Testimony of
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Senate Health, Education, Labor and Pensions Committee
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Chairman Alexander, Ranking Member Dodd, and Members of the Committee, I appreciate the opportunity to testify before you on a topic of great importance to me personally and to the nation's future – the state of mathematics, science, and technology education in our elementary and secondary schools.

As you are well aware, the National Science Foundation has been selected to play a major role in the President's American Competitiveness Initiative. One of the cornerstones of our involvement is preparing the nation's scientific, technological, engineering, and mathematics workforce for the 21st Century while improving the quality of math and science education in America's schools.

NSF's investments in research and education – in discovery, learning, and innovation – have a longstanding and proven track record of boosting the nation's economic vitality and competitive strength. Today's youngsters face a world of increasing global competition. We depend on the excellence of U.S. schools and universities to provide them with the wherewithal to meet this challenge and to make their own contributions to America's future. We need to build strong research foundations and foster innovation in K-12 science and mathematics education.

In line with the Administration's focus on this vital national priority, and in partnership with the Department of Education, NSF will invest $104 million in a new effort named Discovery Research K-12 that aims to strengthen K-12 science, technology, engineering and mathematics education. We will refocus our efforts on a vital cluster of research in three well-defined grand challenges:

- Developing effective science and mathematics assessments for K-12;
- Improving science teaching and learning in the elementary grades; and
- Introducing cutting-edge discoveries into K-12 classrooms.

We will also increase funding for the Graduate Teaching Fellowships in K-12 Education—better known as GK-12—by nearly 10 percent to $56 million, supporting an estimated 1000 graduate fellows. By pairing graduate students and K-12 teachers in the classroom, this program has been particularly successful in encouraging effective partnerships between institutions of higher education and local school districts.

In our budget request NSF proposes a reorganization of the Education and Human Resources Directorate so that we can more effectively focus NSF's contributions to improving science, technology, engineering and mathematics (STEM) education to include greater emphasis on effective evaluation of the programs we fund. The American Competitiveness Initiative provides a framework for research agencies that support STEM education programs to work more collaboratively and with a greater attention to evaluating the efficacy of these programs.

Last week the National Science Board released its biennial report, *Science and Engineering Indicators*. This document is a compilation of up-to-date quantitative data on the U.S. scientific and engineering research and education enterprise. It provides a summary of the scope and quality of various facets of that enterprise and provides a wealth of information for policymakers.

One of the striking trends in the overview chapter is documentation of the pace of the increasing internationalization of science and technology. Graph after graph show the worldwide growth of investments in research and development, the increase in international scientific publications, and the expanding production of science and engineering degrees in Europe and Asia,

On the plus side, the U.S. share of the world's high technology manufacturing (aerospace, pharmaceuticals, office and computing equipment, communications equipment, and scientific instruments) grew from 25 percent in 1990 to nearly 40 percent in 2003. But a larger question is whether we are training new entrants into the high tech workforce with the skills they will need for these jobs.

The *Science and Engineering Indicators* devotes an entire chapter to elementary and secondary education in mathematics and science. While there is clearly some good news on this front, we have room for improvement.

For example, between 17% and 28% of public high school math and science teachers lack full certification in their teaching field. College graduates who become teachers tend to take fewer rigorous academic courses in high school, scored lower on college entrance exams, and graduated from less selective colleges.

A number of programs at NSF are aimed at improving various aspects of K-12 education. Within our Division of Elementary, Secondary and Informal Education we have programs that support a range of activities, including the development of new curricula, new pedagogical techniques, better ways to train K-12 teachers, educational activities that take place out of the classroom, and the application of new technologies to education.

In addition, we have numerous programs within our Research and Related Activities Directorates targeted at improving K-12 education. Examples of these include:

- The aforementioned GK-12 fellowship program which provides support for graduate students to provide science and engineering expertise in elementary and secondary schools;

- Research Experiences for Teachers, which provide hands-on research opportunities for K-12 teachers working with NSF Grantees;

- Science of Learning Centers;

- Geoscience Teacher Training designed to improve the quality of geoscience instruction at middle and high school levels;

- Centers for Ocean Science Education Excellence (COSEE) to promote ocean education as an exciting vehicle to interest students in science and enhance science education.

