

Inspired by the ASSET science instruction program, Edgeworth Elementary School Teacher Elise Woodburn uses hands-on experiments, like this one involving a millipede, to help her students study science by actually practicing it.



When Elise Woodburn's 23 first-graders came charging back into the classroom after a morning assembly, the millipedes were waiting just as they had been left. If any of the 6-year-olds were creeped-out by the leggy, brown insects, the stars of a class research project in early May, they didn't show it.

Buzzing with anticipation, the kids slipped into their lab coats — Dad's Goodwill-bound dress shirt for most. They had been introduced to the millipedes the previous day and a critical question had surfaced: If you found one of these things and wanted to keep it alive, what kind of home should you make? They pondered, proposed and debated their way to several possibilities and ways to test each.

The experiments were about to begin.

the Science BUG

By Jeffrey Fraser

Photography by Steve Mellon

**Bury those fact-packed science textbooks with the dinosaurs:
A new way of teaching has science educators cheering and students outscoring peers.**



Hot/cold, food/no food, moist soil/dry soil, dark/light, something to climb on, or not — all of the conditions the children thought might be necessary for millipedes to survive in comfort were represented in five experiments. All, except for one.

“Why can’t we test whether or not they need air?” Woodburn asked.

“If we did, they may die,” Jason replied.

“And that’s not enthusiastic,” added Marigrace.

“Do you mean, it’s not ethical?” her teacher said.

“Oh, right. Not ethical.”

Hands-on experimentation, inquiry-based learning, young children being exposed to scientific process and ethics, the excitement of exploring the unknown, and the fun of figuring out how to do it themselves: All of this is science in Woodburn’s classroom at Edgeworth Elementary in the

Quaker Valley School District west of Pittsburgh. It is science taught the ASSET way.

Woodburn is a disciple of Allegheny Schools Science Education and Technology (ASSET) Inc., a nonprofit provider of hands-on teaching materials and a reform-minded advocate of replacing the textbook-only, rote memorization approach to teaching with one that seeks to kindle scientific inquiry among young children.

Thirty-four school districts in Allegheny County are involved in ASSET, which, in addition to fee-for-service revenues, has been nurtured by grants totaling more than \$3 million from several foundations, including The Heinz Endowments, since 1994. In return, ASSET provides instructional materials and professional development around teaching children to think for themselves. The combination, studies suggest, helps to engage children in science and elicits test scores rivaling those from Japan and other nations whose students routinely outscore U.S. children on standardized science exams.

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They really think they
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Elise Woodburn teacher, Edgeworth Elementary School



“It has really changed the way I do my lessons,” says Woodburn, who has been teaching for 10 years. “You see it in their faces. They really think they are scientists.”

What the numbers show is that too few children imagine themselves as scientists and move into science-based higher education and careers. It’s that lack of enthusiasm that is fueling science education reform. Another lingering worry is the level of science literacy. It is not just that jobs demand a greater technical expertise. Americans are being asked to choose sides on issues steeped in science that are as complex as their consequences are profound. How do we balance the demand for oil and gas exploration with the threat it poses to wildlife habitats? Do we completely ban cloning to suppress those with designs on reproducing a fully formed human being?

Answering these questions requires a foundation in science that U.S. elementary schools have long ignored. “I didn’t like teaching science, so it would be the last thing I ever did,” says Sharon Beddard-Hess, an ASSET convert from Quaker Valley now on loan to the nonprofit as a member of its professional development team. “Nobody would hold you accountable for teaching science. If I taught it at all, it was at the end of the day, and I would just use the book.”

ASSET was launched in the fall of 1992 with seed capital from Bayer Corp. The foundation groups signed on the following year with the ambitious goal of changing the culture of science teaching in western Pennsylvania schools. Three years later, ASSET received more than \$3 million from the National Science Foundation for hands-on teaching materials and intensive training of some 1,000 teachers. That pilot program

Woodburn’s first-grade students Mathew Regueiro, left, and Katie Thomson relish their new roles as fledgling scientists, while Theresa Campisano has the hoped-for reaction to a curriculum that even specifies professional ID cards.

was so successful that the Science Foundation has become a steady giver—nearly \$4.5 million has gone to ASSET since its beginning.

