fostered through ongoing efforts to work with the Scouts, science museums, and other organizations. For example, the Museum of Science in Boston engages visitors, including families, in psychological experiments as exhibits. The theoretical issues and the nature of the experiments in which visitors are engaged must be made clear to them, but it is a way of showing that psychology is a science.

An additional problem that needs to be addressed is our culture's general lack of understanding of science. People see science as a collection of visible facts and lack any appreciation of the inferential length between science facts and theory. People do not know the kinds of questions addressed, models made, etc. If the public understood the nature of science, it would be easy to see that behavioral and social sciences are STEM disciplines. The solution to this problem includes communication efforts, *e.g.*, public relations and image campaigns to get people engaged in science. The public perception of the framework of science needs to be changed from collections of facts to critical thinking.

Fostering the view that science entails critical thinking would also help combat misinformation, which is increasingly being packaged in "science-ese". Preschool, kindergarten, and elementary

[8] National Research Council and Institute of Medicine. *From Neurons to Neighborhoods: The Science of Early Childhood Development*. Washington, DC: National Academy Press; 2000.

school are important points for early entry into scientific consciousness-raising and thinking, as are media efforts (*e.g.*, television, social media, etc.).

Project 2061 (see below) is a long-term initiative of AAAS designed to help all Americans become literate in science, mathematics, and technology. This will improve individuals' abilities to make sense of reports in the news, and make informed decisions about monetary crises, health care reform, etc. That goal of science literacy for all is different from creating a new generation of scientists, but a scientifically literate public will be able to appreciate science even if they do not become scientists.

Finally, evidence obtained from behavioral and social sciences research can and should be used to inform how scientists engage with the public, as well as efforts to change the public understanding of science. Chris Mooney (*The Republican War on Science*, 2005[9]) is talking about a new innovation in science: scientists' perception of the public. Behavioral and social sciences research can contribute to our understanding and amelioration of why the public does not understand scientific phenomena or stands firm on ideological ground. Moreover, findings from research in these scientific disciplines, *e.g.*, how and why people change attitudes, can inform legislative and policy-making efforts to effect change.

STEM Education Reform and the Behavioral and Social Sciences

Bruce A. Fuchs, PhD, Director, Office of Science Education, NIH

The Obama Administration's goals for education are, by 2020, to have the United States be first in the world in college graduation rates, and for K-12 to move from the middle of the pack to the top; 40 years ago the United States as ranked number one in the world for the rate of high school graduation, but this is no longer the case. International comparisons using, for example, the PISA 2006 test that assesses the performance of 15-year-olds in science, reading, and mathematics, reveal the relatively poor performance of U.S. students. Overall, the United States scores in the middle, but among rich nations, the United States is at the bottom, even though it spends more than most other countries. Top U. S. students were in 24th place.

The National Assessment of Education Progress (NAEP) is the only U. S. example of (voluntary) national testing standards. One elementary school focus is the 4th grade. This is when teachers stop teaching students to learn to read, and students begin to read to learn; it is a critical time for elementary education. Many states have their own assessments, but state standards for proficiency tend to be lower as compared to the NAEP. For example Mississippi considered 88% of their 4th-graders proficient where NAEP considered 18% proficient; Maryland, 82% vs. 32%; and Massachusetts, 48% vs. 44%. Shifting to higher educational levels, Richard J. Murnane and Frank Levy, in *Teaching the New Basic Skills* (1996)[10], listed skills needed to get a middle-class job as: read at a 9th grade level, do math at a 9th grade level, solve problems with hypotheses, be able to work with diverse people, be able to communicate effectively both orally

[9] Mooney, C. *The Republican War on Science*. NY: Basic Books, Inc., 2005.
[10] Murnane, R.J., & Levy, F. *Teaching the new basic skills: Principles for educating children to thrive in a changing economy*. NY: Free Press, 1996.

and in writing, and be able to use personal computers for basic tasks. But only 50% of U. S. students leave high school without these skills. Consider further that the gross domestic product (GDP) more than doubled between 1947 and 1973 while household income increased 79%; but between 1973 and 2008, while GDP again more than doubled, household income increased by only 10%. Between 1973 and 2008, median earnings for men declined by 4% (the 30% increase for women likely reflects other influences).

Lynn Dierking, PhD, Professor of Science Education and Free Choice Learning, Oregon State University

Among the issues not yet mentioned is first, the need to include underserved communities in this discussion. But in addition, schools are not always places of innovation or places reaching children and youth effectively to engage them. The challenge is how to motivate interest and passion both in and out of school. Tai, Sadler and Mintze's study of people who are successful in college revealed that the most important factor was the students' desire in the 7th and 8th grades to succeed in college[11]. Examples of successes must be found to create tipping points and to build on them.

Jo Ellen Roseman, PhD, Director, Project 2061, American Association for the Advancement of Science (AAAS)

Project 2061 (http://www.project2061.org/) was founded in 1985 to help all Americans become literate in science, mathematics, and technology. In 1991, the first publication, a synthesis of scientific enterprise called *Science for all Americans*[12], laid out knowledge presented as coherent stories about the world that a literate adult should know as a basis for learning more. However, it became clear that educators needed tools to assist in the development of curricula to meet the content standards articulated in *Science for All Americans*. This led to the development of *Benchmarks for Science Literacy* (1993)[5], which specifies how students should progress toward science literacy, recommending what they should know and be able to do by the time they reach certain grade levels. Together, the two publications can help guide reform in science, mathematics, and technology education.

Project 2061's *Atlas of Science Literacy*[13] and *Designs for Science Literacy* (2001)[14] provide additional tools to inform the successful implementation of the *Benchmarks for Science Literacy*. The *Atlas of Science Literacy* uses existing research data to show how students' understanding of the ideas and skills that lead to literacy in science, mathematics, and technology might develop. *Designs for Science Literacy* focuses on strategies and techniques for aligning the entire K-12 curriculum to specific learning goals such as Project 2061's *Benchmarks*, national standards in

---

[11] Tai, R. H., Sadler, P. M., & Mintzes, J. J. Factors influencing college science success. *Journal of College Science Teaching.* 35(8), 56 – 60, 2006.
[12] Rutherford, F, J., & Ahlgren, A. *Science for All Americans*. NY: Oxford University Press, 1991; http://www.project2061.org/publications/sfaa/online/sfaatoc.htm accessed March 18, 2011.
[13] American Association for the Advancement of Science. *Atlas for Science Literacy*. Volumes 1 and 2. Washington, D.C.: AAAS, 2000; http://www.project2061.org/publications/atlas/default.htm accessed March 18, 2011.
[14] American Association for the Advancement of Science. *Designs for Science Literacy*. Washington, D.C.: AAAS, 2001, http://www.project2061.org/publications/designs/default.htm accessed March 18, 2011.

science and mathematics, or state and local frameworks. In doing so, it addresses many of the considerations and constraints that attend curriculum design.

