Testimony of
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Chairman Baird, Ranking Member Ehlers, and members of the Subcommittee. Thank you very much for inviting me to testify before you today on science, technology, engineering, and mathematics (STEM) education.

This Subcommittee's commitment to excellence in STEM education at the National Science Foundation (NSF) is well known, and we are extremely appreciative of your long-standing support.

As you are well aware, the NSF provides leadership at the Federal level to advance learning and discovery in all disciplines of science and engineering and to foster connections among the disciplines. The Director of NSF, Dr. Arden Bement, has presented the case eloquently: "Our job is to keep science and engineering visionaries focused on the furthest frontier, to recognize and nurture emerging fields, to prepare the next generation of scientific talent, and to ensure that all Americans gain an understanding of what science and technology have to offer."

The questions for today's hearing center on the coordination of STEM-related programs, the evaluation of those programs, and the dissemination of information about effective strategies. These long have been central concerns for NSF, as is evident in activities we have undertaken over the years. But we are cognizant of changes looming on the horizon that will require heightened attention to coordination, research and evaluation as well as dissemination.

On Coordination and Collaboration.

The National Science Foundation works in partnership with the research and education community to promote excellence. Hence, for us effectiveness is indicated in no small part by the connections we establish and maintain with researchers and educators as well as with agencies and organizations that share our commitment to excellence in STEM education. We seek opportunities to foster exchanges on matters critical to such excellence. An example: the conference held recently on state standards for mathematics. What gave rise to the conference were the development by states of different standards, the efforts of several national organizations to align those standards, and the interest of state supervisors of mathematics in exchanging ideas and experiences. The conference, held in February 2007, featured presentations on recommendations regarding standards

and engaged "users" of standards -- state and district curriculum specialists, textbook and assessment publishers, K-12 district and teacher leaders, and representatives from higher education and business. The National Science Foundation served as a co-sponsor of the conference, along with Achieve, Inc., the American Statistical Association, the College Board, the Mathematical Association of America, and the National Council of Teachers of Mathematics. The idea for the conference emerged from an NSF-sponsored entity: the Center for the Study of the Mathematics Curriculum at Michigan State University. That Center organized the conference, in concert with the State Supervisors of Mathematics. The case illustrates that NSF takes a broad approach to the challenges associated with coordination and collaboration.

Our approach to coordination and collaboration extends beyond the formal education sector to include important activities in promoting understanding of science in the wider public. Towards that end, NSF organized in March 2007 a workshop on informal science activities conducted through science centers, museums, community projects and the media. The workshop brought designers of informal science initiatives together with program evaluators, to generate guides for the evaluation of such initiatives. The workshop included representatives from other Federal agencies. Again, the action reinforces the theme that NSF supports coordination through outreach – to various communities and agencies – on matters relevant to STEM educational policies and practices.

The informal science workshop demonstrates, too, that NSF both endorses and seeks to provide leadership on program evaluation. The evaluation efforts are tailored to the goals and state of development for any given program. Moreover, NSF invests in research and evaluation, not just to assess outcomes, but also to build knowledge about and a community prepared to advance STEM research and evaluation.

A distinctive feature of the NSF STEM education portfolio is its breadth. Not only does it incorporate program development as well as research, and the informal as well as formal sectors; it addresses the pre-college realm, undergraduate and graduate education, post-doctoral experiences, and the STEM workforce of the nation. This breadth has profound implications for the collaborations NSF undertakes, the evaluations it supports, and the dissemination strategies it pursues.

Subcommittee Questions

Having provided a general context for the questions central to this hearing, let me now turn more specifically to those questions.

1. As co-chair of the NSTC Subcommittee on Education and Workforce Development, please describe the make up of the group, current activities, and planned activities.

In response to the Academic Competitiveness Council (ACC) report, the Subcommittee is being re-constituted through representation from the agencies that comprise the Committee on Science of the National Science and Technology Council (NSTC). The

representatives are to possess (1) substantive knowledge of STEM education programs within the given agency's portfolio, and (2) experience with evaluation research and/or the development and application of performance measures. These requirements will enable the Subcommittee to meets its initial goal to coordinate and facilitate implementation of the ACC recommendations. The Subcommittee is also expected to address a range of issues related to STEM education at all levels.

2. What steps has your agency taken to improve its coordination with other federal agencies' STEM education activities? How has your agency improved its collaboration with states and districts in developing STEM education programs? Please describe your agency's commitment to establishing formal mechanisms to improve in these areas.

Past coordination activities include formal memoranda of understanding with the Department of Education (ED) and the National Institutes of Health (NIH) in 1992 and with the Department of Energy in 1995. Through the Interagency Educational Research Initiative, launched in 1999, NSF, NIH, and the U.S. Department of Education sponsored a program of research designed to develop and/or investigate the effectiveness of educational interventions in classrooms across the United States.

