March 6th, 2012

The Honorable John Holdren
Co-Chair, President's Council of Advisors on Science and Technology
Director, Office of Science and Technology Policy
White House
1600 Pennsylvania Avenue, NW
Washington, DC 20500

Dear Dr. Holdren:

The National Center for Women and Information Technology (NCWIT) is pleased to provide the requested comments to you and the President's Council of Advisors on Science and Technology (PCAST) concerning unimplemented recommendations for K-12 computing and computer science education made in prior PCAST reports.

Specifically, two prior reports are relevant: the September 2010 Report, ***Prepare and Inspire: K-12 Education in Science, Technology, Engineering, and Math (STEM) for America's Future*** and the December 2010 Report, ***Designing a Digital Future: Federally Funded Research and Development Networking and Information Technology***. This letter seeks to reiterate the following recommendations as previously submitted by PCAST, and make suggestions for moving forward.

The September 2010 PCAST report, ***Prepare and Inspire: K-12 Education in Science, Technology, Engineering, and Math (STEM) for America's Future***, recommends a definition of K-12 "STEM Education" that includes computer science, a definition that is not yet in common use in federal and local STEM policy and education discussions:

"STEM education," as used in this report, includes the subjects of mathematics, biology, chemistry, and physics, which have traditionally formed the core requirements of many state curricula at the K-12 level. In addition, the report includes other critical subjects, such as computer science, engineering, environmental science, and geology, with whose fundamental concepts K-12 students should be familiar.

We noted how helpful it would be to explicitly mention computer science as a STEM discipline in our recent conversation with you on February 14th, 2012.

On page 50, the report further expands on the importance of K-12 computer science education:

Computer-related courses should aim not just for technological literacy, which includes such utilitarian skills as keyboarding and the use of commercial software packages and the Internet, but for a deeper understanding of the essential concepts, methods and wide-ranging applications of computer science. Students should gain hands-on exposure to the process of algorithmic thinking and its realization in the form of a computer program, to the use of computational techniques for real-world problem solving, and to such pervasive computational themes as modeling and abstraction, modularity and reusability, computational efficiency, testing and debugging, and the management of complexity.

The report goes on to mention model-computing curriculum put forth by organizations such as the Association for Computing Machinery (ACM), the National Science Foundation (NSF) and the College Board. Although these efforts are progressing they could benefit from accelerated support from the White House. Other topics discussed included teacher preparation and the technology readiness of public schools.

The December 2010 PCAST report **Designing a Digital Future: Federally Funded Research and Development Networking and Information Technology** noted in Section 8.2 that:

NIT (Networking and Information Technology) pervades modern life. Every citizen – not just the NIT professional – needs to be fluent with information technology. The various dimensions of "NIT fluency" were the subject of a landmark 1999 National Academies study that has stood the test of time remarkably well. Fluency obviously involves a set of skills, such as using a word processor or spreadsheet, using the Internet to find information and resources, and using a database system to set up and access information. But fluency also involves a set of concepts and capabilities that have little to do directly with the use of a computer, but rather have to do with "computational thinking. Basic concepts of computational thinking include abstraction, modeling, algorithmic thinking, algorithmic efficiency and analysis, stepwise fault isolation, and universality. Basic capabilities include algorithmic expression, managing complexity, and evaluating information.

The report then went on to make this recommendation:

If Americans are to acquire proficiency in all levels of computing, their education must begin when they are children. Fluency with NIT skills, concepts, and capabilities; facility in computational thinking; and an understanding of the basic concepts of computer science must be an essential part of K-12 STEM education.

We hope pointing out these unimplemented PCAST recommendations is helpful to you. This letter is particularly timely in light of the release of the recent PCAST report, **Engage to Excel: Producing One Million Additional College Graduates with Degrees in Science, Technology, Engineering, and Mathematics**, which states:

College level skills in mathematics and, increasingly, computation are a gateway to other STEM fields. Today many students entering college lack these skills and need to learn them if they are to pursue STEM majors.

Closing this gap will require coordinated action on many fronts. While some states allow computer science courses to count toward a secondary school core graduation requirement, most states that have specific course requirements for graduation count computer science courses only as electives. Many states also do not have a certification process for computer science teachers, and where certification processes do exist, such processes often have no connection to computer science content.

To reverse these troubling trends and prepare Americans for jobs in this high-wage, high-growth field, the Computing in the Core Coalition, of which NCWIT is a member, believes we must:

- Ensure computer science offerings are an integral part of the curriculum;
- Develop state computer science standards, curricula, and assessments;
- Improve access to underserved populations;
- Create professional development and teacher certification initiatives, including computer science teacher preparation programs in higher education;
- Form a commission on computer science education to bring states together to address the computer science teacher certification crisis; and,
- Establish an independent, rigorous evaluation of state efforts with reporting back to Congress and the administration.

Congressman Polis and Senator Casey have put forth these recommendations in the Computer Science Education Act as introduced in September 2011. The bill would also provide two-year competitive planning grants to states of at least $250,000 per state, as well as five-year competitive implementation grants to states to support their plans to increase and strengthen schools' capacity to offer effective computer science education.

At NCWIT, we believe we will never attract the necessary number of women and under-represented groups to computing if it's not taught in ways that are rigorous, inclusive and relevant to 21st century learners. The lack of computer science education in U.S. K-12 public schools is a national crisis and one we cannot continue to ignore. Please let us know how we can help.

Warm regards,
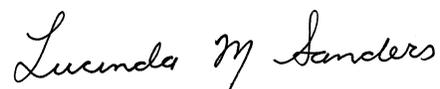
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