



Reaching Out to Convey the Excitement of Science

How do you convey the excitement of science to young people? Motivate them to consider a college major in engineering or mathematics? Convince them to seriously think about going for an advanced degree and/or career in science... mathematics... engineering... information technology?

These are significant challenges that must be surmounted if the U.S. is to avoid what promises to be a serious problem: a future with an acute shortage of scientists and engineers.

Louisiana's Center for BioModular Microsystems (CBM²) has developed a program that "should be showcased and highlighted as a success" in addressing that problem. "In an era when science and the teaching of science have come under attack, CBM²'s education outreach program is an outstanding example of leadership in exposing our nation's youth to the technologies of tomorrow," reports the team of experts serving as the Center's Science Advisory Board (SAB).

"Our objective is to engage and familiarize a diverse community of students, teachers and the public with the broad range of opportunities available through the science, technology, engineering and mathematics (STEM) disciplines and the significance of their research to healthcare and related industries," says Dr. Steve Soper, director of CBM², the centerpiece of a \$9 million National Science Foundation EPSCoR and \$3 million Board of Regents Support Fund grant.

Housed at Louisiana State University and A&M College (LSU), it is comprised of a multi-institutional, interdisciplinary research team with expertise in microsystems engineering, materials, chemistry, and biological systems. The collaborating institutions are LSU, the LSU Center for Advanced Microstructures and Devices (CAMD), LSU Health Sciences Center in New Orleans, Tulane Health Sciences Center and Xavier University. External partners include researchers at Cornell Medical College, Sloan Kettering Memorial Cancer Research Center, and Baylor College of Medicine.

"Rather than reinvent the educational infrastructure, we opted to collaborate with existing programs, a strategy that offers the strongest likelihood for long-term sustainability," says Dr. Warren Waggenpack, Director of CBM²'s Education and Outreach (E&O) program. Partnerships have been established with LSU's Cain Center and its Minority Engineering Program; Louisiana Arts and Science Museum, Audubon Girl Scout Council, Howard Hughes Medical Institute's Scope on a Rope Program (SOAR) and Louisiana Tech's "Center for Applied Teaching and Learning to Yield Scientific Thinking" (CATALyST) program.

To maximize its E&O efforts, CBM² first convened focus groups comprised of diverse members of academia and the public to determine community needs, held workshops and attended teacher conferences. Additionally, they researched state and national data on the public's general scientific knowledge, elementary STEM



One of CBM²'s largest outreach events was its participation in LSU's "Science Saturday" during which over 1,100 youngsters and their families visited its booth where they participated in hands-on demonstrations.

tests results, current programs, and the field and level of awarded university degrees.

"The resulting consensus was that science is not reaching students; that they are not adequately prepared for rigorous STEM university degree programs," says Ms. Dann-Johnson, CBM²'s E&O program coordinator. "For example, Louisiana eighth graders scored below the basic understanding of science principles in a 2000 national examination on the fundamentals of earth, physical and life sciences.

"A majority of science teachers expressed a need for hands-on materials, continuing education workshops, and classroom equipment. And many organizations identified a need for hands-on science camps or science-based experiences for students."

Based on CBM²'s preliminary research, its E&O program is divided into three categories: K-12 (students and teachers); university level (students, faculty and staff) and the general public.

The Key

"The key to engaging people in science, which many find intimidating, is to relate it to something in their everyday world," says Ms. Dann-Johnson. "This piques interest and makes it easier to understand, creating a lasting impression that memorizing can't match. We do that through hands-on demonstrations and projects."

CBM²'s E&O program thus encompasses a range of creative activities that are fun and educational. "A favorite project is one in which you build a DNA model with gum drops and toothpicks. Another favorite activity of the students is using SOAR, a miniature-self-lighted video camera that magnifies images up to 200 times on a television monitor that can be used by a five-year old," says Ms. Dann-Johnson.

"It allows you to see patterns on micro-fabricated devices which, as seen by the eye, look like smudges. It's great for looking at different materials, metals, plastics and ceramics. The teachers and students use SOAR, which was developed by LSU professors, to magnify almost anything — a fingerprint, skin, a hair, butterfly

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wing scales, or microfossils — for an entire group to view at the same time.”

Noting that the need for professional development of science teachers is often “underappreciated in outreach programs,” the SAB team also cited CBM² for its programs that include “teaching middle school as well as high school teachers, many of whom come from as diverse backgrounds as the predominantly minority students who attend the schools.”

“We find the best way to reach the most students is through teachers, who each influence an estimated 30 students annually,” says Ms. Dann-Johnson, who adds that CBM²’s partnerships with the Cain Center and Louisiana Tech’s CATALyST program allowed it to offer four continuing education workshops for approximately 120 middle and high school teachers. Teachers, in turn, developed education modules, also for classroom use, incorporating hands-on demonstrations with accompanying experiment instructions.

“Because Louisiana is in the lower range of states awarding science and engineering degrees to women, two *Science Adventures* summer camps, developed with the Audubon Council Girl Scouts, had the specific goal of encouraging elementary school girls to consider science careers,” says Ms. Dann-Johnson, who holds an undergraduate degree in psychology and mechanical engineering and a master’s in mechanical engineering.

Each of the 60 girls attending the camps assembled a robot which was entered in a robot race at the conclusion of the camp; participated in hands-on projects, learned the basics of micromachining techniques and crystal properties, and was exposed to women with STEM-field careers.

“In surveys at the beginning and end of camp, the girls were asked what they want to be when they grow up. Initially, most gave traditional answers — teacher, veterinarian, or ballerina. By camp’s end, over half had decided they want to be a scientist or engineer,” says Ms. Dann-Johnson. “Several parents indicated surprise that their daughters understood and/or talked about circuitry, electrons and bridges even several weeks after the camp’s conclusion.”

In continuing the “STEM interest pipeline,” CBM² supports high school students in their classroom, such as the St. James Magnet High School and in a summer engineering camp, Recruitment Into Engineering of High-Ability Minority Students (REHAMS). Students are encouraged to investigate science and engineering

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principles through tours, labs and project design and required group presentations on what they have learned.

Projects included the design of containers for dropping eggs from their school stadium, solving a crime and designing a catapult. Among lab procedures the REHAMS students performed were microscopic hair and skin comparative analyses, basic DNA extraction, and a technique that can amplify a specific DNA sequence by as many as one billion times.

The outreach oriented E&O program provides opportunities for college students and faculty to mentor and instruct K-12 students in all of the workshop and summer camps, as well as the year-long engineering projects class at St James Magnet High School.

In addition, CBM² faculty and staff and university students participated in programs geared towards the general public, including LSU’s Science Saturday Lecture series and the Louisiana EPSCoR *Speaking of Science* (SoS) Speakers Bureau. One of Dr. Soper’s presentations, “Tiny Machines Do Big Jobs in Medicine,” has been developed as the first in a series of SoS talks aimed primarily at high school and general public audiences.

The CBM² E&O program ended its first year on a high note. “We are expanding our activities to include among other new programs, a camp for both boys and girls, and research experiences for teachers,” says Ms. Dann-Johnson. “And we have been asked to support and help develop second generation classes and workshops for our chemistry workshop for teachers as well as the Girl Scouts.”

For more information on CBM², go to <http://appl003.lsu.edu/cbmm/cbmm.nsf/index>. For SoS, go to <http://laregents.org/www2/programs>.



Louisiana EPSCoR
P.O. Box 3677
Baton Rouge, LA 70821-3677