Spreading the Word, Staying the Course

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4

Broadening the pool of future scientists and engineers

Recruiting students in engineering and the sciences is highly competitive, and the pool of qualified applicants is limited. It takes creativity and commitment to expand that pool, and to retain those students once they’re admitted. Here’s how UCSB tackles the challenge?

Face it: Math and science are not the easiest subjects. They’re tough in middle and high school, and their difficulty takes a quantum leap in the college years. Engineering combines the two—even more challenging for most students. UC Santa Barbara is sending a different message to kids who may not think of themselves as potential scientists or engineers: Don’t sell yourself short. You may be a future engineer and not yet know it. Science may be your strong suit. Set your sights on a career in these areas, and we’ll help you get there.
UCSB’s Message:

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*Set your sights on a career in these areas, and we’ll help you get there.*

That message is embodied in an alphabet soup of UCSB programs—CAMP, EPSEM, INSET, LEAPS, MESA, PREM, SIMS and others—that reach out to students from a wide range of backgrounds and seek to give them a pathway to success in college and beyond.

Some of this effort is explicitly directed at minority students. CAMP (California Alliance for Minority Participation in Science, Engineering, and Mathematics) and PREM (Partnership for Research and Education in Material Science) are two such programs. Others, such as MESA (Mathematics Engineering Science Achievement) have a somewhat wider target group—students who come from families with no history of attending college.

**MESA Pitches Science and Math**

MESA is one of the oldest and largest recruiting and outreach programs in California
higher education. Founded in 1970 and run out of the UC President’s office, it is active at six UC campuses, 11 Cal State University locations, 30 community colleges and about 300 middle and high schools. It has more than 180 industry partners— including big names such as Google, Microsoft, and Hewlett-Packard—and is a model for similar programs in seven other states. At UCSB, MESA activities run the gamut of recruitment and retention. At 24 schools in Santa Barbara and Ventura Counties, MESA provides academic enrichment, training in study skills, guest speakers, field trips, SAT/PSAT training, and other activities aimed at getting more students ready for college. For MESA students who go on to study engineering at UCSB, the program provides tutoring, support services and career networking.

Bob Cota, a mechanical engineer, spent 30 years in private industry before coming to UCSB nine years ago to be director of the MESA Center. He notes that UCSB has taken a lead role in developing the statewide MESA summer algebra academies. It is one of four institutions in California that join with Johns Hopkins University to offer an intensive five-week “What is engineering?? residential summer course for about two dozen 11th and 12th grade students. Cota calls this “an extremely tough, very good program? that ?gives students a better perspective on what to expect at the college level, and also tells them what they need to do to prepare.?

MESA’s profile on the UCSB campus is highest each year at the Science and Technology/MESA day, held in March. About 1,000 students come to UCSB for science and engineering competitions, tours of campus labs and libraries, and a chance to meet with UCSB faculty and students. They get quite a show. At the 2005 event, for instance, they talked via video link with astronaut (and UCSB alum) Leroy Chiao, in orbit at the International Space Station.

LEAPS—a Two-Way Education
MESA does its work with a staff of five, including two field operators working full-time in the area schools. Another outreach program, Let’s Explore Applied Physical Science (LEAPS), relies on UCSB graduate and undergraduate students to help eighth-graders get on track toward college-level science. Seven graduate students in engineering and the sciences are designated each year as LEAPS Fellows, receiving stipends from the National Science Foundation. Six of them work two mornings a week with teachers in middle school science courses, focused mainly on helping students do inquiry-based labs. The seventh leads 10 undergrad LEAPS Fellows in conducting after-school programs. The target student population is similar to that of MESA.
UCSB Professor of Physics Elisabeth Gwinn, who has headed LEAPS since its start in 2002, says the program is a two-way education. The eighth-graders learn how to do science, while the UCSB students learn something about teaching—both from their own interaction with students and from working with experienced local teachers. Gwinn says the fellows learn quite a bit of science, too. Explaining the basics of chemistry, physics and astronomy to middle-schoolers forces graduate students to fill gaps in their own knowledge. Fellows “know a lot about narrow fields going in,” she says, “and they leave with a broad knowledge of the sciences.”

Promoting Literacy at CNSI
UCSB’s outreach effort also extends to community colleges, where programs work to recruit students to summer internships that introduce them to the university. EPSEM (Expanding Pathways to Science, Engineering and Math) and INSET (Interns in Nanoscience and Engineering), both funded by the National Science Foundation, are two of these.

