

Elaborate
Explore Explain
Evaluate Engage

Five Es =
better math,
science teaching

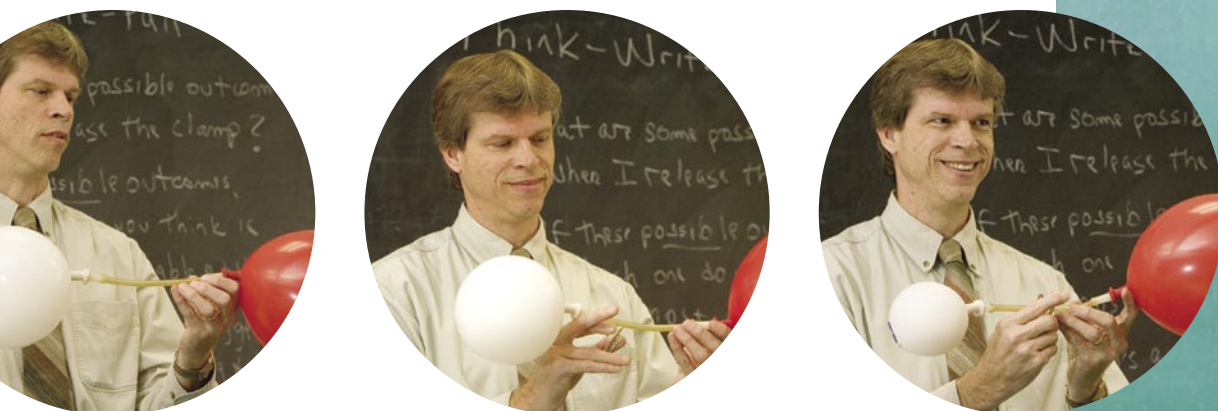
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CENTER STRIVES TO MEET THE CRITICAL NEED FOR TOP-QUALITY K-12 INSTRUCTORS

At least since Oct. 4, 1957, when the Soviet Union successfully launched Sputnik and began the space race, leaders in government, business and academia have worried over the performance of U.S. students in math and science — and over how the nation's standing in the world would be affected by it.



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— Thomas O'Brien

Today, that concern is as urgent as ever, and Binghamton University is stepping to the forefront of efforts to improve science and math instruction in U.S. schools, said Thomas O'Brien, associate professor in the School of Education and director of Binghamton's Center for Science, Math and Technology Education (CSMTE).

In 2006, the National Science Board reported that U.S. students were at or near the bottom among the 29 member nations of the Organisation for Economic Co-operation and Development that took part in a study of how well 15-year-olds use math and science knowledge.

In an effort to explain and help reverse such a poor showing, the NSB, which is the governing body of the National Science Foundation, took a close look at the ranks of U.S. science and math teachers.

“The number of certified science and math teachers at the middle school and high school levels is down, science education for pre-service teachers at our nation's education schools appears to be less rigorous compared to other subjects, and elementary teachers do not feel qualified teaching science,” the board concluded.

O'Brien agrees. “There's a need for updating a lot of teachers who are in

the field,” not only in terms of recent scientific developments, but also in “pedagogical content knowledge, the intersection between pedagogy with the particular discipline,” he said.

Although they have mastered their subject areas and care deeply about their students, many public-school teachers face a challenge in teaching science and math because their training isn't informed by the latest research, O'Brien added.

Binghamton's CSMTE, an organized research center, brings faculty and gradu-

ate students from Binghamton's School of Education, Harpur College of Arts and Sciences and Watson School of Engineering and Applied Science together with practicing teachers for professional development programs. The aim is to raise the level of math and science education and enhance the use of technology in public-school classrooms.

CSMTE's science programs expose teachers to a concept called the Five E Cycle — “Engage, Explore, Explain, Elaborate, Evaluate,” O'Brien said.

Relying only on “Engage” — enlivening lessons with hands-on activities — isn't the way to make sure students absorb new concepts, he said.

The most effective format for instruction is instead the integrated content unit, “a sequence of linked activities, some of which could be book learning, some of which could be a hands-on lab, some of which could be a computer simulation,” followed by an assessment, he added.

Teaching math and science is especially challenging for many instructors in kindergarten through seventh grade. Unlike their colleagues in eighth grade and high school, these teachers aren't required to specialize in a content area, said C. Beth Burch, a professor in the School of Education. They may have taken one or

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two mathematics courses in their entire college careers, she said.

Burch's husband, Paul-William Burch, assistant research professor of education, leads a CSMTE-affiliated project called Teacher Leader Quality Partnership (TLQP). Beth Burch and Jean Schmittau, associate professor of education, are co-principal investigators in the project.

Supported by a \$1.1 million grant from the New York State Education Department, the four-year TLQP project is a partnership among Binghamton University, SUNY Albany, the Sage Colleges, Mount Saint Mary and The College of Saint Rose. So far, it has provided 165 middle-school math teachers and selected fourth- and fifth-grade teachers in small-city and rural districts in New York state with professional training sessions that focus on teaching math.

"In many cases, the grant is not only teaching methods for how to teach it, but teaching the math itself," deepening teachers' understanding of the concepts so they can better convey them to students, Beth Burch said.

Schmittau, a specialist in math education, provides the math content for teachers who attend the sessions at Binghamton University, including teachers from the Binghamton City School District.

Meetings are marked by a great deal of lively discussion and collaboration, Paul-William Burch said. The program gives teachers "the opportunity not only to talk to each other about what has been successful" in the classroom, "but to engage speakers and university educators."

TLQP trains participants to share what is learned in the seminars with colleagues in their schools. And since part of CMSTE's mission is to focus on the needs of girls, students of color and students who are economically disadvantaged, TLQP offers "equity training" through the Albany-based New York State K-16 Alliance.

Other CSMTE programs in progress or recently completed include the \$1.3 million Enhancing Education Through Technology program, which is funded by a grant from the New York State Education Department and provides computer equipment and training to teachers in the Binghamton City School District; a \$150,000 Klee Foundation Award, which supports five science and five math education students in Binghamton's master of arts in teaching program; and ecological investigations at the University's Nature Preserve, which brought 480 Binghamton seventh-graders to campus for science field trips, using \$6,200 from the Stephen David Ross University and Community Projects Fund.

While many colleges and universities operate teacher education programs, few of them "place as much emphasis on research-informed pedagogy at the program level," O'Brien said. And while many programs use public schools as student teaching venues, they don't necessarily offer much to those schools in return. Binghamton's School of Education models a different approach and "has a long record of serving area schools," he said.

Ron Fisher, assistant superintendent for secondary instruction and personnel at the Union-Endicott Central School District, agrees.

"They're integral partners with us, in terms of providing professional development for our teachers, as well as providing opportunities for their students to work in the schools," he said.

O'Brien feels confident CSMTE's approach will add up to better math and science education. By working with public schools, promoting ongoing dialogues and training, better preparing new teachers and helping classroom teachers to employ research-informed teaching practices, the center seems to have devised a formula that promises to help spur a resurgence in U.S. math and science education. ■