

Office of Academic Communications & Assessment

CIESE Executive Director Beth McGrath Brightens America's Future in STEM

Stevens Celebrates National Engineers Week 2011

"We teach what we test and we test what we value." This adage informs the work of **Beth McGrath**, Executive Director of the **Center for Innovation in Engineering and Science Education (CIESE)** at **Stevens Institute of Technology**. McGrath is devoted to strengthening education in Science, Technology, Engineering, and Mathematics (**STEM**) fields at the primary and secondary school levels. Through its integrated approach in which students engage in scientific inquiry, problem-based learning, and engineering design challenges, CIESE gives teachers the tools they need to influence the innovators of tomorrow.



Video of Beth McGrath

Under McGrath's leadership, CIESE has become a national leader in K-12 engineering education and STEM education research. It was most recently honored as a recipient of the 2011 **Presidential Awards for Excellence in Science, Mathematics, and Engineering Mentoring (PAESMEM)**. Since 2004, the organization has garnered \$26 million in grant funding, including five **National Science Foundation (NSF)** grants. Through initiatives like PISA and PISA², the CIESE team is providing resources and instruction for educators to shape the future. CIESE has had an impact on over 30,000 educators and annually engages nearly 100,000 students in 35 countries through its online classroom projects in science and engineering.

CIESE collaborates with K-12 and university educators, researchers, policymakers, and educational organizations to develop curriculum materials, conduct professional development programs, and research new methodologies to strengthen STEM education. The Center's most recent project is the **Partnership to Improve Student Achievement in Physical Science: Integrating STEM Approaches (PISA²)**, made possible by a five-year, \$11.5 million Math-Science Partnership Grant from the NSF. The five-year program will impact 12 diverse New Jersey Schools with the goal of strengthening STEM programs in elementary and middle schools statewide. In total, PISA² will impact 87,000 students and 570 teachers, administrators, and Stevens students.



In a nation in which so much prosperity has been created by investments in research and development, it is surprising to find that STEM fields are lagging behind other nations. Yet, the National Assessment of Educational Progress (NAEP) has found that 43 percent of U.S. eighth graders failed to show basic science proficiency. That number was 35 percent in New Jersey. President

Barack Obama has stressed that continued advancement in science and technology are crucial for the economic prosperity of the United States as it loses workers to overseas competition not only in manufacturing jobs, but also in administration, finance, engineering, and research.

One challenge McGrath works to overcome is simply getting students interested in STEM fields. Studies have shown that 85 percent of economic growth per capita is due to technological innovation. However, only 4 percent of students pursue a technical field. "That's a big burden for a

small percentage of the population," McGrath says. "In order to create a workforce that is able to have the skills and the technological background in all the STEM fields, we have to do more at earlier stages to ensure that number can be a larger percentage of the population."

McGrath has worked toward this since she came aboard CIESE in 1993. She joined the program as Deputy Director under Founding Director Dr. Ed Friedman, when CIESE programs focused on exploring applications of math software to strengthen teaching and learning in middle and high schools. As technology evolved, CIESE began to pioneer use of the Internet for "unique and compelling" learning opportunities, such as engaging students in global telecollaboration on science investigations and using Internet-based real time data from research, government, and commercial databases such as those used by practicing scientists and researchers. McGrath was named Director of CIESE in 2004. A year later, she steered CIESE toward the then-nascent field of K-12 engineering. "K-12 engineering has become a major part of CIESE's overall portfolio of programs and research," McGrath says.

To test what we teach, we must first teach the teachers. PISA² is a scale-up of a previous program, **Partnership to Improve Student Achievement (PISA)**, a collaborative effort involving 50 teachers from 22 New Jersey schools, which has shown dramatic learning increases in science and engineering for elementary teachers and their students. PISA², an \$11.5 million, five-year grant from the National Science Foundation, aims to provide teachers with deeper science content knowledge, research-based instructional materials, and an understanding of how students learn science and engineering. The idea is to educate and provide resources for teachers, who in turn are better prepared to engage and facilitate their students' learning in STEM fields. The results speak for themselves: in the third year of the original study, PISA students had a 46 percent increase in post-test scores, versus a 17 percent increase for a similarly matched group of students whose teachers were not part of PISA.

Another initiative that McGrath launched and the CIESE team led, **Engineering Our Future NJ**, provided professional development to more than 3,300 educators in 1,500 schools in 465 public school districts and 182 private schools in all of New Jersey's 21 counties. "The EOFNJ initiative's goal was to ensure that all K-12 students in New Jersey would have an engineering experience as a core part of their education – not only as an elective or extracurricular activity," McGrath says. Though the grant funding for the program has ended, McGrath says it continues to garner positive buzz in K-12 schools. "We're getting a lot of requests to deliver teacher workshops on K-12 engineering programs," she explains. "Many schools throughout the state are starting to meaningfully engage in K-12 engineering programs," McGrath says, "and that's a recent development."

K-12 engineering is gaining prominence on the national level as well. McGrath was recently appointed to the Standing Committee of the **National Assessment of Education Progress NAEP 2014 Technology Education Literacy Assessment**, the first ever national assessment of engineering literacy to be administered at 8th grade. Advances like these, she says, bode well for the future. "It's a sign of the times that engineering is coming into its own. It still has a way to go in the K-12 world, but it's making progress."

With CIESE continuing to test what we teach and the way we teach it, the engineers, scientists, and mathematicians of tomorrow stand to provide America with an even brighter future.