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Teacher Training Means More Science at Montgomery County Elementary Schools

First graders in Julia Bialeski's class hustled milk bottles and thermometers from the mini refrigerator to shared tables in their classroom. Their goal: measure and compare the temperature of bottles that had been refrigerated for three minutes to the ones that had been sitting on their desks.

The 18 students at Sargent Shriver Elementary School in Silver Spring, Maryland, were using the milk bottles in an experiment they designed in response to a challenge from Bialeski: Does air temperature outside a car affect the temperature of the air inside a car?

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> **- Julia Bialeski**

"The kids came up with the idea of using milk bottles to simulate a car and the mini fridge to simulate a cold day," says Bialeski, who teaches an experiment-based science class three days a week.

As the new school year begins, similar science experiments will be taking place across Montgomery County as part of an initiative funded by the Howard Hughes Medical Institute that aims to place a highly-trained science

teacher in each of the district's 130 elementary schools. Bialeski, one of 100 teachers participating in the Elementary Science Leadership Program (ESLP), has spent the last two years bolstering her own knowledge of science and exploring the best ways to teach it to young kids.

"As an educator, I've always been interested in science," says Bialeski, who has been teaching for five years. "I just didn't have the content knowledge. But my comfort level has gone way up over the last two years. It would be wonderful if every teacher had the opportunity to go through this program."

That may not be necessary. If ESLP works as planned, elementary teachers will be able to call on "science ambassadors" like Bialeski and her colleagues at their own schools to expand their understanding of science and identify new teaching approaches. "Basically, these teachers are being trained to be the go-to person for science at their schools," says Mary Doran Brown, an elementary school science curriculum specialist with Montgomery County who oversees ESLP. "It's a long process to get inquiry [teaching] through an entire school."

When Bialeski's first graders came together to share the results of their milk-bottle experiments, they discovered that their answers didn't agree. "Maybe we made some little mistakes when we were measuring the temperature," one student suggested, and Bialeski quickly agreed. "It's hard for the kids to grasp that if they don't follow the procedure exactly, they will not get data they can rely on," she says. She noted, however, that the students did learn one important lesson: science experiments may not always go right the first time.

The same could be said of science education. In elementary school, science class is often based on lectures from the teacher or readings from a book, rather than on hands-on, research-based projects that can help draw kids into science. Even more troubling, though, is the fact that the emphasis on reading and math skills sometimes means that science as a subject receives less consideration and emphasis from principals. "At the elementary level, Montgomery County schools, like many districts across the country, put their emphasis on reading and math because that is what they are going to be tested on and that's what the school is going to be measured on," Doran Brown says. "Unfortunately, social studies and science can take a bit of a backseat in such an environment."

In Montgomery County, on the northern edge of Washington, D.C., elementary students receive between 20 and 90 minutes of science instruction a week and Doran Brown says that's not enough. "Research has shown that

by the time kids get to middle school, they've pretty much started to set where they want to go in life. If we don't give them (early) experiences with science then we've really limited what their choices are going to be," she says. "We want teachers to use their ESLP training to help principals understand the importance of science."

The science leadership program in Montgomery County schools has its roots in an earlier HHMI-supported initiative that sought to remake the county's elementary science curricula and enhance science teaching. In the late 1980s, the county decided to change the curriculum by doing away with traditional lecture-based classes in favor of classes taught around a series of kit-based units, which would help students learn how to ask and answer questions.

Since 1999, HHMI has funded professional development classes and workshops that help Montgomery County teachers improve their understanding of important science topics. In 2006, Doran Brown began to overhaul these courses to refocus them on helping educate teachers who are comfortable at using inquiry-based teaching to instruct students about science. Doran Brown also wanted to develop leaders who could serve as science teaching experts in their individual schools. In addition to science training, ESLP teachers are given a $200 budget to stock supplies needed to conduct inquiry experiments and acquire training materials to help other teachers bring science into their classrooms. They are also encouraged to form a school science committee.

By bringing their excitement about science to other teachers, principals, and administrators, ESLP participants become advocates for the importance of science education. "We want all of our elementary students doing inquiry in the classroom and then talking about their experiences by engaging in meaningful scientific discourse with each other," Doran Brown says.

All teachers entering the ESLP program start with an intensive week-long summer session that provides an introduction to inquiry-based science learning. The crash course covers a variety of topics, such as how to ask a "testable question," generating hypotheses, and identifying dependent and independent variables. When the school year begins in the following fall, the teachers are ready to use the tools and techniques they learned over the summer.

Some teachers, like Bialeski, jump right into using inquiry-based learning in their own classroom. Others might establish an optional science club for interested students. That's the approach adopted by Deneise Hammond, a fifth grade teacher at Little Bennett Elementary School in Clarksburg,

Maryland. At Friday afternoon science club meetings, Hammond encouraged the fifth graders to identify questions and then design an experiment to see if they could find the answer.

Hammond guided her students in considering whether the sense of smell is necessary for the sense of taste. The students tasted jelly beans, but they couldn't come to a consensus about whether they needed their sense of smell or not. "We had to talk about refining the experiment," Hammond said. "But this is a really important part of the scientific process."

Hammond, who has been teaching for six years, says the focus on inquiry has changed the way she approaches teaching other subjects as well. "I am thrilled that I joined this program because it has changed my entire philosophy of teaching."

As the school year progresses, the ESLP teachers continue to refine their science knowledge and inquiry skills during four meetings during the school year. In addition to teaching more science and teaching techniques, Doran Brown and the other Montgomery County organizers set aside time to discuss ways teachers can serve as science leaders in a school where the principal may not place much emphasis on science education or doesn't provide teachers adequate time to pursue science inquiry.

The culminating event for many ESLP teachers is taking their students to a district-wide scientific inquiry conference. The conference, which is modeled on a scientific meeting, gives students a chance to present their work to peers from other schools. The students then take questions from the audience of kids from other schools about how they designed their projects or what they could do differently next time. "It's important that we ensure that we have respectful, constructive dialogue," Doran Brown says. "These student inquiry conferences really drive the program."

Thirty-six students attended the first conference in 2001, when it was part of inquiry-based teacher training. This spring, nearly 500 elementary students attended the conferences at Montgomery College's campuses in Takoma Park and Germantown and at the Universities at Shady Grove. Bialeski, who helped organize the conferences this spring, says they are far superior to the traditional science fair. "Too often, traditional science fairs feature simplistic, non-relevant questions and parent-made displays," she says.

In contrast, these conferences give all students, even those who might struggle in school, the opportunity to shine. "The children absolutely glow as they take part in all aspects of the conference—from the moment they walk in the door and receive their name badges, presenter ribbons, and conference packets, to the time they tour a real college science lab, to their individual presentations," she says.