Leading EPSEM and INSET is the California NanoSystems Institute (CNSI), jointly run by UCSB and UCLA. Its director of education, Fiona Goodchild, sees its mission as fundamentally one of “promoting literacy in science and engineering.” CNSI’s other outreach initiatives include the Apprentice Researchers program, which has engaged local high school juniors in campus research groups since 1991, and shorter-term projects such as the current “Too Small to See” nanotechnology exhibit. Designed for children ages 8 to 13, the exhibit at CNSI’s Elings Hall continues through May 31 of this year, teaching through hands-on activities how scientists use electron microscopes, molecular models, and computer graphics to understand the structure and properties of nanomaterials.

At UCSB’s Materials Research Laboratory (MRL), educational outreach is a core activity, equal in importance to research. “It is written into the mission of the center,” says MRL’s education director, research scientist Dotti Pak. “The faculty see it as part of their responsibility, and their mission as well.” MRL initiatives are aimed at teachers, undergraduates, community college students and K-12 students, with several programs (including CAMP and PREM) aimed at minority students or predominantly minority
schools.

**Teaching with ?Buckyballs?**

MRL works closely with MESA in its local outreach, focusing its efforts on schools in the MESA program and, with MESA, running the summer algebra academy. But MRL initiatives have their own distinct flavor, thanks to the involvement of faculty members such as Ram Seshadri, an associate professor of Materials. Seshadri has built an educational program, mainly for eighth graders, around models of molecules called buckminsterfullerines, or buckyballs (their spherical structure of carbon atoms resembles that of R. Buckminster Fuller’s geodesic domes). Using a kit with which students can make scale-model buckyballs of their own, Seshadri’s program opens their minds to the wonders of nanoscience. As Pak explains, ?We talk to the kids about scale?what?s the scale of a nanometer relative to things they know?and the relationship between structure and properties of a material.?

The effort does not stop once students are admitted to UCSB. It enters a new phase?helping students stay the course?that can be just as challenging as anything that comes before. The sustaining effort targets community college transfer students as well as freshmen, and it starts in earnest before these students begin their UCSB classes.

The annual EPSEM Summer Institute, for instance, brings prospective transfer students to Santa Barbara for two weeks of interaction with UCSB faculty via lab projects, mentoring and social activities. Goodchild says students who get through the period of transfer shock? do well. ?If you talk to faculty, they often remember outstanding transfer students,? she says. ?Transfers usually know why they?re here, whereas many of the freshmen have not yet have figured out their priorities.?

EPSEM also sponsors the Summer Institute for Math and Science (SIMS), engaging about two dozen high-school graduates in two weeks of intensive instruction in mathematics, chemistry, writing, and lab skills, to prepare them for university-level work.
As is the case in many other outreach programs, the students going through UCSB's summer programs tend to be pioneers in their families or communities—the first to go to college. Most tend to come from minority groups, though a substantial share are non-Hispanic whites. Of the 107 students in the 2007 EPSEM summer program, 61% were minority. Their stories can be dramatic. UCSB Mathematics Professor Ken Millett, who has long worked with the SIMS program, recalls that one fellow a few years back was homeless; his family lived in a car in Los Angeles. People getting to college against such odds have a huge capacity for success, he says.

That particular student ultimately transferred from UCSB to a Cal State University campus. Millett recalls, for him, living in the dormitories was very traumatic. In his situation, UCSB was more than he could handle. But if the success rate of SIMS students isn’t 100%, it ranks favorably with that of UCSB students as a whole. From 1998 through 2005, according to figures from CNSI, 85% of SIMS students graduated in six years or less, compared to 76% for the full student body. Their average grade point average was 2.94 (just short of a straight B?), compared to a GPA of 2.92 for all UCSB engineering undergrads and 2.98 for undergraduates in general.

For the 75 to 80 MESA students enrolled in Engineering at UCSB, there are services such as tutoring and contact with alumni who have gone on to jobs with firms such as Boeing, Chevron and Raytheon. Cota, the MESA director, says this side of the program gets less generous funding than the K-12 recruitment side. Still, he says, it has achieved retention rates of 75% or better, and that’s significant in a field such as engineering.
The success of outreach and recruiting programs is tricky to measure, especially when their objective is not necessarily to get kids to go to UCSB. As Millett puts it, "I'm a faculty member at UCSB, and my first priority and objective would be for students to come to UCSB, do well, and go on to have a fabulous life." But he says he is happy if they go to other colleges on their way to success.

Likewise, K-12 outreach programs such as MESA measure their success not by the number of students who go to a particular college, but by the number who meet the standards for any UC campus, or for other four-year schools. On that score, MESA points to statewide numbers showing that its minority high school graduates have a high rate of eligibility for admission to UC—29%, in the latest report well above the statewide rate of 6.2% for African Americans and 6.5% for Latinos. "We have accomplished a lot with regard to increasing the number of students who prepare and are able to matriculate to a four-year campus," Cota says.

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