In addition to the activities described above, Project 2061 team has engaged in benchmarks-based evaluations of middle and high school biology textbooks, and middle school math books, for content alignment with the National Research Council's *National Science Education Standards*[6] and Project 2061's *Benchmarks for Science Literacy*[5]. This textbook evaluation exercise has not been done in the social sciences because there has been no national push to incorporate them. Project 2061 would be delighted to work with people in behavioral and social sciences.

In addition to performing research, Project 2061 develops tools and services—books, CDs, on-line resources, professional development, and public outreach—that educators, researchers, parents and families, and community leaders can use to make critical and lasting improvements in the nation's education system.

Discussion

The following issues were raised during the discussion:

- What can we learn from other countries? Do other countries have benchmarks and agreed-upon rubrics for science education? Most countries have national curricula and national testing, which means that teachers are educated to implement those curricula. Finland, for example, has no national standards, but does have a clear examination and thus, a clear goal for students' knowledge acquisition. Germany has the same kind of education system the United States does, including the same fights. However, similar negative results nearly caused a national crisis and served as a wake-up call. Why is the wake-up call and sense of crisis not experienced here?
- Which grade level might be appropriate for the introduction of behavioral and social sciences? A range of views was expressed. There could be experimentation in the K-6 curriculum, embedding strengths of behavioral and social sciences, teaching the elementary principles of how to frame a question, how to distinguish a concept, a hypothesis, and a variable. In fact, such pilot efforts are in place in some schools. Others would not recommend starting in elementary grades because an unintended consequence of No Child Left Behind (NCLB) is that science has been eliminated from the elementary curriculum. Moreover, most elementary teachers do not see themselves as science teachers. Introduction of behavioral and social sciences during high school might be difficult as well, since the curriculum is tight and is geared toward college admission. However, in various high school courses, after the final tests for the year are completed, there is a lame-duck period in which interesting work in behavioral and social sciences could be done. Perhaps the "sweet spot" for behavioral and social sciences instruction is middle school, and there may outside organizations interested in working with schools to help with this.
- In addition to introducing behavioral and social science content to the K-12 curriculum, it is important not to lose sight of the importance of student's development of reasoning and other skills (*e.g.*, critical thinking), that are needed for success in many other subjects and in fact, throughout life. These can and should be taught even in the absence of science

curricula. Moreover, since fundamental concepts of reasoning come out of behavioral and social sciences research, this presents another opportunity to use the findings from these sciences to improve education. *Science for all Americans*[12] does have a chapter on this. Knowledge in and of itself will not be useful without those habits of mind and skills.

Report Summaries: NRC Board on Science Education Conceptual Framework for Science Education Standards, and APA Task Force on Psychology as a STEM Discipline

Martin Storksdieck, PhD, Director, Board on Science Education (BOSE), The National Academies (NAS)

The National Academies is a non-governmental organization founded in 1863 to bring together committees of experts in all areas of scientific and technological endeavor, and charged to address critical national issues and advise the federal government and the public. A draft of *Conceptual Framework for Guiding New K-12 Science Education Standards*[7], a framework designed to help those who want to develop standards, is now available for public review and feedback. The conceptual framework is a representation of core ideas in science with examples of performance expectations. Standards are an elaboration of core ideas into K-12 outcomes. The goal is to prepare students to be ready for the work force, for college, and for life. To provide intellectual guidance and blend current understanding of teaching and learning with new developments in science, the authors used a two-stage process: first get the science right and bring in research, then embark on developing standards. The NRC study committee consists of highly respected scientists and engineers and experts on science education, learning sciences, and educational system policy. There were four design teams. The NRC process is to convene stakeholder meetings for informed input, conduct study committee and design teams, draft the conceptual framework, review feedback, and finalize the report. This report will be released early in 2011.

The Committee concluded that less content should be taught, but it should be taught more clearly. Principles of the framework are the following: children are born investigators; understanding develops over time; science is more than a body of knowledge; effective teaching and learning connect to students' interests and experience; and equity will be promoted. A core idea for K-12 science instruction is defined as a scientific idea or practice that has broad importance across multiple science or engineering disciplines or is a key organizing concept to a single discipline. A core idea provides a key tool for understanding or investigating more complex ideas and solving problems. It relates to the interests and life experiences of students or can be connected to societal or personal concerns that require scientific or technical knowledge. Finally, a core idea is teachable and learnable over multiple grades at increasing levels of sophistication and depth.

The Framework addresses Life Sciences, Earth and Space Sciences, Physical Sciences, and Engineering and Technology, each of which has four core disciplinary ideas. For example, in Life Sciences, a core idea is: "Organisms have structures and functions that facilitate their life processes, growth, and reproduction." A core idea for Earth and Space Sciences is: "Human

activities are constrained by and, in turn, affect all other processes at Earth's surface." Cross-cutting science concepts are: patterns, similarity, and diversity; cause and effect, *i.e.* mechanism and prediction; scale, proportion, and quantity; systems and system models; energy and matter, *i.e*., flows, cycles and conservation; form and function; and stability and change. Topics include History and Cultural Roles of Science, Engineering and Technology; and Impact of Societal Norms and Values on the Practices of Science and Engineering. The framework ends with a chapter on performance expectations and a large table of detailed prototype learning progressions.

The NRC Board on Science Education (BOSE) welcomes comments on the draft framework (http:www7.nationalacademies.org/bose/StandardsFrameworkHomepage.html or http://www.nas.edu/bose).

Stephen Pruitt, Director of Science, Achieve

Achieve is an education think tank, created in 1996 by the nation's governors and corporate leaders. It is an independent, bipartisan, non-profit education reform organization based in Washington, DC that helps states raise academic standards and graduation requirements, improve assessments, and strengthen accountability. It is in the business of supporting states with developing their own college rating and standards, and it is helping to lead the effort for standards development. To do this, *Achieve* is in the process of developing action plans for the NRC Conceptual Framework (described above), once it is handed off. Just as AAAS began by getting the scientific community involved, *Achieve* believes that transparency, partnership, and engagement are the only way to ensure that the states will adopt standards. *Achieve's* focus is on students doing science, not just viewing it, and are also building and linking knowledge over time into their action plans. Beginning with work The National Academies have done with cognitive ability of children, *Achieve* will next ensure broad stakeholder involvement.

Achieve has an international benchmark study focused on standards of other countries to inform how they develop the framework to put students in a position where they can be competitive. The biggest focus is not simply supporting The National Academies, but getting the science right first. Now *Achieve* needs partners to provide more context, examples, and opportunities for children and teachers.

