

Batteries, Bulbs and – Band? Mason Graduate Teaching Fellows Take Their Research to K-12 Classrooms

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Mason graduate student Catherine Sausville oversees a sixth-grade science experiment at Manassas Park Middle School as part of a National Science Foundation grant program. With her are students Victoria Powell and Alicia Jimenez.

By Colleen Kearney Rich

Being a scientist is hard work. You have to deal with equipment failures, time constraints and problems with your colleagues — and that's all before lunch period.

That's what sixth graders at Manassas Park Middle School in Manassas Park, Va., are discovering this year. They are studying science a little differently with the help of Mason and the National Science Foundation (NSF).

For the first time, Mason's is participating in NSF's Graduate Teaching Fellows in K-12 Education Program (GK-12), which provides funding to engage science, technology, engineering and mathematics (STEM) students in teaching. Mason is currently the only university in Virginia participating.



One recent winter morning, Mason graduate student Catherine Sausville was conducting an experiment with Kelly Beatty's science class on the temperature of stars using batteries, wires and miniature light bulbs. The 25 students were working their way through the experiment with mixed results and a lot of chatter as Beatty and Sausville moved among the lab tables.

Sausville, who is working on her master's degree in mathematics, is one of eight fellows the [Schools, University 'N' \(and\) Resources in Science and Engineering \(SUNRISE\)](#) Project has placed in elementary and middle schools in Alexandria, Manassas Park and Fairfax County.

Fellows spend 10 hours a week in the classroom and work closely with the resident teacher to provide hands-on experiments that not only adhere to the Virginia Science Standards of Learning, but enhance them.

"The students have been very excited about having an actual scientist in the classroom, and theoretically it seems to be working," says Beatty, who is also working on a master's degree in educational leadership at Mason. "During the labs, my students are actively engaged, and test scores on the quarter exams have increased."

Putting Knowledge to Work

The project is a win-win situation for the university and the public schools, according to Rajesh Ganesan, an assistant professor in Systems Engineering and Operations Research in the Volgenau School of Information Technology and Engineering, who is a principal investigator (PI) on the \$3 million, five-year grant.



Rajesh Ganesan

*Photo by
Laura Sikes
Photography*

"We want the fellows to serve as a role model in the classroom and excite those students about math and science," he says. "But we are also working to create a group of scientists and engineers who are not only competent in research, but capable of communicating their knowledge to a wide variety of audiences. [The fellows] have the content knowledge, but not the pedagogical skills."

That's where co-PI Donna Sterling and the resident teachers come in. Prior to entering the classroom, the fellows received training from Sterling, a professor in the College of Education and Human Development and director of the Center for Restructuring Education in Science and Technology (CREST) at Mason.

"There is a huge shortage of science teachers," says Sterling. "Of those who do go into teaching, 60 percent normally leave the profession within five years. By providing support systems for these teachers, more will stay in the classroom, and that will result in better student scores."

In addition to having access to Sterling and attending weekly meetings as a group, the fellows also receive a critique on their teaching methods by the teachers with whom they are partnered. At the same time, fellows continually assess the units they teach with pre- and post-testing. So in exchange for assistance with their teaching skills, such as classroom management, the fellows help the resident teachers expand their content knowledge.

"And Kelly will be there when [the students] get out of hand, which they do," says Sausville of her teaching partner.

Providing Needed Resources

Ganesan is the veteran on the SUNRISE Project. (Faculty members Kathryn Laskey, Systems Engineering and Operations Research, and Robert Sachs, Mathematical Sciences, are also co-PIs on the project.) Prior to joining Mason, he was involved with the NSF program in the Tampa, Fla.,

school system while a PhD candidate at the University of South Florida.

Ganesan sees building the workforce of the future as one of the benefits of the SUNRISE project. Another is providing additional resources to the public school systems.

“Every school is so different,” he says. “Some schools have many more English learners. That affects how things are taught and how long some take.”



Teacher Kelly Beatty and Sausville watch students Adam Morin (standing), Juan Rivera-Argon and Christopher Hoffa tackle the battery-and-bulb experiment.

Photos by Evan Cantwell

Ganesan has plans to continue the project beyond its five-year NSF commitment and is already working to find future funding. He also wants to make the inquiry-based curriculum materials created as a result of the fellows' work to be available to other teachers and school systems.

Some of the other experiments and learning units taught by the fellows have included observing, recording and analyzing weather data; looking at infrared properties and how they are used in imaging; and investigating how differences in ocean salinity affect density and turn over. Ganesan has also encouraged the fellows to incorporate their areas of research into teaching.

Fellow Manisha Shrestha, a graduate student in chemistry and biochemistry, introduced lessons on protein bonding from her research, and Christy Henderson, a fellow and graduate student from physics and astronomy, introduced lessons on the sun's electromagnetic spectrum from her research in solar physics.

Fellow Joe Cremaldi, a graduate student in systems engineering and operations research, found an effective method for supplementing the sound unit he was teaching his fifth-grade class.

“About 50 percent of the class was taking band, so I told them to bring their instruments in,” says Cremaldi. He also invited the band director to join them. In labs he designed, the students explored the relationship between frequency, wavelength and pitch, and they were able to see some of the concepts they were learning demonstrated in class.

Since its inception in 1999, the NSF GK-12 program has funded more than 200 projects at more than 140 universities throughout the United States and Puerto Rico.

Other SUNRISE fellows are David Barr, physics and astronomy; Melanie Larson and Matthew Dale, systems engineering and operations research; and Jon Malachowski, electrical and computer engineering.

Other SUNRISE teachers and their schools are Colleen Vaughan, Beech Tree Elementary; Kelly Morris, Manassas Park Elementary; Ross Baker, Hutchinson Elementary; Sandra Haley, Lynbrook Elementary; Jennifer Orr, Annandale Terrace; Mark Walker, Cora Kelly; and Beverly Welch, Patrick Henry Elementary.

The project is overseen and supported by K-12 administrators in the three participating school systems: Bruce McDade, Manassas Park; Myra Thayer, Fairfax County; and Melissa Hamilton, Alexandria City.