IMPROVING SCIENCE LITERACY

Project 2061, the science-education reform initiative of AAAS, conducts rigorous research to improve the quality of science education at the K-12 level. Drawing on findings from its own work and that of others, Project 2061 develops curriculum and assessment resources to help educators and students focus on the goals for science learning that are recommended in national standards documents. As a longtime leader in the development and implementation of education standards, Project 2061 helps students make connections across science, mathematics, and technology, and engages in the practices and habits of mind that are central to science literacy.

NEW TOOLS FOR TEACHING EVOLUTION

High-schoolers took on the role of researchers while using a new curriculum and computer simulations designed by Project 2061 and the University of Utah's Genetic Science Learning Center to teach key concepts about evolution.

Responding to research showing that students often have a poor understanding of natural selection and genetics—which hampers their success in the study of biology—Project 2061 and the Genetic Science Learning Center continued their work in 2013 on an innovative new curriculum unit. The effort was supported by a two-year exploratory grant awarded by the National Science Foundation.

The unit strives to overcome students' difficulties with understanding evolution by engaging them in collecting, analyzing, and arguing from scientific data that provide evidence for common ancestry and that illustrate the links between genetic variation in traits and natural selection. Interactive computer-based simulations allow students to collect and analyze data from populations in the same locations over several virtual years.

One animation, for instance, shows how a modern-day population of stickleback fish changed from fully armored to low-armored in just 13 generations. Experiencing the simulations helps students to visualize the habitats and organisms, understand sampling processes, and make measurements. A key focus for Project 2061 is designing ways to evaluate the students' learning and teachers' understanding and use of the unit.

"This is an opportunity to move our work in some new directions," said Project 2061 Director Jo Ellen Roseman, referring to the interactive computer simulations, "while also building on our experience in curriculum and assessment design."

GAUGING STUDENT KNOWLEDGE OF WEATHER AND CLIMATE

How much do high-school and undergraduate students understand about weather and climate? Project 2061 set out to get a clearer picture of that in 2013 by asking earth science and meteorology teachers to give their students an online test of important weather and climate concepts. The students who took

Project 2061 uses pre- and post-tests to assess students' understanding of natural selection after they participate in in activities including a simulation on how stickleback fish from the ocean evolve to have less protective armor in a lake environment.

GENETIC SCIENCE LEARNING CENTER, UNIVERSITY OF UTAH

the test were expected to have been taught how seasonal changes in the relationship between the Earth and the sun affect hours of daylight, the maximum height of the sun in the sky, and the amount of energy a place on Earth receives from the sun.

The questions for the multiple-choice test were developed by Project 2061 as part of a study funded by the National Oceanic and Atmospheric Administration (NOAA) and the National Aeronautics and Space Administration (NASA). The students' responses became part of a national dataset showing what students understood at different educational levels, and what misconceptions were most common.

SCIENCE EDUCATION RESEARCH, POLICY, AND PRACTICE

AAAS reached out to young science education scholars in 2013 with the Sandra K. Abell Institute for Doctoral Students. The students had the opportunity to discuss their research with experienced mentors, including Project 2061 director Roseman. They also attended workshops and lectures, learning about worldwide efforts to improve science teaching and increasing opportunities to connect science education research to the real world of school policy and classroom practice.

The doctoral students worked in small groups on issues related to their research, received tips on how to hone their skills, and made valuable contacts. The scholars' research included such topics as weighing the value of culturally relevant approaches to help students engage with and understand science, and whether strong feelings about such topics as environmental problems can provide avenues for understanding the underlying science.

The 2013 institute was sponsored by the National Association for Research in Science Teaching, AAAS, the University of Georgia, Michigan State University, and Michigan State's CREATE for STEM Institute.

TOWARD HIGH-SCHOOL BIOLOGY

Project 2061 moved ahead in the development of a new middle-school curriculum unit in 2013, after analyzing the results of pilot testing involving 677 students and their teachers at schools in four states.

The unit, known as *Toward High School Biology: Understanding Growth in Living Things*, was developed with the Colorado-based Biological Sciences Curriculum Study (BSCS). The new unit integrates physical science and life science concepts, and pilot test results showed that students made significant gains in understanding key ideas about chemical reactions in both living and non-living systems. Reflecting three rounds of testing and revision, the 2013 version of the curriculum unit responds to the latest recommendations of the National Research Council's *A Framework for K-12 Science Education*, which emphasize integrating core scientific ideas and practices, such as modeling and constructing explanations, across the science disciplines.

The unit helps students learn important chemistry ideas that can be used to explain growth and repair in animals and plants. For example, students use LEGO® bricks and ball-and-stick models to see how the food that animals eat undergoes chemical reactions that break down and rearrange atoms to form new molecules that become part of the animals' bodies.

Abell Institute students and mentors.

AAAS/ROBERT BEETS