Rena F. Subotnik, PhD, Associate Executive Director, Education Directorate, American Psychological Association (APA)

Psychology as a Core Science, Technology, Engineering, and Mathematics (STEM) Discipline[15] is the report of the 2009 Presidential Task Force, which will be published August 11, 2010. (http://www.apa.org/science/about/psa/2010/08/stem-report.pdf). The goal of the task force was to look at the status of psychology as a STEM discipline; articulate problems of inconsistent recognition of psychology as a core STEM discipline; provide a rationale for consistent

[15] *Psychology as a Core Science, Technology, Engineering, and Mathematics (STEM) Discipline* Report of the American Psychological Association 2009 Presidential Task Force on the Future of Psychology as a STEM Discipline, 2010.

recognition of psychology as a STEM discipline; and recommend specific actions to achieve this outcome.

The report notes that psychology contributes directly as a basic science and indirectly as a collaborator or "handmaiden," as a source of statistical analysis, and contributor to the study of teaching, learning, and assessment. For example, contributions of psychology include how people use products and inventions, diagnosing and treating post-traumatic stress disorder, and improving displays in airplane cockpits.

A sampling of the report's recommendations includes:

- Create interdisciplinary research centers targeting specific problems.
- Increase the number of psychological scientists at STEM agencies and on boards, panels and senior staffs.
- Increase recognition of psychological scientists in scientific panels and honorific societies.
- Increase funding for training graduate students and early career professionals in STEM-related activities (we need more psychologists who are quantitatively focused—most become clinicians).
- Increase sources where psychological sciences are eligible for STEM funding.
- Increase resources for teaching psychology as a lab and quantitative science.
- Include psychological sciences in courses required for general STEM education.
- Acknowledge psychological sciences' contribution to teaching, learning and assessment in STEM.
- Include extended F-1 visas for students.
- Increase women and minorities in sub-disciplines where they are underrepresented.
- Include psychological science instructors in initiatives to expand quantity and quality of STEM teachers.

A meeting of the Science Leadership Conference will be convened in November, 2010 to develop these ideas. We also need to consider how we should address the less scientific elements in our community (*e.g.*, how to foster advocacy in this area), and how we can incorporate more science into curricula and have more faculty capable of doing that. In addition, the science of persuasion – a behavioral/social science – should be harnessed to achieve success in this regard.

Discussion

Issues raised during the discussion included the following:

- Teaching science inquiry and method is a challenge, since teachers, particularly elementary school teachers, often have little background in science and have not done research themselves. Teachers may be fearful because of their own learning experiences with science when they were students, which often turned them off, and it will be hard to turn them back on.
- Again, there are opportunities to harness behavioral and social sciences research to inform the teaching of science. There is research and there are conceptual frameworks related to how children learn science, beginning at an early age. One recommendation, particularly on the nature of conceptual change at the elementary school level, is the work

of Sister Gertrude Hennessey (a practitioner/Ph.D. in science education), who has been successful working with young students by focusing on ideas and reasoning skills, rather than specific focus on content. Barriers often have more to do with teachers than with the students themselves. Behavioral and social scientists have an opportunity to help define the next steps, *i.e.,* what is needed for pre- and in-service training to move that training forward.

- The BOSE draft *Framework* described above is a missed opportunity, as it excludes behavioral and social sciences as core disciplines. When science standards are developed, all of the sciences should be included. As described earlier, opinion leaders are needed to point out the importance of including behavioral and social sciences in any efforts to develop science frameworks and standards.
- In the BOSE draft *Framework,* not everything is done all the time, but on a learning progression. Examples can be found in the table at the end of the framework. The vision written in the framework is that science is accumulated over time. How likely this is to be implemented is another question.

Research Priorities & Next Steps for the Social and Behavioral Sciences and STEM Education

A Discussion, Facilitated by Drs. Olster, Carey, and Levine, around Specific Questions

What research questions should be addressed to inform the more visible and successful inclusion of behavioral and social sciences in STEM education?

- In the education arena, research is needed on how best to train teachers to educate students in the behavioral and social sciences. The challenge is to produce teachers who understand the scientific content that they are teaching, when they will likely have little background in these sciences.
- It is important to confirm the assumptions being made. For example, although it is intuitively attractive, research is needed to test the hypothesis that the use of curricula designed to teach children to think scientifically will improve their problem-solving abilities.
- Given the earlier discussion about public understanding (or lack thereof) of science in general and perceptions behavioral and social sciences, in particular, a communications research agenda is needed. Exploration of how different audiences respond to messages, for example, will guide the development of effective communications activities, tailored to different relevant audiences.
- It would be useful to map these research questions on to a framework to show how they relate to one another.

How can the understanding of behavioral and social sciences be improved? Does that happen at the graduate level? How can the general public become more knowledgeable about the behavioral and social sciences?

- Create compelling examples of behavioral and social sciences research, including experiments (*e.g.*, optical illusion tasks such as the "young girl/old woman" image), for use in classrooms and other venues.
- Scientific reasoning and scientific method should be taught regardless of the particular discipline. Such early exposure will improve individuals' abilities to conceptualize problems, and will also facilitate the resolution of disputes, understanding of issues, and elevation of public understanding to better appreciate all of the sciences.
- One specific topic to tackle is the difference between correlation and causation. Improving the understanding of causal inference would be enormously useful for allowing the public to draw valid conclusions from many research findings with which they are presented.
- Infuse behavioral and social sciences as examples throughout science curricula to disabuse people of the common notion that human behavior is free from influence and operates magically. It is not enough that "social studies" textbooks represent behavioral and social sciences; "social studies" are not in the sciences, so behavioral and social sciences are delivered inappropriately.
- Tailor communication vehicles and content for the particular audience (*e.g.*, student, teacher, administrator, policy maker).

Is there a shortage of behavioral or social scientists? What are workforce needs for the future and how can these needs be met?

- Training and investment in career preparation in behavioral and social sciences is needed. Sustaining careers in science is an economic recovery issue.
- Perhaps middle school is a target to improve the pipeline of future behavioral and social scientists as this is a point where many children get lost from science.
- The issue of diversity needs to be on the table. Students get away from math early and behavioral and social sciences research might lead to more successful approaches to capture their interest.

Open Discussion, Wrap-up, and Next Steps

Suggestions for next steps included the following:

- Invite additional groups to these discussions: the National Association of Education of Young Children (NAEYC), Institute of Museum and Library Services, Association of Science and Technology Centers, Center for Advancement of Informal Education; and funding organizations, such as the Noyce Foundation in Palo Alto, which has a project studying the kind of environment that furthers science education. Many private foundations are looking at this issue. The after-school arena and community-based social services organizations should also be included.
- Liaison with the National Governors' Association (NGA) and the Council of Chief State School Officers (CCSSO).
- Comment constructively on the BOSE conceptual *Framework*[7].
- Host a congressional seminar with maybe three presentations on what can be learned in behavioral and social sciences.
- Write an editorial for *Science* or *American Scientist.*

- Use behavioral and social sciences research to achieve the goals of today's workshop: identifying ways to embed behavioral and social sciences as core components of STEM education; defining strategies to increase public understanding of behavioral and social sciences; enhancing awareness of the value of these sciences; and creating a stronger career pipeline for behavioral and social scientists.

