CIESE HELPS EDUCATE TOMORROW’S ENGINEERS

New Jersey teachers participate in programs emphasizing science, technology and engineering in the classroom.

After the earthquake struck Josephine DiGennaro’s fourth-grade classroom at Connors Primary School in Hoboken, her student-architects rushed to examine their recently constructed buildings. Many found devastation.

It came as little surprise that several had tumbled down when hit with a violent jolt: they were made out of toothpicks and marshmallows on foundations of jello. The students were encouraged to experiment with a wide range of designs to determine what constructions could withstand the simulated quake. They eagerly rebuilt the ones that fell to better stabilize them.

“In some cases, we had to do go back and do some re-engineering,” DiGennaro recalled.

DiGennaro is one of 50 teachers from northern New Jersey elementary schools to learn innovative, hands-on teaching strategies from the Center for Innovation in Engineering and Science Education's (CIESE) at Stevens. The center’s Partnership to Improve Student Achievement program brings teachers to Stevens for two weeks in the summer over three years to improve their understanding of science, technology and engineering design and to teach them problem-based methods for conveying these subjects to students.

CIESE instructors follow up with the teachers at additional workshops during the school year, and by visiting their classrooms to coach them as they implement the lessons they’ve learned. They also observe the students and assess their progress.
Carving out a role for Stevens in strengthening math and science education in schools was a top priority for President Hal Ravché when he joined Stevens in 1988 and founded CIESE to expand the pool and capabilities of students who pursue science and engineering degrees.

Since then, CIESE has received more than $30 million in funding from the state and federal government, public agencies such as the National Science Foundation and from corporate and private foundations. The center has worked with more than 25,000 teachers in New Jersey and across the US on science, technology, engineering and mathematics initiatives at every grade level.

More recently, CIESE has begun offering programs that bring students to campus.

Sponsored by the National Science Foundation, a program called Build IT challenges middle and high school students to construct submersible robots from LEGO and other parts that can perform complex underwater tasks. More than 2,000 students from 36 schools throughout New Jersey and New York City have participated in the program, which grew out of research at Stevens’ Davidson laboratory.

Each spring, they bring their vessels to campus to compete.

Dee Guarino, an eighth-grade science teacher at the Linwood Middle School in North Brunswick, is one of the more than 70 teachers to embrace the program as a way of supplementing textbook science.

“We’re looking at real-world applications, using scientific tools,” she said of the program, in which student submersibles are tested on their ability to speed across a pool, maneuver around obstacles and pick up objects. “The students love it, because it’s hands-on. They can go off on their own creative tangents.”

She added, however, that courses such as Build IT emphasize the importance of scientific and engineering discipline. “We test nothing without documentation, either written or in a diagram.”

Guarino said it is not just the programs, but the engineers her students meet who make an impact on their view of the field.

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— Beth McGrath, CIESE’s Director

“The people who come to speak here, from Stevens and from our community, are not just people wearing lab coats. They are all kinds of people. We go from 23-year-olds in jeans to a 65-year-old mechanical engineer who builds remotely controlled planes,” she said. “This impacts the girls greatly. They understand that there are engineers in many fields.”

Her school district has responded enthusiastically to the program. The high school now offers electives in engineering, including a course next year that requires her science class as a prerequisite.

CIESE evaluates the success of its programs through several methods, including testing teachers and students before and after they use a new curriculum, and by reviewing their work.

Beth McGrath, CIESE’s Director, said that in two programs in particular, teachers and students showed very significant learning gains over comparison classrooms when tested on the science and engineering concepts they had learned through hands-on projects. The evaluations also showed substantial increases in interest and motivation, particularly among girls and disadvantaged students.

Enticing a more diverse group of students to enter these fields is one of CIESE’s primary aims.

“We’re teaching basic engineering techniques and concepts to students who might not get it in their schools,” said Pietro Vardro, a senior at Stevens majoring in biomedical engineering, who worked for two years with the Build IT program.

“The students who participate are incredibly diverse. They’re from every background, race and creed,” he said. “They’re very open to new ideas—simple, complicated, even crazy ideas.”

Attracting a diverse pool of students to engineering is a central concern of the program’s many funders, who believe it is important to the industry’s future vitality that it draw from all demographic groups.

“There’s a recognition among industry, government and universities that the US must do more to produce homegrown engineering talent that is representative of the US population,” McGrath said.

CIESE also invites students to campus for a chance to see the next stage in a possible career in technology and engineering. A recent Student Innovation Day in June brought 60 middle school children from northern New Jersey to Stevens to meet with young entrepreneurs who had designed patented technologies and secured funding from venture capitalists.

“This was a first exposure to a university environment for many of these young men and women and gave them a chance to visit a lab and interact with researchers,” McGrath said. “This program, which was sponsored by Honeywell, also provided students with real-life examples of young entrepreneurs, recent Stevens graduates, who are just a few years older than they are and who—because of their Stevens education—have designed a technology that addresses a market need and has potentially great economic value.”