Helping Students Learn Science the Way Scientists Work

The groundwater beneath an oil "tank farm" in a Washington, D.C., suburb has been contaminated and two dozen teachers are assessing the damage and developing a cleanup plan.

No, they didn't spend summer break moonlighting as engineers. For 6 weeks the mid-Atlantic middle-school teachers donned hats as environmental problem-solvers in the first phase of a new program designed to help them take that kind of scientific thinking back to their students.

The program—a partnership of AAAS and George Mason University—took the teachers to a Chesapeake Bay tidal marsh, a water treatment plant, a NASA remote-sensing lab, and other sites to learn the methods of working scientists. Back on the campus of GMU, they converted field data into spreadsheets and graphs and used other tools to aid their analysis of real-life environmental issues. "They always worked with real data, not simulated. It's the same data scientists are using on the job," said Donna Sterling, a professor of science education at GMU who helped organize the program, called Project Alliance.

The aim of the project, funded by the National Science Foundation, is to give teams of teachers a framework for developing courses that link science, mathematics, and technology.

Curriculum-building. Don Rodgers and Kathryn Dickey incorporated many computer exercises into their unit on use and abuse of water.

Small groups from eight schools participated; at least one had to be a science teacher and one an administrator. "We believe a greater impact can be made if teams of teachers, not just individuals, participate," said AAAS project coordinator Betty Calinger. Each team works closely with a local scientist or engineer during the 2-year program.

Integrated Studies

The environmental theme is in line with an education reform movement toward integrated studies and "contextual learning."

"Many people believe science is being taught and learned incorrectly because it tends to be modulized," said Richard Tollo, a geology professor and associate dean at George Washington University who planned much of the science content. "Environmental science by its very nature is an integrated science. This program looks at science as a series of topics that are constantly interacting. That's the way science works today."

The summer workshop was built around environmental problems the teachers can tailor to lessons using situations in their own communities. Each team was required to develop an environmental science and technology unit, with plans for implementation. Instructors and peers critiqued the proposals and offered suggestions. The results, presented the final week, were eight different curriculum models.

Lesa Warrick, Karen Griffin, and Janice MacKinnon of Stuart-Hobson Middle School in Washington, D.C., developed a "mini-course" that weaves science lessons and activities across core subjects. The unit, "Go With the Flow," explores the ecology of the Potomac River watershed area and related pollution problems.

Kathryn Dickey and Don Rodgers of Laurel Junior-Senior High School in New Castle, Pennsylvania, took a more high-tech approach. Their 7-week unit on water, using topics of interest to a largely rural student population, takes advantage of their school's well-equipped computer labs.

PHOTOS BY DIANA PABST

Wading in. Philadelphia teachers Patricia Whack and Steve Coleman prepare to record data from a Chesapeake Bay tidal marsh.

Laurel principal Leonard Rich heard Dickey and Rodgers' plan at GMU. "Eventually I would like to offer this to all seventh-graders," not just those in two science classes, as the teachers proposed. "I think this program is good, but it's where you go from here that counts," he said.

New Methods and Tools

Pedagogy and technology are key components of Project Alliance. Sterling said methodology is included because education research has shown the importance of "modeling" new instructional approaches. "This program stresses that science deals with solving problems and shows teachers how they can help students learn science that way, by framing lessons in terms of questions to be answered," she said. Each teacher was videotaped doing a science lesson to review style.

There were sessions on a wide range of computer applications and other technologies that can enhance learning and teaching. "Even if they can't implement all this immediately, we can provide a vision of how learning is going to look," said Sherwood Wang, an assistant professor of instructional technology at GMU who taught many of the sessions.

The project gives each team member 6 hours a month on America Online, for students to tap information and communicate with partner schools around the country. Participants will stay in touch in a weekly electronic "conference call."

The teachers will return to GMU for 2 weeks next summer to get more science basics, report the results of their study units, and discuss ways of disseminating their ideas and materials. In the meantime, project staff and independent evaluators will make site visits to talk with the teachers and administrators and their students and provide support.

Computer science teacher Alfina Gorrell said her team from John Paul Jones Middle School in Philadelphia applied to Project Alliance because the state is pushing for a more interdisciplinary curriculum. "There's a lot of talk about integrated studies and team-teaching, but the logistics aren't there for teachers to get together to develop plans."

Science and math teachers Marva Hawkins and Deatra Rider said the program would help them enrich learning opportunities for students at Clarence Pickett Middle School in Philadelphia. Said Hawkins: "You want to keep giving your kids a competitive edge, and you need to learn to tap whatever mode it takes to reach them."

For more information, call Betty Calinger at 202-326-6629.

Building Bridges in the Arctic

About 15,000 years ago, humans first entered North America by crossing the Bering Strait on a now submerged land bridge connecting modern-day Siberia and Alaska. A month ago, those attending the 45th Arctic Science Conference symbolically re-created that link by meeting in Anchorage, Alaska, and then jetting across the sea to resume sessions in Vladivostock, Russia.

The conference, of about 400 registrants, was sponsored by AAAS through its Arctic and Pacific Divisions and national office along with the Far East Branch of the Russian Academy of Sciences. Nearly 500 research papers were presented.