Appendix

Panelists

Susan Carey, Professor of Psychology and Chair, Harvard University
Lynn Dierking, Professor of Science Education and Free Choice Learning, Oregon State University
Bruce Fuchs, Director, Office of Science Education, NIH
Elisa Klein, Office of Behavioral and Social Sciences Research, NIH
Michael Lach, Special Assistant for STEM Education, Department of Education
Felice Levine, Executive Director, American Educational Research Association
Deborah Olster, Acting Director, Office of Behavioral and Social Sciences Research, NIH
Stephen Pruitt, Director of Science, Achieve
Steven J. Robinson, White House Domestic Policy Council
Jo Ellen Roseman, Director, Project 2061, American Association for the Advancement of Science
Paula Skedsvold, Executive Director, Federation of Associations in Behavioral and Brain Sciences
Martin Storksdieck, Director, Board on Science Education, National Academies of Science
Rena F. Subotnik, Associate Executive Director, Education Directorate**,** American Psychological Association
Patricia White, Acting Deputy Director, Social and Economic Sciences, National Science Foundation
Marty Zaslow, Director of Policy and Communications, Society for Research in Child Development

Speaker Biographies

Susan Carey, PhD
Professor and Chair
Department of Psychology
Harvard University
William James Hall
33 Kirkland Street
Cambridge, MA 02138
scarey@wjh.harvard.edu

Susan Carey is a Professor of Psychology at Harvard University. She is a renowned expert in language acquisition and is known for introducing the concept of fast mapping, whereby children learn the meanings of words after a single exposure. Dr. Carey received a BA from Radcliffe College in 1964 and a PhD from Harvard University in 1971. She was employed at the Massachusetts Institute of Technology from 1972 to 1996 and New York University from 1996 to 2001 before joining the faculty at Harvard University in 2001, where she is currently chair of the psychology department. Carey is a fellow of the National Academy of Sciences and has received many academic awards and distinctions, including the Jean Nicod Prize for philosophy of mind in 1998, and the Rumelhart Prize in 2008.

Lynn Dierking, PhD
Sea Grant Professor in Free-Choice Learning
Department of Science & Mathematics Education
College of Science
Oregon State University
235 Weniger Hall
Corvallis, OR 97331
Tel: 541-737-1823
dierkinl@science.oregonstate.edu

Lynn Dierking is a Professor of Free-Choice Learning in the Science & Mathematics Education (SMED) Department, College of Science, Oregon State University, a comprehensive lifelong learning research program, integrating K-12, Collegiate Teaching and Free-Choice Learning concentrations. The program supports a community of researchers conducting studies that cross settings, ages and backgrounds; students also build specific knowledge and expertise in their specialty area. Over her career, Dr. Dierking has worked in a range of educational settings: as a middle and high school science teacher, a researcher at the Smithsonian Office of Educational Research, as coordinator of a business-education STEM partnership project, a science educator at University of Maryland's College of Education and director of a middle school curriculum project, *Science in American Life*, at the Smithsonian's National Museum of American History. Prior to joining OSU, Dr. Dierking was a Senior Researcher and Vice President for Special Initiatives at the Institute for Learning Innovation, a not-for-profit research organization in Maryland, focused on understanding lifelong free-choice learning. Her work centers on the long-term learning of children, youth and families; the development and evaluation of community-based efforts; public engagement in STEM, and the communication of complex STEM topics such as conservation, climate change and health issues. She publishes extensively and serves on the Editorial Boards of *Science Education* and the *Journal of Museum Management and Curatorship*. Currently she is co-PI on a NSF-funded research project at the Franklin Institute in Philadelphia, investigating long-term impacts of gender-focused free-choice learning experiences on interest, engagement, and involvement in science.

Bruce A. Fuchs, PhD
Director
Office of Science Education
National Institutes of Health
6100 Executive Boulevard, Suite 3E01
Bethesda, MD 20892
Tel: 301-402-5225
bruce.fuchs@nih.gov

Dr. Bruce A. Fuchs is currently the Director of the National Institutes of Health's (NIH) Office of Science Education (OSE). Dr. Fuchs is responsible for monitoring a range of science education policy issues and providing advice to NIH leadership. He also directs the creation of a series of K-12 science education curriculum supplements that highlight the medical research findings of the NIH. The *NIH Curriculum Supplement Series* is designed to meet teacher's educational goals as outlined in the *National Science Education Standards* and is available free to teachers across the nation. Teachers have requested the seventeen titles currently in the series more than 375,000 times. The office also actively creates innovative science and career education Web resources, such as the *LifeWorks* career exploration site, accessible to teachers and students across the nation. These resources are available at http://science.education.nih.gov.

Dr. Fuchs is currently serving as a co-chair of the Education Subcommittee of the *National Science and Technology Council* (NSTC). For a number of years Dr. Fuchs was the NIH representative to the Department of Education's *National Education Research Policy and Priorities Board* (NERPPB). That experience led to his continuing interest in the debate over how to make educational research more effective. Prior to coming to NIH, Dr. Fuchs—an immunologist who did research on the interaction between the brain and the immune system—was a researcher and teacher on the faculty of the Medical College of Virginia.

Elisa Klein, PhD
SRCD/AAAS Science and Technology Policy Fellow
Office of Behavioral and Social Sciences Research
National Institutes of Health
31 Center Drive
Building 31, Room B1C19
Bethesda, MD 20892
Tel: 301-435-6780
kleinel@od.nih.gov

Elisa Klein is a Society for Research in Child Development and American Association for the Advancement of Science Executive Branch Science and Technology Policy Fellow in the Office of Behavioral and Social Sciences Research at the National Institutes of Health. Executive branch fellows work in various federal agencies to learn about the federal policy making process and the role of science in that process, and provide scientific expertise to policy makers throughout government.

Dr. Klein comes to the fellowship from her position as an Associate Professor in the Department of Human Development and the Institute for Child Study at the University of Maryland, College Park, where she teaches graduate and undergraduate courses in child development, social policy, early education, and social science teaching methods, and conducts research on child social policy, teacher education and young children's development. She was a Visiting Scientist and Child Development Research Fellow in

the Research, Demonstration and Evaluation Branch of the Administration on Children and Families in HHS during an earlier leave from her academic position. Dr. Klein was also the director of the University of Maryland's first child care research and demonstration program, the Center for Young Children. Prior to her positions at Maryland, she was a faculty member at The Ohio State University, Columbus. She has worked extensively with the Maryland State Department of Education in the development of early childhood policies such as universal preschool education, and has been a consultant to many local, non-profit, and governmental agencies, including Head Start, The Children's Defense Fund and the National Science Foundation. Dr. Klein holds an undergraduate degree in Psychology from Kalamazoo College, and M.S. and PhD degrees in Human Development from The Pennsylvania State University.

