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# STATEMENT ON THE NATION'S REPORT CARD: *NAEP 2009 Science Trial Urban District Assessment – Grades 4 and 8*


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Science has been an important part of my life ever since I was a high school student in one of the big-city public school districts on which NAEP is reporting today. I had fabulous physics and geometry teachers at North Fulton High School in Atlanta. That was one of the reasons I went into physics, first as an undergraduate and then on to a Ph.D.

For more than 22 years I was director of a science museum, the New York Hall of Science, which had a very close relationship with the New York City school system, another urban school district in this NAEP report. Two years ago I served on the jury for the Sloan Awards for Excellence in Teaching Science and Mathematics, so I know New York City has many extraordinarily good science and math teachers, not only in specialized schools, but in public schools across my city. I also know the richness of the cultural resources in science that nearly all our big cities offer.

So I was surprised and disappointed to see that NAEP is reporting, on average, a very low level of achievement in science in large city public schools. In fourth grade 44 percent of big-city students are below the *Basic* level set by the Governing Board. In eighth grade 56 percent fall below the NAEP *Basic* standard for that grade. Keep in mind that *Basic* is only partial mastery so those who fall below *Basic* have very serious gaps in their understanding of science and in their ability to apply scientific methods and reasoning in different situations that can affect their education, their work, and their lives.

The NAEP Science Report Card for the nation and the states, which was released last month, also shows lackluster performance. But the situation is worse in the big cities. And, unfortunately, the achievement deficit in the cities is considerably greater in science than it is in reading and math.

For large city public schools as a whole, average performance in science is quite a bit farther behind the national averages than it is in the other two subjects. In terms of national percentile rankings, the large city schools are about 14 points behind the nation in science, compared to about 10 points behind in reading and math —about .4 of a standard deviation compared to .3. The pattern is similar in both fourth and eighth grades.

Also, the percentage of big-city students reaching the *Basic* achievement level in 8th grade science is 17 points below the proportion reaching that standard among public school students nationwide. In both reading and math the gap in reaching *Basic* is 11 percentage points between big-city students and eighth graders nationwide.

There are 17 districts in this TUDA report. In 14 of them more than half of eighth graders score below *Basic*. And in two of the districts—Baltimore and Detroit—80 percent of students score below *Basic* in eighth-grade science. In all except three of the TUDA districts—Austin, Charlotte, and San Diego—the average score in science is significantly below the average for their state in both fourth and eighth grades. In only one TUDA district, Austin, Texas, do more than 1 percent of students reach the *Advanced* level.

These results matter, for the students themselves, for their cities, and for the nation. The results are shouting at us: Whatever we are doing in science education in these big-city public schools, it isn't working for the vast majority of our students. The big-city lag in science is greater than in reading and math, probably because those two subjects are regarded as "basics" and, science, mistakenly, is not. Unfortunately, the emphasis on reading and math was codified in the No Child Left Behind law, but it was the practice before in many districts with a large proportion of low-income children.

You need a pretty strong background—in both science and math—in order to move successfully into many fields in college and the work force. If you're not doing well in science in eighth grade you're in danger of being shut out of doing advanced work in the field for the rest of your life. In big-city public schools throughout the nation just 17 percent of eighth graders reach *Proficient* in science, compared to 29 percent among all eighth graders in public schools nationwide. The cities may attract others for their scientific jobs, but the NAEP figures mean that relatively few students who are educated in the big-city public schools are likely to qualify for those jobs.

The large numbers of students scoring below *Basic* is a huge problem. Even for students who don't enter careers requiring some science competence, as citizens they will soon be involved in issues like climate change, energy policy and medical research. Lack of even *Basic* level knowledge and skills endangers these students' ability to participate wisely in vital public decisions.

But the same assessment that delivers this bad news to us also offers powerful tools to understand what's happening, and how we might improve our education systems. As Commissioner Buckley has already told you, NAEP is a deep, rich source of information not only on student achievement, but also on many factors which may be related to student achievement. The NAEP survey not only asks what students know and can do, it also has background questionnaires for students, teachers and school administrators. There are 357 variables, including factors like race/ethnicity, income levels, teacher qualifications and backgrounds, and how time is spent outside of school, all of which can be correlated to academic achievement. All of these data are now freely available on the Web, along with a powerful tool to crunch the numbers for you and to print out charts and graphs for any combinations of factors which interest you.

We do have to be careful how these correlations are used. NAEP does not track the same students over time. There are no longitudinal data, no control groups. So any particular correlation can't be used to prove causation. But the NAEP database provides a wealth of information for framing the crucial questions we should ask on education policy for the nation as a whole or for each of our urban districts.

For example, NAEP data show that a larger proportion of students in big-city schools than in public schools nationally are being taught eighth- grade science by teachers who entered the classroom through non-traditional, alternative routes. And these students have lower average achievement in science than those with teachers holding traditional credentials. The same pattern is true nationwide.

Does this mean that the alternate-route teachers are less qualified or less effective? Perhaps the alternative route teachers are assigned more often to schools with lower-income students, and we see there is also a very strong correlation between income levels and student performance. There are many different alternative route systems, from the rigorous UTeach program that began in Austin to the national Teach for America and the New York City Teaching Fellows routes. Which variables should we investigate and perhaps change? NAEP data cannot give us the final answers, but it certainly can help us decide where to start looking.

NAEP reports wide differences among the TUDA districts in the proportion of eighth graders taught by teachers with a science background and those without a science background. Policy-makers and the public may want to consider that in setting priorities for hiring new teachers in their own city. But surprisingly, at least for me, there seems to be no difference overall in average achievement for eighth-grade students taught by someone who majored or minored in science as a college undergraduate, compared to those students with teachers who did not. This doesn't prove that having a strong science background does not matter. It may mean that some other systemic difference is swamping the effect of having a teacher with a science background—another opportunity for further investigation.

The 2009 NAEP science assessment is a new test. It has a new, greater emphasis on using science, not just knowing science facts, although a considerable amount of knowledge is still needed for students to do well. Particularly in fourth grade, the knowledge needed and the ability to apply it are likely to come from many sources, not just the schools—from television science programs, science museums, after-school programs and the Internet, as well as from the classroom. Obviously, academic performance is also affected by problems in homes and communities and in schools. Whatever its sources, the weak performance in science of many students in our big-city schools is a challenge for the cities and for our nation. The NAEP 2009 Trial Urban District Assessment in science is a compelling statement of the problem. It can also help guide us in inventing solutions.