ASSET Executive Director Reeny Davison knows the national support hinges on the group’s main goal of training teachers. She was a teacher herself—of German and Dutch at the university level. Directing a science initiative, she says, is not as much of a stretch as it might seem. “Students don’t learn a foreign language unless you get them to speak it and make meaning out of what they are saying. The same is true for science. You have to get them to do it and make meaning out of it.”

When ASSET students do science, it is with prepackaged experiments supplied by the organization. Proof of ASSET’s remarkable growth is no more evident than at its distribution center, 14,000 square feet of warehouse space adjoining its offices in an industrial park west of Pittsburgh. The place is crowded with science kits stacked high on pallets and steel shelving heavy with instructional materials. Each kit contains durable items like pulleys, and consumables like fast-growing seeds, to keep a class of 30 busy for eight weeks in fields ranging from physics to botany. In 1995, ASSET distributed 25 science kits to schools. Today, it distributes more than 3,500 in a school year.

Students love the ASSET approach, but it requires new training for science teachers. At a recent ASSET coaching session, Environmental Education Coordinator Cindy Cirucci (standing) familiarizes South Allegheny School District's Michelle Finneran, left, and Aimee Jackson with a student project.



As important as the instructional materials are, their impact on learning would be blunted without adequate instruction, support and a regular offering of professional development.

ASSET courses and institutes cover a wide range of science subjects — from rocks to pollinators. On a crisp Saturday morning in early April, eight teachers gathered in an elementary school in the West Mifflin School District for one of those courses, a primer on the local ecology led by Thelma Redick, director of professional development and outreach. She took them from the swamp that was western Pennsylvania 600 million years ago through the Ice Age; introduced them to writing field journals; shoed them into the chilly outdoors to make observations; and reviewed the evidence they found on the local ecosystem, including a plastic spoon that betrayed the presence of humans. The following Saturday, they learned how to make a schoolyard habitat — a garden or nature trail to use as an outdoor laboratory.

Teaching environment and ecology is new ground for most elementary school teachers, and the subject is not often on the radar of most students. “I’ve had crazy questions,” says Glassport Elementary teacher Audrey Albrecht, “like, ‘Are there whales in the Monongahela River?’”

“On one hand, it’s good the kids are thinking ecosystem thoughts,” says Redick. “Unfortunately, that question suggests our kids probably know more about the ocean than what is here, right under our feet.”

To ensure this kind of strategic thinking about science teaching, the Endowments has been one of ASSET’s primary funders, giving nearly \$800,000 during the past decade. Much of the money has gone to brace the program’s \$2 million average yearly operating budget through the bumps and grinds of building up a paying client base. But other grants have been earmarked for specific purposes that address the Endowments’ larger mission in education. Last year, for instance, the foundation awarded a \$150,000 grant to develop an ecology and

environment curriculum for elementary schools. Pennsylvania this year adopted learning benchmarks on the environment, including detailed knowledge of watersheds, wetlands and endangered species. “If teachers and principals weren’t thinking about it before, they are now,” says Cindy Cirucci, coordinator of ASSET’s environmental education.

The effect of standardized testing — that it acts as a sword hanging over educators to ensure learning about the environment — sits well with the foundation community, which has increasingly been supporting environmental education efforts. “The children in elementary schools today will be making critically important decisions on the environment as adults, so they need to have a solid grounding in the sciences around this subject,” says Caren Glotfelty, director of the Endowments’ Environment Program, which has helped shape ASSET grants.

