



It is more important
to pave the way for
the child to want to
know, than to put him
or her on a diet of facts
-Rachel Carson

THE DIRECTOR'S REPORT:

Science for the City's Children

Within months of becoming president of the Carnegie Institution of Washington, Dr. Maxine Singer opened the doors to neighborhood children by founding the First Light Saturday science school. Since 1989, the school has invited children from Washington, D.C.'s public elementary schools to learn about science by doing science. Every Saturday morning at 9:30, about 30 third- to sixth-grade students arrive at the school to engage in activities such as building wind racers, analyzing the building's tap water, or starting a mineral collection. After lunch, which is provided by the program, the children go on a field trip, which may be a hike along the Potomac River, a visit to the new earth science exhibit at the Museum of Natural History, or a tour of a nearby Carnegie laboratory. Many children stay in the program for several years, and some of the students from those first years are now in college. Over the past decade, we have watched students develop their ability to ask questions, investigate their questions scientifically, arrive at answers, and generate new questions. We believe that some of our students will become professional scientists. More important, we expect that all First Light students will grow up with an understanding of the scientific approach to answering questions and solving problems.

Learning Science Is an Active Process

During the early years of First Light some parents, teachers, and one principal noticed that the students who were in the program were doing better academically than they had before. This observation was the impetus to start the Carnegie



First Light students go on weekly field trips, such as this one to nearby Chesapeake Bay.

Academy for Science Education, CASE. In December 1993, CASE was established with a five-year National Science Foundation grant to strengthen the teaching of science and mathematics in the public elementary schools of Washington, D.C. Since the first CASE Summer Science Institute in 1994, we have brought more than 550 teachers from over 50 schools to the Carnegie Institution for intensive professional development in these subjects. In 1999 we formed a separate mathematics institute. Both programs immerse teachers in content, either science or mathematics, with two goals: to substantially increase their knowledge of the subject, and to give them experience with a variety of instructional strategies.



First Light students learn some chemistry by making play dough. They need only three ingredients: flour, salt, and water.



First, they mix the ingredients. Then half the class cooks their mixture, and the other half does not.



The class discovers that the uncooked dough is goeey and hard to mold.



They find that the cooked dough, however, has the same consistency as the commercially made product. The key is to cook the mixture until it pulls away from the side of the pan.



CASE summer institute teachers learn about the basic concepts of force and motion with a real-world example—roller coasters.



Teachers in elementary schools are required to teach a broad range of topics. In the case of science and mathematics, instructors are typically poorly prepared. At CASE we heard from the teachers themselves about the kind of professional development they need to improve in these areas. From their comments, and from our observations, we built the summer institutes on the basis of national standards. These standards include the American Association for the Advancement of Science's (AAAS) Benchmarks for Science Literacy, the National Academy of Sciences' National Science Education Standards, and the National Council of Teachers of Mathematics' Curriculum and Evaluation Standards for School Mathematics. These standards establish the content teachers must teach at specific grade levels and provide guidance on how best to teach it. However, the standards do not constitute a curriculum; the curriculum is the course work used by the teachers to present the standards to the students. At CASE we have changed the curriculum over the years as we have learned what works and what does not. Our current curriculum is organized around a general theme that is approached through a series of questions, which are investigated through activities.

For example, the science institute is organized around four themes, each defined by an organizing question. The first week's theme is the nature of science. CASE teachers begin learning how to approach the topic through the organizing question: How do we make good decisions about

which product is best? They test features of many products we use in our daily lives, including the absorbency and strength of paper towels, the size of detergent bubbles, and the contents of a super-absorbent diaper. Through their activities the teachers learn what makes a scientific test fair and accurate, and how product tests are used to develop new products. The activities also help them see immediately the connection between mathematics and measurement, and understand concepts such as variables, data analysis, graphing, and statistics. Throughout the rest of the institute's session the organizing questions center on the earth, life, and physical sciences.

Improving Science Education Is Part of Systemic Education Reform

To improve student achievement in science and mathematics, the Carnegie Institution recently joined with the AAAS and the D.C. public schools in a partnership called DC ACTS. The premise of the program is that student achievement will increase when teachers know what the students must learn at each grade, develop year-long instructional plans for science and mathematics, and have the necessary materials and equipment. The National Science Foundation funded DC ACTS for three years beginning in September 2000. Over this three-year period we must make significant reforms in 2 high schools, 4 middle/junior high schools, and 15 elementary schools. Our effectiveness will be measured by whether we can increase the Stanford 9 mathematics achievement test scores, and increase the number of students passing Algebra 1 and advanced-placement courses in science and mathematics. If we can meet these goals, we will have successfully developed a program that can bring about reform across the whole school system.

The CASE staff is working with the 15 elementary schools across the city to provide professional development through the summer institutes, graduate-level courses, and workshops. At 8 of these schools, groups of teachers are working closely with a CASE Staff Member to develop yearlong instructional plans. Additionally, with funds from the Howard Hughes Medical Institute, Carnegie



This First Light student learns about data collection by weighing acorns.

is purchasing equipment for instruction such as stereoscopes, balances, thermometers, and graduated cylinders.

The Key Is in the Individuals

Each year at CASE we identify talented teachers who enjoy teaching science and mathematics and can function as leaders. We now have a group of these "mentor teachers" as part of the CASE summer teaching staff. Many of them are also the DC ACTS facilitators for their schools; they are responsible for ensuring that reform takes root. These educators are essential to our success. In the short time CASE has been in existence we have dealt with four school superintendents. Since the average tenure of a superintendent in an urban school system is only about three years, our approach is to work closely with teachers and principals since they, along with the students, are the people who remain in the school system the longest.

Although the DC ACTS program is off to a good start, only time will tell if we will succeed in our efforts to become the catalyst for changing a low-performing school system into one that we can be proud of. Our eventual goal is for the D.C. school system to exemplify the Carnegie way—achieving excellence, supporting exceptional individuals, promoting creativity, and managing with fiscal responsibility.

—Inés Lucía Cifuentes