GLASS OF SCIENCE IS HALF-EMPTY:

For the first time since 1983, the United States made a clean sweep of the science Nobel Prizes. Americans in general and scientists in particular are celebrating winning achievements regarding the cosmic structure of the universe, the structure of proteins, and the deactivation of genes.

Whoa! Not so fast. Time for a reality check!

Our system of public education where the Nobel laureates were trained and the well-supported research laboratories where they work today is doing fine. But in the trenches of K-8 public education, U.S. schools are struggling mightily to teach enough science to keep voters informed enough to make wise choices.

Here's what the schools are up against. The National Science Foundation recently reported that half of the American public believes that dinosaurs and humans lived at the same time, and that atoms are smaller than electrons.

This astonishing display of ignorance comes, in part, from the parents putting kids on the bus. Second, teachers, especially in the elementary grades, are likely to have met only the minimum requirements for science preparation. Finally, the federal mandate to level the educational playing field through the No Child Left Behind Act is creating incentives for teaching knowledge about science, rather than how science works.

The National Academy of Science, however, has the right idea. While reading Chapter 6 of its National Science Standards, I was delighted to learn that the content standard for elementary and middle school science wasn't a list of things to know (like the facts about dinosaurs and electrons cited above), but a list of abilities -- questioning, planning, measuring, interpreting and communicating -- required to behave like a scientist.

In the national academy's opinion, the best science teachers will be those who move beyond the requisite acquisition of science facts to the fostering of creative inquiry, problem-solving and the methods of investigation and reporting. Their approach is mirrored by the Connecticut State Board of Education's Position Statement on Science Education (2004): "Science is a creative process for investigating, reasoning, critiquing and communicating about ideas, not ... a static body of facts to be memorized."

The basic idea is to train kids to do what the Nobel science laureates do each day with gusto, which, from the academy report, is to "Ask questions about objects, organisms and events in the environment. Plan and conduct a simple investigation. Employ simple equipment and tools to gather data and extend the senses. Use data to construct a reasonable explanation. Communicate investigations and explanations."

Consider this playground scenario: How can I make the best snowball? Does a dry one fly farther than a wet one? Let's throw some of each and see what happens. By my measure, the dry ones fell short. Maybe it's because the air slows them down more. Let's tell the others what we found out and see what they think.

This snowball experiment includes all five of the abilities the National Research Council lists above.
The operating assumption here is that the curiosity to know things and the skills to find answers will be the motor that will drive the acquisition of scientific knowledge, in this case the differential density of the different snowballs and the viscosity of the air.

A contingent assumption is that by the time students finish high school, teachers will have introduced enough varied learning opportunities that the graduate will be not only scientifically inclined, but science-literate as well.

No scientist I know sits around learning new concepts for fun. They're way too busy questioning, planning, measuring, interpreting and communicating their joy in having discovered something new.

President George II is absolutely right that reducing the achievement gap between underprivileged and privileged schools requires evidence of performance. He might also be right that performance in basic skills such as math and reading is best accomplished with standardized pencil and paper tests. But how can one measure the ability to generate good questions, the sine qua non of science? The answer is you can't.

America's sweep of Nobel science prizes is well deserved, both for the five individuals and for our nation. America's simultaneous failure in science literacy is glaring by international standards among developed nations.