Michael Lach
Special Assistant for STEM Education
U.S. Department of Education
Michael.Lach@ed.gov

Michael Lach leads science, mathematics, engineering, and technology education efforts at the U. S. Department of Education. Previously, Michael was Officer of Teaching and Learning for the Chicago Public Schools, overseeing curriculum and instruction in the 600+ schools that comprise the nation's third largest school district. Mr. Lach began his professional career teaching high school biology and general science at Alceé Fortier Senior High School in New Orleans in 1990 as a charter member of Teach For America, the national teacher corps. After 3 years in Louisiana, he joined the national office of Teach For America as Director of Program Design, developing a portfolio based alternative-certification system that was adopted by several states. Returning to the science classroom in 1994 in New York City Public Schools, and then back to Chicago in 1995 to Lake View High School, he was named one of Radio Shack's Top 100 Technology Teachers, earned National Board Certification, and was named Illinois Physics Teacher of the Year. He has served as an Albert Einstein Distinguished Educator Fellow, advising Congressman Vernon Ehlers (R-MI) on science, technology and education issues. He was lead curriculum developer for the *Investigations in Environmental Science* curriculum developed at the Center for Learning Technologies in Urban Schools at Northwestern University and published by It's About Time, Inc. As an administrator with the Chicago Public Schools, he led the district's instructional improvement efforts in science and mathematics in a variety of roles between 2003 and 2007. He has written extensively about science teaching and learning for publications such as *The Science Teacher, The American Biology Teacher,* and *Scientific American.* He earned a bachelor's degree in physics from Carleton College, and master's degrees from Columbia University and Northeastern Illinois University.

Felice Levine, PhD
Executive Director
American Educational Research Association
1430 K Street NW, Suite 1200
Washington, DC 20005
Tel: 202-238-3200
flevine@aera.net

Felice Levine is Executive Director of the American Educational Research Association. Previously she was Executive Officer of the American Sociological Association. She was also Director of the Law and Social Science Program at the National Science Foundation (NSF) and Senior Research Social Scientist at the American Bar Foundation. She holds AB, AM, and PhD degrees in sociology and psychology from the University of Chicago. Dr. Levine's work focuses on research and science policy issues, research ethics, data access and sharing, the scientific and academic workforce, and higher education. She is

currently collaborating on a major NSF-supported assessment of education research doctorate programs in U.S. universities, and is principal investigator of the AERA Grants Program and member of its Governing Board.

Dr. Levine served on the National Human Research Protections Advisory Committee of the U.S. Department of Health and Human Services and on the 2000 Decennial Census Advisory Committee. She also served on the National Research Council (NRC) panel that produced the report, *Putting People on the Map: Protecting Confidentiality with Linked Social-Spatial Data* and chaired the recent NRC workshop on *Protecting Student's Records and Facilitating Education Research*. In addition, she co-authored *Education and Training in the Social, Behavioral, and Economic Sciences: A Plan of Action*. This report to the National Science Foundation was published in May 2004.

Dr. Levine is Associate Editor of the *Journal of Empirical Research on Human Research Ethics*. She also serves on the Executive Committee of the Consortium of Social Science Associations, is Vice Chair of the Board of Directors of the Council of Professional Associations on Federal Statistics, and is Secretary General of the newly established World Education Research Association. She is also a Fellow of the American Association for the Advancement of Science, the American Educational Research Association, and the Association for Psychological Science as well as an elected member of the International Statistical Institute. She is also a past President of the Law and Society Association.

Deborah H. Olster, PhD
Acting Director
Office of Behavioral and Social Sciences Research
National Institutes of Health
31 Center Drive
Building 31, Room B1C19
Bethesda, MD 20892
Tel: 301-402-1147
olsterd@od.nih.gov

Deborah H. Olster, PhD joined the Office of Behavioral and Social Sciences Research (OBSSR) in 2002 and is currently serving as its Acting Director. She came to the NIH following completion of an American Association for the Advancement of Science/National Science Foundation (NSF) Science and Technology Policy Fellowship in 2000–2001. Prior to that, Dr. Olster was a Professor of Psychology at the University of California, Santa Barbara. Since joining OBSSR in 2002, she has developed extramural research programs at the intersection of the biological, behavioral and social sciences. Dr. Olster participates in several trans-NIH activities, including the NIH Roadmap for Medical Research, the NIH Genes, Environment and Health Initiative, the NIH Obesity Research Task Force, the NIH Blueprint for Neuroscience Research, and the NIH Basic Behavioral and Social Science Opportunity Network.

Dr. Olster earned a PhD in Physiology from The University of Michigan, after which she did postdoctoral work in the Department of Obstetrics and Gynecology at the College of Physicians and Surgeons of Columbia University and in the Department of Psychology at the University of Massachusetts, Amherst. Her primary research focus has been the neuroendocrine control of reproduction. With support from the NIH and the NSF, she has investigated seasonal and pubertal transitions in reproductive function, sexual motivation, and reproductive dysfunction related to stress, obesity and under-nutrition, using a variety of animal models. She has also collaborated on research projects related to stress hormones and human behaviors, the regulation of food intake and body temperature in laboratory animals and color perception and seasonal sexual displays in Australian bowerbirds.

Stephen L. Pruitt, PhD
Director of Science
Achieve, Inc.
1775 Eye Street NW, Suite 410
Washington, DC 20006
Tel: 202-419-1540
Fax: 202-828-0911

Stephen Pruitt joined Achieve as the Director of Science in July of 2010. Stephen began his career as a high school Chemistry teacher in Georgia, where he taught for 12 years. In 2003, he joined the Georgia Department of Education (GaDOE) as the Program Manager for Science. He served in that role for 4 years before becoming Director of Academic Standards, where he oversaw the continued implementation of the Georgia Performance Standards in all content areas. In 2008 he became the Associate Superintendent of Assessment and Accountability, responsible for directing all state assessments and overseeing the No Child Left Behind accountability process. In April 2009, Stephen became Chief of Staff to State School Superintendent Kathy Cox, coordinating the work of the agency and a variety of projects such as Georgia's third-ranked Race to the Top application. In addition to his state-level work, Stephen also served as President of the Council of State Science Supervisors and a member of the writing team for the College Board's *Standards for College Success* Science Standards. Most recently, he served on the National Academies of Science's Committee on Conceptual Framework for New Science Education Standards, which is developing the framework for the Next Generation Science Education Standards. A native Georgian, Stephen earned a bachelor's degree in chemistry from North Georgia College and State University, a master's in science education from the University of West Georgia, and a doctorate of philosophy in chemistry education from Auburn University.

