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STATEMENT ON THE NATION'S REPORT CARD:
Science in Action: Hands-On and Interactive Computer Tasks From the 2009 Science Assessment

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Our increasingly global society, with technology at its center, requires constant change and innovation for progress. Our nation's students require higher-order skills to successfully navigate education and eventually the workforce. The National Assessment of Educational Progress (NAEP) is meeting that challenge of change and innovation. Through today's report, *Science In Action*, and our work developing a Technology and Engineering Literacy (TEL) assessment, NAEP has now invented ways to measure, with validity and practicality, a set of skills and understandings that are key to finding out what students know and can do in science, engineering and technology, well beyond what we have been able to measure with paper-and-pencil tests for the last 40 years.

These new measures involve such "21st century skills" as applying science to real-life situations, designing complex experiments, and interpreting results of scientific queries, not to mention communication, collaboration, creativity and critical thinking. These tasks include dealing with the inconsistencies, outliers and ambiguities that are normally part of the real world of work and life. Although these skills and understandings may be called "21st century," they have, in fact, been essential for several centuries, since the industrial revolution. But it is just now that we are finally able to assess them in a nationwide, representative sample of our students.

Because this was a special study of updated science hands-on tasks (HOTs) and new interactive computer tasks (ICTs), it wasn't included in the 2009 NAEP Science Report Card. But now that NAEP has been able to analyze the data carefully, these kinds of items will be ready for use in future special studies on a national level. That's wonderful news because these kinds of tasks really give us an accurate portrait of students' higher-order skills that I previously mentioned.

Why do these skills matter? Science and technology would be easy if all our challenges could be solved with simple memorization of accepted facts, and purely procedural application of known principles and laws. In the real world, things are messy and one size does not fit all. There are

many ways to design investigations to answer our questions. And since we never have infinite time or money, we have to choose our strategies thoughtfully. The variety of answers we get in an investigation usually contains some ambiguities, uncertainties and inconsistencies. So it is crucial to understand how experiments are designed, how data are analyzed, and how to draw the best possible conclusions when there are no simple, single right answers to our questions. To deal with complex real issues like global warming, nuclear power or medical treatment options, we all need to understand the strengths and limitations of science and technology investigations. The new HOTs and ICTs are our first solid measures of what students know and can do with these understandings and skills. That matters for daily life, and for career choices.

What we learned from these new assessment tasks in *Science In Action* is that U.S. students are actually pretty good at dealing with limited data sets and straightforward interpretations, as well as selecting correct conclusions from investigations. However, they had trouble with more complex investigations and performed poorly when they tried to articulate how the conclusions they selected were supported by the data they obtained.

The report features a summary of how well fourth, eighth, and 12th graders supported key discoveries on the ICTs and HOTs. When it came to making straightforward observations and correct conclusions, the median percent correct—i.e., the proportion of students who answered multiple-choice questions correctly and received at least partial credit on constructed-response questions—was 76 percent and 71 percent, respectively. Good numbers. However, the median percent correct dips way down to 36 percent and 30 percent, respectively, when it came to strategic decision-making and explaining results.

The development of these important skills is contingent on instruction and learning processes, and how well science is tied to other important areas. The report features interesting background variables that shed light on some classroom practices. For example, we find that only 53 percent of 12th graders reported that they were enrolled in a science course, and only 28 percent reported writing a report on a science project at least once a week. Meanwhile, only 39 percent of fourth graders and 57 percent of eighth graders had teachers who reported at least a moderate emphasis on developing scientific writing skills.

In 2009 on NAEP, fourth, eighth, and 12th graders who talked about their studies at home scored higher than students who reported they never talk about their studies at home. This performance gap is 7 points at grade 4 and 11 points at grade 8. In grade 12, this gap is 12 points. Additionally, eighth and 12th graders who reported they engage in science activities outside of school scored higher than students who indicated they do not engage in science activities outside of school. In grade 8, this performance gap is 6 points. In grade 12, it’s 13 points. Those numbers show correlations, not causality, but they raise important questions. Are students asked often enough to explain science results using scientific language? Are they being challenged to analyze and think outside the box?

I urge everyone to try these innovative and vitally important new ICTs, which are available on the Web in full interactive form just as the students saw them. You will find they are challenging, instructive and actually fun to do. When I saw an early version of one item, I thought there were some typographic errors in the data values given. I was surprised and then delighted to learn that those were not mistakes, because the item included real data that had been

published in a leading scientific journal just a few months earlier, and that scientists too were scratching their heads about some aspects of what the data apparently showed. Something new, beyond our current understanding, might well be lurking in this data. A student taking this test could make a discovery, or ask a new question that could lead to an explanation. How's that for reforming our views of what can come out of taking a test!

Just as these HOTs and ICTs are highly promising and represent an important advance by NAEP in our understanding of what students know and can do, the new TEL assessment will take things even further. Now in development for nationwide testing in 2014, TEL will have the next generation of advanced ICTs that will be even more impressive than what you see today. And just as we are expanding NAEP with challenging tasks that put science in a real-world context, we need to push ourselves to develop those real-world skills for students—for the 21st century and beyond.