Even the most innovative programs, however, will not result in improving STEM achievement unless we find ways to scale them up and remove impediments to their broad adoption. That is where NSF's coordination with the Department of Education is important. I have met personally with Secretary Margaret Spellings and I believe we have a shared sense of mission to identify and implement high quality programs that will result in improvements in student performance. When three quarters of American colleges find it necessary to offer courses in remedial mathematics and 22 percent of entering freshman take these courses, it is clear that our high schools are not doing the job they should be doing.

Let me turn for a moment to address several of the provisions in S. 2198 that are directed at NSF, including Sec. 132, NSF scholarships for mathematics and science teachers. This Section would authorize NSF to award merit-based scholarships of up to $20,000 per year to students majoring in mathematics, science or engineering who also pursue teacher certification.

This program very closely parallels the existing Robert Noyce Scholarship program at NSF, except that the Noyce program makes awards to institutions rather than individuals. The grantee institutions are then responsible for administering the scholarship program. The benefit of this approach is that it places the management of the scholarship program – selecting recipients, setting course requirements, monitoring progress, counseling students, assisting with placement, ensuring compliance with post graduation requirements, and so forth – in the hands of the college or university.

When we established the Noyce Scholarship program we felt that it would be inefficient, if not impossible, to duplicate that management structure at NSF. Estimates were that it would cost up to one-third of the scholarship funding for administration purposes, should we choose to run the program at NSF. By comparison, the Noyce Scholarship program is administered by the recipient institutions for a 10 percent overhead. For these reasons we feel that the current Noyce scholarship program is preferable to the program proposed in the PACE-Education bill.

A second provision in the PACE Education bill specific to NSF is Section 141, which would establish NSF Fellowships for Mathematics and Science Teachers. This program would provide up to $10,000 annually for four years to support ~~for~~ certified math, engineering or science teachers who teach in their specialty areas in high-need school districts. Teachers with a Master's degree in science or mathematics education could receive 5 years' support for undertaking additional leadership responsibilities such as mentoring.

Incentives to attract and retain high-quality science, mathematics and engineering teachers in the K-12 education system should be encouraged. Fellowships for Mathematics and Science could help achieve these goals, but we should examine this proposal in terms of potential cost-effectiveness. As a hypothetical example, if we applied $100 million a year (a very large program by NSF standards), we would support 10,000 teachers annually. In 5 years, we would have placed the equivalent of approximately 4 Fellowship teachers in each of the nation's school districts Ironically, the average length of a career for math and science teachers is about 5 years. The challenge is clearly not just one of recruitment of trained math and science teachers, but also their retention.

It is not the case that because we cannot do everything, we should do nothing. Because resources are limited, however, we must be very judicious in identifying and supporting programs that will have the greatest impact, all the while recognizing that many of the decisions on taking steps to improve math and science education will be made by local school districts.

A number of other programs that would be established in the PACE legislation, although not at NSF, are reflective of the types of activities NSF has supported over the years. We have, for example, ongoing programs such as the Centers for Learning and Teaching; the Mathematics and Science Partnerships Teacher Institutes; Early Career Awards; and incentives for high-risk/high-payoff research projects. In light of the ACI provision to evaluate ongoing programs, I feel that implementing any programs that replicate those at NSF should await a review of existing programs in order to determine where the greatest promise for making a national impact lies.

Finally, Mr. Chairman, let me extend my thanks to you your leadership examining opportunities to improve innovation and competitiveness in America. I look forward to working with you and the Committee to help identify, and better develop, the pipeline of future leaders in math and science. S. 2198 is being reviewed by the Administration, and we would appreciate the opportunity to provide views on the bill's provisions prior to further consideration by the Committee. I would be happy to answer any questions that you may have.