Steven J. Robinson, PhD
White House Domestic Policy Council
Steven_j.robinson@who.eop.gov

Steve Robinson is on assignment to the White House Domestic Policy Council from the Office of Elementary and Secondary Education at the Department of Education. Dr. Robinson served as the Legislative Assistant for education in the office of then-Senator Barack Obama, advised on policy development during the presidential campaign, and worked on education issues with the Obama-Biden Presidential Transition Team. Dr. Robinson first joined the office of Senator Obama in July 2005, supported as a fellow through the Albert Einstein Distinguished Educator Fellowship Program. During his time as a Senate staffer, he also served as a mentor for students in the DC public schools, as a reading tutor for elementary grade students and as a math tutor with middle school students. Prior to joining Senator Obama's office, Dr. Robinson was a high school science teacher in Eugene, Oregon. He grew up in the suburbs of Chicago, earned a degree in Biology at Princeton University, and then a PhD in Cellular and Molecular Biology at University of Michigan. On the Biology faculty at the University of Massachusetts, he headed a laboratory and mentored PhD students. His teaching experience includes more than 15 years in the classroom at middle school, high school, and postsecondary levels.

Jo Ellen Roseman, PhD
Director
Project 2061
American Association for the Advancement of Science
1200 New York Avenue, NW

Washington, DC 20005
Tel: 202-326-6752
jroseman@aaas.org

Jo Ellen Roseman is director of Project 2061 of the American Association for the Advancement of Science and oversees its programs and activities aimed at improving education in science, mathematics, and technology for all students. Dr. Roseman joined Project 2061 with the release of *Science for All Americans* in 1989 and has been involved in the development, testing, and dissemination of its subsequent tools, including *Benchmarks for Science Literacy*, *Resources for Science Literacy: Professional Development*, *Atlas of Science Literacy* and its current effort to design assessments of science literacy. Her research focuses on the selection of important and appropriate learning goals for all K-12 students and their use in designing and analyzing curriculum, assessment, and teaching materials. Dr. Roseman is the principal investigator for the Center for Curriculum Materials in Science, funded through the National Science Foundation's (NSF) Center for Learning and Teaching program; several projects focused on climate literacy that funded by NSF, the National Oceanic and Atmospheric Administration (NOAA), and the National Aeronautic and Space Administration (NASA); and a curriculum development project funded by the U.S. Department of Education and focused on middle and high school chemistry and biology. Dr. Roseman's PhD in biochemistry is from the Johns Hopkins University.

Paula R. Skedsvold, JD, PhD
Executive Director
Federation of Associations in Behavioral and Brain Sciences
750 First Street NE, Suite 905
Washington, DC 20002
Tel: 202-336-5920
pskedsvold@fabbs.org

Paula Skedsvold serves as Executive Director of the Federation of Associations in Behavioral & Brain Sciences (FABBS) and the FABBS Foundation. In this capacity, she represents the interests of twenty-two scientific societies in the sciences of mind, brain, and behavior and promotes efforts to educate the public about the contributions of these sciences to the well-being of individuals and society. Through this role, she has become actively engaged in promoting the behavioral and social sciences as integral to STEM and STEM education. Dr. Skedsvold previously staffed the Social and Behavioral Sciences Working Group of the National Human Research Protections Advisory Committee, an advisory committee for the Secretary of the U.S. Department of Health and Human Services. She has also served as Science Policy Analyst for the National Institutes of Health's Office of Behavioral and Social Sciences Research and as a Congressional Science Fellow supported by the American Psychological Association. Dr. Skedsvold was previously Director of Education Research Policy for the American Educational Research Association, Scientist in the Public Interest for the Society for the Psychological Study of Social Issues, and Adjunct Professor at Georgetown Law. She holds a PhD in Experimental Psychology from the University of South Carolina and a JD from the Georgetown University Law Center.

Martin Storksdieck, PhD
Director
Board on Science Education
The National Academies
500 Fifth Street NW, 1153
Washington, DC 20001
Tel: 202-334-3987

mstorksdieck@nas.edu

Martin Storksdieck is the director of the Board on Science Education at the National Academy of Sciences/National Research Council where he oversees studies that address a wide range of issues related to science education (*e.g.*, climate change education, science learning from games and simulations, developing a conceptual framework for new science education standards, discipline-based education research). Dr. Storksdieck also serves as a research fellow at the not-for-profit Institute for Learning Innovation, where he is involved in research on science learning in immersive environments; models of involving researchers and scientists in science museums and science centers; and understanding the impact of science hobbyists, such as amateur astronomers, on the public understanding of science. His areas of interest include factors that influence what and how we learn when we do so voluntarily and how this "learning" is connected to our behaviors, identities and beliefs; the role of personal and perceptual filters in science learning, particularly of controversial topics such as climate change or evolution; and how schools and out-of-school learning can be mutually enhancing in creating and sustaining lifelong interest in (science) learning. He holds a Masters in Biology from the Albert-Ludwigs University (Freiburg, Germany), a Masters in Public Administration from Harvard University, and a PhD in education from Leuphana University (Lüneburg, Germany).

Rena F. Subotnik, PhD
Director of the Center for Psychology in Schools and Education
Associate Executive Director
Education Directorate
American Psychological Association
750 First Street, NE
Washington, DC 20002
Tel: 202-336-5923
rsubotnik@apa.org

Rena F. Subotnik, PhD began her position at APA in 2002. Before she came to APA, Dr. Subotnik was professor of educational psychology and research design at Hunter College where she also coordinated the secondary education program and served as research liaison to the Hunter College laboratory schools (grades PK-12). In 1997–1998, Dr. Subotnik was an APA Congressional Fellow in child policy with U.S. Senator Jeff Bingaman. Since arriving at APA, Dr. Subotnik has been awarded grants from the National Science Foundation, McDonnell Foundation, Institute for Education Sciences, Jack Kent Cooke Foundation, Camille and Henry Dreyfus Foundation, and the American Psychological Foundation. She is a 2009 Fellow of the American Educational Research Association.

Currently, Dr. Subotnik is PI of an ongoing NSF funded study of specialized science high schools and their impact on the science research pipeline, as well as the Catalyst Program funded by the Camille and Henry Dreyfus Foundation serving adolescents gifted in physical sciences. She is co-editor (with Bruce Thompson) of *Methodologies for Conducting Research on Giftedness (2010)*, (with Frances Horowitz and Dona Matthews) of *Developing Giftedness and Talent Across the Life Span (2009);* (with Robert Sternberg) of *Optimizing Student Success with the Other Three R's* (2006); (with Herbert Walberg) *The Scientific Basis of Educational Productivity* (2005); (with Kurt Heller, Franz Monks, and Robert Sternberg) *The International Handbook of Research on Giftedness and Talent* (2000); *Remarkable Women: Perspectives on Female Talent Development* (1997); *Beyond Terman*: *Contemporary Longitudinal Studies of Giftedness and Talent* (1994); and the author of *Genius Revisited: High IQ Children Grown Up* (1993).