Earlier this year, NSF signed a memorandum of understanding on STEM education cooperation with National Aeronautics and Space Administration (NASA). The goal of this partnership is to support the development of a creative and diverse engineering workforce that comprehends the technical and social impacts of technology applications and needs in a rapidly changing environment. Interactions with NASA precede the memorandum, however, and include our joint participation on a task force "to examine the feasibility and benefits of using a portion of the International Space Station payload resources and accommodations for education."

Among the ways in which NSF cooperates with the Department of Education, these especially warrant notice. A memorandum of understanding enabled the NSF and ED to fund jointly two of the large projects in our Math and Science Partnership (MSP) programs. Moreover, almost two-thirds of the sites in the NSF portfolio have some involvement as well with the state MSP projects that ED supports.

In 2005 the U.S. Department of Education and the Education and Human Resources (EHR) Directorate of the National Science Foundation began collaborating on a Mathematics Education Toolkit. The Toolkit provides resources for state and district leaders on how to improve mathematics teaching and learning for Title I students. The Toolkit represents a response to concerns that states and districts have expressed. The workshop on standards, cited earlier, provides another example of the NSF connections beyond the Federal level.

The coordination challenges in the years ahead will extend beyond those found among Federal agencies. Increasingly, foundations and corporations are investing in STEM education and the workforce. The National Science Foundation has a leadership role

within the ACC and is committed to establishing whatever connections and mechanisms offer heightened possibilities for innovation in STEM education within the United States.

3. The ACC report reinforces the need for better evaluation and performance metrics for federal STEM education programs. How has your agency made improvements in its evaluation of programs? How has this affected your agency's funding for STEM education programs?

The emphasis in NSF on program evaluation precedes the ACC report. A Congressional mandate in 1992 set in motion a systematic plan for assessment of programs within the EHR portfolio. The approach has evolved quite significantly over time, from one focused largely on the monitoring of developments to evaluations of impacts. The evolution has reinforced the importance of enhanced capacity for evaluation of STEM programs and accounts, then, for investments NSF has made in increasing expertise on evaluation.

EHR education programs require project and program evaluations, and there is now greater emphasis on collecting evaluation information at the start of a program. The evaluation of a program's value, worth, and impacts is based on a multiplicity of assessment and review studies. NSF evaluation efforts range from periodic measures of project activities to in-depth analyses of a program's success. Quantitative and qualitative data are obtained to measure a program's success in achieving its goals.

Our current approach encompasses a multiple method evaluation framework that combines theory and research to better understand and assess the R&D educational investment. This methodological pluralism enables programmatic decision-making to be based on the preponderance of the evidence from external studies. Through the NSTC, we will work to improve evaluation for STEM education initiatives across the Federal government, including at NSF, to ensure that the most rigorous methods appropriate are used to assess Federal programs.

4. How does your agency determine priorities for its K-16 STEM education portfolio? Has your agency's balance of programs at graduate/post doctoral, undergraduate, K-12, and informal education changed? Do you foresee a change in that balance in the future?

Issues for the K-16 STEM education portfolio emerge from various sources. The staff within NSF consists of specialists on STEM education within given disciplines, researchers with on-going connections to resources and knowledge, and experts on trends in STEM education in the United States and elsewhere. The panels that review proposals, the Committees of Visitors for our programs, and the Advisory Committees for each directorate keep us abreast of developments and interests. In recent years, reports on STEM education have yielded many recommendations, as have the priorities established in both the Executive and Legislative branches. In determining priorities for NSF funding, consideration is given to the capacity of external communities to pursue given lines of inquiry, the activities underway through other agencies and organizations, and the appropriateness of the topics for the NSF portfolio.

The Foundation strives to address a broad portfolio for STEM education, but does not have a formula for investments at each educational level. The substance of those investments does not remain static, however, for it must reflect changes over time in knowledge, national needs, and capacities within our communities and NSF.

5. How does your agency disseminate information about its STEM education programs? What organizations, both government and private, have your partnered with to reach educators in the field?

The National Science Foundation disseminates information about its programs and the results of its investments through various channels. There are websites for particular programs. These include IGERT.ORG, a website produced by the Integrative Graduate Education Research and Traineeship (IGERT) program that seeks to attract to STEM research groups now under-represented in science and engineering. Communication and collaboration among MSP partners is promoted through MSPNet. Similarly, the Center for Learning in Out of School Environments (UPCLOSE) at the University of Pittsburgh serves to link researchers and educators who want to enhance teaching and learning in informal environments.

Publications from the National Academy of Sciences serve to share widely the results from NSF-investments. Among these: the path-breaking volumes, *Adding it Up: Helping Children Learn Mathematics,* and *Taking Science to School.*

Our outreach efforts are extensive. What we intend to undertake in the near future is an assessment of the effectiveness of our strategies in reaching underserved communities – of educators, researchers, and institutions. Such an assessment, to be pursued in connection with our panels, advisory communities, and public and private partners, may result in modifications to our outreach efforts.

We in NSF will not rest on past achievements or accolades. Rather, we will continue to strive to foster and tap the creativity this nation needs for the success of our citizenry in the years ahead.