

Improving Science Literacy

To prepare today's students for a future that is increasingly dependent on science, mathematics and technology, educators need well-designed and effective preparation, curriculum and assessments. Project 2061 is helping to meet that need through its research and development efforts funded by the National Science Foundation, National Oceanographic and Atmospheric Administration, NASA, and the U.S. Department of Education. Building on its own earlier accomplishments in standards-based science education, Project 2061's current work integrates the teaching and learning of core science ideas, science practices and concepts that cut across disciplines as recommended in the National Research Council's 2012 report, *A Framework for K-12 Science Education*.

BETTER BIOLOGY IN MIDDLE SCHOOL

Cutting-edge research in biology, biotechnology and biomedicine is advancing quickly, with enormous potential for 21st-century innovation. Biology education, however, has mostly not kept up. New approaches are needed that incorporate scientific practices, offer students the opportunity to experience and think about a variety of real-world and relevant phenomena, and let students see how foundational principles can be applied across the sciences.

Now in its third year of a research grant from the U.S. Department of Education, Project 2061 and collaborators at the Biological Sciences Curriculum Study have been working with teachers in Colorado, Maryland, Boston, and Washington, D.C., to develop and try out an innovative curriculum unit designed to prepare middle-school students for success in high-school biology. The unit takes a novel approach by focusing first on core ideas about chemical reactions and then using those ideas to explain growth and repair in living

organisms. Students also work with a variety of models—from LEGO® blocks to more conventional models and equations—and learn how to use their new ideas, evidence and reasoning to develop a scientific explanation for what they observe. (See photo, next page.)

Schools serving K-12 students are the fastest-growing segment of the “green building” industry, encompassing efforts to adopt more energy- and water-saving technologies. In 2012, Project 2061 began to investigate strategies for leveraging green schools as powerful, real-world contexts to help middle-school students learn important science, mathematics and technology ideas. The effort is being funded by the National Science Foundation.





“We want students to be able to use what they learn from studying relatively simple chemical reactions to then explain more complex phenomena such as protein synthesis in animals or carbohydrate synthesis in plants,” said Project 2061 Director Jo Ellen Roseman. After two rounds of classroom pilot testing, she said that the unit has resulted in “significant learning gains” for all populations of students who have used it.

UNDERSTANDING EVOLUTION THROUGH MATHEMATICS

Project 2061 received a grant in 2012 from the National Science Foundation to develop a curriculum to help high-school students understand core ideas about evolution and data analysis. An understanding of evolution is crucial to the study of biology, but research has shown that many students have a poor grasp of the topic and fall victim to misconceptions about natural selection and genetics.

The University of Utah’s Genetic Science Learning Center, a collaborator on the project, is developing prototype lessons and interactive, multimedia, computer-based simulations. By allowing the students to collect and analyze data from certain animal populations over several virtual years, the simulations will help the students to visualize the organisms and habitats, understand sampling processes, make measurements, and see evidence of natural selection in the data. Project 2061 is

developing instruments that will be used to measure what students and teachers understand about the concepts being targeted in the curriculum and to monitor the quality of the curriculum itself.

“CREATE AND TAKE” TESTS

Project 2061 launched a new online feature in 2012 that allows teachers to create tests targeting key ideas related to 16 science topics, from evolution and natural selection, to the mechanics of earthquakes. The new feature builds on the capabilities of the AAAS Science Assessment Web site developed by Project 2061 to provide educators with access to more than 700 carefully developed science test questions. It allows teachers to assess what their students are learning and where they may have gaps.

“Getting reliable and timely information about what students know or don’t know means that teachers can adjust their instruction to respond quickly to their students’ needs,” said George DeBoer, deputy director of Project 2061.

By April 2012, a year after its initial launch, the Project 2061 Web site had logged 12,000 registered users and nearly 70,000 visitors.

IMPROVING ENERGY EDUCATION

In 2012, the U.S. Department of Education awarded a \$1.6 million grant to Project 2061 to develop new assessments of how students build their knowledge of energy concepts from elementary school through high school. The testing tools will also identify where students are struggling so that teachers can target those areas. The project was one of only 26 funded by the Education Department in 2012 through its competitive education research grants program.

“A strong foundation of knowledge about energy is essential,” said Cari F. Herrmann Abell, senior research associate for Project 2061. “Whether choosing which cars we drive or thinking about national energy policy issues, understanding basic energy concepts can help everyone make more well-informed decisions.”