Patricia White, PhD
Acting Deputy Director
Division of Social and Economic Sciences
National Science Foundation
4201 Wilson Boulevard
Arlington, VA 22230
Tel: 703-292-8762
pwhite@nsf.gov

Patricia White is currently Acting Deputy Director, Division of Social and Economic Sciences at the National Science Foundation (NSF), where she has been employed since 1988. Dr. White has held several positions at NSF. She served as the permanent Program Director for the Sociology Program, Coordinator of the Social and Political Sciences Cluster, as a senior analyst in the NSF's Division of Science Resources Statistics, and also held Program Officer positions in the Methodology, Measurement and Statistics, and Law and Social Science programs. Over the past five years she has taken a leadership role in defining and articulating "scientific standards" for qualitative research in the social sciences for both investigators developing proposals and reviewers evaluating the merit of the research, co-authoring reports on *Scientific Foundation of Qualitative Research* and *Interdisciplinary Standards for Qualitative Research.* She actively participates in Cross-Directorate activities, having recently served on coordinating committees for on-going research and education initiatives such IGERT (Integrative Graduate and Education Traineeships) and HSD (the Human and Social Dynamics priority area), and presently manages the SBE Alliances for Graduate Education and the Professoriate. She represents NSF on several project boards --the General Social Survey Board of Overseers; the International Integrated Micro-Data Series (IPUMS-International) advisory board; and Luxemburg Income Study board. She is also active in the American Sociology Association, was recently elected to the Committee on Nominations, served on the 2009 Annual Meeting Program Committee and currently serves on the Committee for the Public Understanding of Sociology Award. Prior to coming to NSF, Dr. White was an operations research analyst in the Research Division at the Internal Revenue Service in Washington, DC. Dr. White received her bachelor degree in sociology from the University of Maryland, Eastern Shore; and her MA and PhD degrees in sociology from The Ohio State University.

Martha Zaslow, PhD
Director
Office for Policy and Communications
Society for Research in Child Development
mzaslow@srcd.org

Martha Zaslow, PhD, is a developmental psychologist who received her PhD from Harvard University in personality and developmental psychology and her BA degree in psychology from Cornell University. She is Director of the Office for Policy and Communications of the Society for Research in Child Development (SRCD). Dr. Zaslow was previously the Vice President for Research and Director of the Early Childhood Program Area at Child Trends, a research organization that conducts and disseminates research on children and families in the United States. She is continuing her affiliation with Child Trends as a Senior Scholar. As Director of the SRCD Office for Policy and Communications, Dr. Zaslow facilitates the dissemination of research to decision-makers and the broader public through congressional briefings, research briefs, and press releases focusing on research in SRCD's primary peer reviewed journal. She also monitors and keeps the SRCD membership apprised of social policy and science policy developments related to children and families. She works with the SRCD Policy Fellows who have placements in the Executive Branch or Congress. As a Senior Scholar at Child Trends,

Dr. Zaslow conducts research focusing on the development of young children and programs and policies to support their development. Dr. Zaslow serves on the Advisory Council for the Child Care and Early Education Research Connections website and is part of the planning committee for Head Start's Tenth National Research Meeting. She recently served on the Committee on Developmental Outcomes and Assessments of Young Children of the National Academies of Science.

Participant Roster

Cynthia Allen, MA
Office of Science Education, National Institutes of Health
Tel: 301-580-8473
allency@od.nih.gov

Tony Beck, PhD
National Center for Research Resources, National Institutes of Health
Tel: 301-435-0805
beckl@mail.nih.gov

Juliana M. Blome, PhD, MPH
National Institute of General Medical Sciences, National Institutes of Health
Tel: 301-594-2762
blomeju@nigms.nih.gov

Kerry Bolger, PhD
American Educational Research Association
Tel: 202-238-3222
kbolger@aera.net

Rosalina Bray, MS
National Institute of General Medical Sciences, National Institutes of Health
Tel: 301-443-1852
Rosalina.Bray@nih.gov

Sarah Brookhart
Association for Psychological Science
Tel: 202-293-9300 ext. 120
sbrookhart@psychologicalscience.org

Susan Carey, PhD
Department of Psychology, Harvard University
scarey@wjh.harvard.edu

Fahmida N. Chowdhury, PhD
Program Director, Cross-Directorate Activities, Social, Behavioral and Economic Sciences, National Science Foundation
Tel: 703-292-4672
fchowdhu@nsf.gov

Lynn Dierking, PhD
Department of Science and Mathematics Education, Oregon State University
Tel: 541-737-1823
dierkinl@science.oregonstate.edu

Carla L. Easter, PhD
National Human Genome Research Institute, National Institutes of Health
Tel: 301-594-1364
easterc@mail.nih.gov

Susan Elrod, PhD
Project Kaleidoscope, Association of American Colleges and Universities
Tel: 202-884-0804
elrod@aacu.org

Kevin Foster, PhD
National Science Foundation
kmfoster@nsf.gov

Catherine Fry, PhD
Mobilizing STEM Education for a Sustainable Future
Tel: 301-486-7684
catherinelfry@gmail.com

Bruce A. Fuchs, PhD
Office of Science Education, National Institutes of Health
Tel: 301-402-5225
bruce.fuchs@nih.gov

Paul Gaist, PhD
Office of AIDS Research, National Institutes of Health
Tel: 301-496-0357
paul.gaist@nih.gov

Daniel L. Goroff, PhD
dgoroff@ostp.eop.gov

DeLeon L. Gray
Office of Science Education, National Institutes of Health
deleon.gray@nih.gov

Michelle R. J. Hamlet, PhD
National Human Genome Research Institute, National Institutes of Health
Tel: 301-450-3645
hamletm@mail.nih.gov

Lee Herring
American Sociological Association
Tel: 202-247-9859
herring@asanet.org

Alla Keselman, PhD
National Library of Medicine, National Institutes of Health
keselmana@mail.nlm.nih.gov

Jiwon Kim, BA
National Library of Medicine, National Institutes of Health
Tel: 301-496-5963
kimj1@mail.nlm.nih.gov

Elisa Klein, PhD
Office of Behavioral and Social Science Research, National Institutes of Health
Tel: 301-435-6780
elisa.klein@nih.gov

Sacha Klein, PhD
sachaklein@gmail.com

Pat Kobor, MA
American Psychological Association
pkobor@apa.org

Michael Lach
U.S. Department of Education
Michael.Lach@ed.gov

Felice Levine, PhD
American Educational Research Association
Tel: 202-238-3200
flevine@aera.net

Kathy Mann-Koepke, PhD
National Institutes of Health
KMK@nih.gov

Keith A. Mintzer, PhD
National Heart Lung and Blood Institute, National Institutes of Health
Tel: 301-594-7947
mintzerk@mail.nih.gov