ASSET’s mission fits neatly inside the master strategy of the Endowments’ Education Program, which centers on supporting innovative teaching methods and creating successful learning environments. The program’s steady progress toward self-sufficiency has made it a favorite with regional and national funders, including Alcoa, Grable, Laurel, Pittsburgh, PPG Industries and R.P. Simmons, as well as the William J. Copeland Fund. “Ideally, when funding programs, you will have two components: They are effective in the classroom, and they are sustainable — they work out a stream of income and aren’t entirely dependent on foundation or government money,” says Gerry Balbier, Education Program officer for the Endowments. “With ASSET, you see them getting schools to buy into the program.” Fees charged to schools accounted for 62 percent of the program’s total operating budget last year, up from 28 percent in 2000 and 16 percent in 1995.

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Sharon Beddard-Hess ASSET Teacher Trainer

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It bodes well for ASSET’s potential to expand statewide that Sandy Matrascia, Pennsylvania’s winner of the 2002 Presidential Award for Excellence in Science Teaching, is an ASSET practitioner (and that the two other finalists also are ASSET teachers in southwestern Pennsylvania). But it is the performance of ASSET students on science and math exams that carries the spotlight. In 2000, some 1,600 fifth-graders from ASSET schools scored significantly better than their U.S. peers and on par with children from top-performing countries on select Third International Mathematics and Science Study (TIMSS) questions, according to an evaluation by the University of Pittsburgh Learning Research and Development Center. The study limited the questions to those that addressed concepts covered in ASSET modules. The ASSET fifth-graders hit some rough spots. They stumbled trying to predict the unwanted consequences of introducing a new species into an ecosystem, for example. But overall, they performed as well as seventh-graders from Singapore, Korea, Japan, Czech Republic and Hungary — nations that outperformed U.S. middle schools.

The evaluation also underscored the importance of sustained teacher training, finding that teachers with the most hours of professional development were more confident, had a better grasp of science concepts and presented information more accurately.

The Institute of Inquiry is ASSET’s graduate school of professional development, a five-day program for experienced teachers that explores the notion of teaching children to become active participants in their own education. On the final day of an Institute this spring, two dozen teachers shared their classroom experiences. The testimonials lasted hours. They swore off old ways, praised the new. They spoke of invigorated classes and, more remarkably, of how even some of their most reluctant students are now into science. Most confessed a reluctance to relinquish even a small degree of control. Some were fearful of not knowing the answers to children’s questions.

Sharon Beddard-Hess, once resistant and now converted to the ASSET way, says she came around only after her principal ordered her into training. Even then, she went “kicking and screaming” into the program. “The turning point came when I saw my kids come alive. Science was absolutely our favorite time of the day.”

In Elise Woodburn’s science class, back in that first week in May, first-graders weren’t even thinking about the impending summer break. They split into groups, each assigned to a lab — a cluster of four desks — equipped with a single millipede in a clear plastic tub and materials specific to their experiment. They divided each tub into two sections using a sheet of construction paper and cut a gate to allow the millipede to pass from section to section. The idea was to record the insect’s preferences to the conditions they created. For instance, did it prefer the side heated by a lamp or the one cooled with ice cubes? As they worked, the experiments designed to answer questions raised others. Some were of the sort that might be expected of 6-year-olds, such as, “Do millipedes pee?” Others indicated a deeper level of engagement. In one lab, the millipede spent 70 percent of its time wriggling across clover and other assorted greens placed in one section of its tub as food. Clearly, it preferred the greens to the bare plastic. But, Jake wondered, was that because it saw the greens as food? He hadn’t seen it eat anything. They weren’t even sure if millipedes were vegetarians. “It could be,” Jake said, “that it just wants to crawl on something.”

Such involvement, Woodburn said, is no longer the exception. Her students offer suggestions more freely, give fewer one-word answers and are far less inhibited about asking questions in all subjects, not just science. She also senses a new dimension in the teacher–student relationship. “They’ve started to see me as a learner, just like them.”

Woodburn excused herself to return to the experiments. “I can’t wait to see what these millipedes do.” *b*