Arctic Division president Rosa Meehan said U.S. and Russian scientists broke down cultural and communication barriers and paved avenues for increased collaboration. The conference also provided much knowledge about a region that is one of the world's richest in natural resources and cultural heritage but which was long restricted because of political and military concerns.

Meehan, of the U.S. Fish and Wildlife Service in Anchorage, said in the many biology sessions she attended, "there were numerous examples of scientists making contact with others working in areas or species of mutual interest."

Some agreements happened on the spot. "It was not just exchanging cards but putting together actual plans," said Tom Newbury of the U.S. Department of Interior's Minerals Management Service in Anchorage. An example he cited from the sessions on fisheries: A graduate student at the University of Alaska who is studying the productivity of lakes in which salmon spawn met Russian scientists working on a similar project. After the presentations, she agreed to go to Kamchatka to share her up-to-date methods with the Russian scientists and to tie in her data with their data.

Reported was the first documented case of salmon migration from North America to Asia. U.S. scientist Alfred DeCicco said he and Russian colleague Pavel Gudhov tracked an Arctic char salmon they had tagged across 1690 kilometers—the longest such migration ever recorded.

A highlight of the Anchorage leg was a field trip for museum scientists to Homer for a preview of the "Crossroads of Continents" exhibit. Jointly curated by American and Russian experts, the traveling exhibit will move to Russia next year.

The sessions on land and ocean pollution generated much U.S.-Russian networking and discussion of possible solutions, Meehan said. "The arctic air mass moves from Russia to Alaska so there is considerable interest in this. It was very important for people to get together and talk about it." Among findings reported was major information from Russian scientists on the extent of nuclear contamination in the Kara Sea region.

Other sessions were devoted to climate change, volcanic and earthquake activity, flora and fauna, parks and nature reserves, marine ecosystems, biological diversity, and the geology, archeology, and ethnology of the North Pacific.

Dale Taylor of the U.S. National Park Service in Anchorage said there was wide interest in a host of papers by Russians and Americans on the science, sociology, and economics of Beringia. Participants also got an update on plans to establish a bi-national park in the Bering Strait area, agreed to by U.S. and Russian presidents during the Bush administration, for cooperative scientific and cultural programs in the region.

Contact Arctic Division executive secretary Patricia Anderson by phone at 907-474-5698; by fax at 907-474-6722; or via the Internet at **fnpaa@aurora.alaska.edu.**

Election Ballots, Nominations Due

Ballots for the election of AAAS president-elect, members of the Board of Directors and the Committee on Nominations, and section officers were mailed to all active AAAS members (as of the 2 September *Science*). Members enrolled in a second or third section will receive a separate ballot for each section. If you did not receive a ballot or received an incorrect one, write to Linda McDaniel, AAAS Executive Office, 1333 H Street NW, Washington, DC 20005.

Your vote is important, so please return ballots by 10 November. Ballots postmarked after that date will not be counted.

AAAS members can nominate candidates (including themselves) for president-elect and the Board of Directors for election in the fall of 1995, for terms beginning in February 1996. For a list of this year's candidates see the "Inside AAAS" section in the 24 June *Science*, and see the contents page of any recent *Science* issue for a list of the current Board members. Please send nominations with the candidate's curriculum vitae no later than 1 November to Gretchen Seiler, AAAS Executive Office, 1333 H Street NW, Washington, DC 20005.

Engineer 'Diplomat' Bound for Kiev

For Janelle Daane, engineering has been a ticket to see the world—mainly places seldom seen by travelers. A specialist in water and sanitation projects, Daane left this month for Kiev, Ukraine, as the 1994–95 AAAS Overseas Science, Engineering, and Diplomacy Fellow. During a previous fellowship at the U.S. Agency for International Development she went to Mozambique, Armenia, and Central Asia and in 1991 worked with the International Rescue Committee in Iraq. Before that, U.S. Public Health Service postings took her to remote Alaskan villages and to Indian reservations in Montana and Wyoming.

Janelle Daane

Based in Kiev, Daane and USAID colleagues will work in Ukraine, Belarus, and Moldava as technical advisers to officials who manage environmental and natural resource issues. "We hope to transfer skills so they can do better environmental decision-making," she said.

Daane sees the fellowship, funded by a USAID grant, as "an opportunity to create your own experience." Her career, she said, evolved from circumstances more than design. A psychology major in college, she looked into a graduate program in city and regional planning but grew impatient when admission was delayed a year. She enrolled instead in engineering after learning the local city and regional planner was an engineer. She holds B.S. and M.S. degrees in civil engineering and is pursuing a doctorate at George Washington University.

Two things Daane found appealing about an engineering career: The prospect of working outdoors and in developing regions. "I get an education myself from exposure to other cultures," she said.

AAAS sponsors a number of public policy fellowships that bring scientists and engineers to Washington, D.C., for 1-year assignments in Congress and federal agencies. Call the AAAS Directorate for Science and Policy Programs at 202-326-6600 or send a fax to 202-289-4950.