Jean Moon, PhD
National Research Council, National Academy of Sciences
Tel: 202-334-2432
jmoon@nas.edu

Deborah H. Olster, PhD
Office of Behavioral and Social Sciences Research, National Institutes of Health
Tel: 301-402-1147
olsterd@od.nih.gov

Stephen L. Pruitt, PhD
Achieve, Inc.
Tel: 202-419-1540

Steven J. Robinson, PhD
White House Domestic Policy Council
steven_j.robinson@who.eop.gov

Jo Ellen Roseman, PhD
Project 2061, American Association for the Advancement of Science
Tel: 202-326-6752
jroseman@aaas.org

Catherine Sasek, PhD
National Institute on Drug Abuse, National Institutes of Health
Tel: 301-443-6071
csasek@nih.gov

Angela Sharpe, MG
Consortium of Social Science Associations
Tel: 202-842-3525 ext. 202
alsharpe@cossa.org

Paula R. Skedsvold, JD, PhD
Federation of Associations in Behavioral and Brain Sciences
Tel: 202-336-5920
pskedsvold@fabbs.org

Martin Storksdieck, PhD
Board on Science Education, The National Academies
Tel: 202-334-3987
MStorksdieck@nas.edu

Rena F. Subotnik, PhD
American Psychological Association
Tel: 202-336-5923
rsubotnik@apa.org

Cindy Wei, PhD
National Science Foundation
Tel: 703-292-8403
cwei@nsf.gov

Patricia White, PhD
National Science Foundation
Tel: 703-292-8762
pwhite@nsf.gov

Jeff Witherly, PhD
National Human Genome Research Institute, National Institutes of Health
Tel: 301-402-7333
jlw@mail.nih.gov

Martha Zaslow, PhD
Society for Research in Child Development
mzaslow@srcd.org

Agenda

7:30am – 8:30am **Registration and Continental Breakfast**

8:30am – 9:00am **Welcome, Introductions and Plans for the Day**

Elisa Klein, PhD
SRCD/AAAS Science and Technology Policy Fellow, Office of Behavioral and Social Sciences Research (OBSSR), National Institutes of Health (NIH)

Deborah H. Olster, PhD
Acting Director, OBSSR, NIH

9:00am – 9:15am **Framing the Issue**

Elisa Klein, PhD
OBSSR, NIH

9:15am – 10:00am **Federal Perspectives on the Social and Behavioral Sciences and STEM Education and STEM Education Reform**

Introduction: *Bruce A. Fuchs, PhD*
Director, Office of Science Education, NIH

Steven J. Robinson
White House Domestic Policy Council

Michael Lach
Special Assistant for STEM Education, U.S. Department of Education

10:00am – 10:15am **Break**

10:15am – 11:00am **What are the Core STEM Sciences?**

Facilitators:

Paula R. Skedsvold, JD, PhD
Executive Director, Federation of Associations in Behavioral and Brain Sciences

Susan Carey, PhD
Professor of Psychology and Chair, Harvard University

Patricia White, PhD
Acting Deputy Director, Division of Social and Economic Sciences, National Science Foundation

Thought Questions:

- What are the criteria for identifying STEM science?
- Should there be a definition of STEM science?
- How do the behavioral and social sciences fit into STEM?

11:00am – 12:00pm **Cultural, Social, and Institutional Forces Shaping Views of Behavioral and Social Science**

Facilitators:

Martha Zaslow, PhD
Director, Office for Policy and Communications, Society for Research in Child Development

Felice Levine, PhD
Executive Director, American Educational Research Association

Thought Questions:

- What are the forces (social, economic, cultural, historical, etc.) that have contributed to inconsistent placement of the social and behavioral sciences in STEM education?
    - What does it take to change public perception of social and behavioral science?
- What are public perceptions of the behavioral and social sciences?
    - Will inclusion of BSS in STEM education increase public understanding of the behavioral and social sciences in general?

12:00pm – 12:15pm **Open Discussion**

12:15pm – 1:30pm **STEM Education Reform and the Behavioral and Social Sciences** (*Working Lunch*)

Facilitators:

Jo Ellen Roseman, PhD
Director, Project 2061, American Association for the Advancement of Science

Bruce A. Fuchs, PhD
Director, Office of Science Education, NIH

Lynn Dierking, PhD
Professor of Science Education and Free Choice Learning, Oregon State University

Thought Questions:

- What is known about the placement of the behavioral and social sciences in school curricula?
    - Are there schools which already identify the BSS as part of the science curricula?
    - What are the barriers to integrating the BSS into the science curricula in elementary and secondary schools?
- What are the most important ideas for learners (K-12) to know in the social and behavioral sciences?
- What areas in the social and behavioral sciences might serve as useful contexts for applying ideas and skills in other science subjects (including the nature of science) and mathematics – and vice versa?

- Does the inclusion of the BSS in K-12 curricula make a difference in public perception of science?
- Would inclusion of BSS in K-12 curricula (and beyond) improve the pipeline of BSS scientists?
  - What are the best ways to develop strategies for creating a stronger pipeline for behavioral and social scientists, in both research and applied settings?

1:30pm – 2:30pm **Report Summaries** (*pending release*): **NRC Board on Science Education Conceptual Framework for Science Education Standards, PCAST Report on STEM Education, APA Task Force on Psychology as a STEM Discipline**

Facilitators:

Martin Storksdieck, PhD
Director, Board on Science Education, The National Academies

Rena F. Subotnik, PhD
Associate Executive Director, Education Directorate, American Psychological Association

Thought Questions:

- Are the behavioral and social sciences adequately incorporated into in the proposed conceptual frameworks for science standards?
- How are standards proposed by behavioral and social science professional organizations (*e.g.,* Voluntary National Standards in Economics, National Standards for the Teaching of Psychology) consistent with current broad science standards?

2:30pm – 2:45pm **Open Discussion**

2:45pm – 3:00pm **Break**

3:00pm – 4:00pm **Research Priorities for the Social and Behavioral Sciences and STEM Education**

Facilitators:

Susan Carey, PhD

Deborah Olster, PhD

Felice Levine, PhD

Thought Questions:

- What are the projected work force needs for behavioral and social scientists in the future?
  - Are we currently meeting the needs?
  - What are alternate career paths for behavioral and social scientists?
- What is the influence of BSS content in elementary and secondary school on future career interests?

- Do learners exposed to the BSS as part of the overall science curriculum in school develop different attitudes, beliefs and career interests compared to those who complete traditional science curricula?

- Are there adequate training opportunities and support for behavioral and social scientists (research and applied)?
- Does improved behavioral and social science education enhance public understanding of the behavioral and social factors related to health, environment, national security and other critical global issues?

4:00pm – 4:30pm **Open Discussion, Wrap Up and Next Steps**

Elisa Klein, PhD

4:30pm **Adjourn**