

See highlighted section re articulation by outcomes

Community Colleges Seen as Source of Engineers

October 8, 2008

The Chronicle of Higher Education
By JEFFREY BRAINARD

Engineers in America are too scarce and too white. That complaint comes from corporate chieftains and education leaders alike, who see those shortfalls as a virtual guarantee that jobs and innovation will head overseas. Now many are looking to remedies to both problems from an unsung source: community colleges.

Thanks to low tuition, overall enrollment is rapidly growing at two-year colleges. It is going down, however, in colleges of engineering at four-year institutions. And while just 12 percent of baccalaureate engineering degrees are awarded to African-American, Hispanic, or American Indian students, community-college students include large numbers from those groups who are potential engineering recruits.

"There is a lot of hidden talent at community colleges ready to jump into these degree programs, and we have to help them succeed," said Jim Vanides, program manager for global education grants at the Hewlett-Packard Company, the computer manufacturer, which has financed projects to help engineering students at two-year institutions. "We have high-tech companies," including his, "saying, 'We don't have enough trained people.'"

But the road leading a two-year engineering student to be a full-fledged engineer has proven to be rough because it travels through four-year degree programs. Universities' requirements for transfer credits vary, sometimes in unpredictable ways, making admissions hard and forcing some students to repeat course work. Even a little additional time and expense can force some of those students, who are frequently from lower-income families, out of engineering altogether.

A few states, such as Maryland and California, have launched broad efforts to smooth the transfer process. But such efforts are rare, and money to pay for them is tight, which irritates their advocates.

"What I've been saying is, okay, we know the gathering storm is coming — now we have to build the ark," says Oscar F. Porter, who leads such a program in California's community-college system. "At some point, you have to fund the guy with the hammer and the nails."

Benefits of Expansion

The warnings that America faces a shortage of homegrown engineers remain controversial because past predictions have been wrong. But educators generally agree that providing more people with an opportunity to study engineering will help produce the very-best engineers and a more tech-savvy work force.

When engineering students transfer from two-year colleges, they perform quite well. They earn better grades and graduate at slightly higher rates than those who started at the four-year institutions, according to research by the Department of Education and individual universities.

The challenge is getting them to switch to four-year institutions in the first place. Across all disciplines, only about one-third of students who enroll in public, two-year colleges eventually transfer, according to a 2003 report from the Department of Education.

Montgomery College, in suburban Maryland just north of Washington, is one example of how this problem affects engineering students, and it is trying to do something about it. Montgomery has 900 budding engineers, making it the largest such two-year program in the country. The institution also has a close, longstanding relationship with the engineering college at the University of Maryland at College Park, located just 12 miles away.

Still, only about 75 students transfer annually. (Most of them go to College Park.) To boost this number, officials from across Maryland's public and private institutions are trying a novel approach: a single, statewide agreement governing the articulation, or transfer of credits, for engineering students from two-year institutions. The agreement is modeled after an existing one Maryland developed for schoolteachers. A draft of the engineering deal, which would be the first of its kind nationally, was unveiled last month for comment.

The broad approach is unusual because such pacts are typically negotiated individually, between single four and two-year colleges. The resulting lists of courses vary widely, even though engineering educators largely agree on what students in each engineering subdiscipline should learn during their first two years.

Instead of course lists, Maryland's agreement defines analytical skills and areas of knowledge expected of prospective transfers. Participating two-year colleges would ask their governing board, the Maryland Higher Education Commission, to certify that their courses leading to an associate degree in engineering provide students with all of those "learning outcomes." Participating four-year institutions would, in turn, agree to accept all of the credits earned by those graduates.

No One Size Fits All

The draft was hammered out over two years by faculty members from most of Maryland's two and four-year institutions, both public and private. If approved by the higher-education commission, it could take effect next fall.

Given the differences in opinion across so many colleges, crafting such an agreement is "not an easy thing to do," says Richard Cerkovnik, who directs a science-and-engineering center at Anne Arundel Community College and helped lead the statewide faculty committee that created the draft. The cooperation, he said, "was very phenomenal."

The draft document does not provide a guarantee of admission, however. Participation by institutions will be voluntary. And four-year institutions can still set their own minimum grade-point averages required for students to get in.

What is more, the agreement would only cover two subdisciplines, electrical and computer engineering. Educators decided to focus on these areas because state officials projected that Maryland faces a bigger shortfall of baccalaureate recipients there — nearly 600 a year through 2014 — than in any other occupations studied.

Another limitation to the plan is that only some of Maryland's 16 community colleges appear equipped to participate. Just half of the colleges now offer an associate degree in engineering designed for students who want to earn bachelor's degrees.

Other colleges may not have enough interested students, qualified faculty, and laboratory equipment to generate candidates who can meet the transfer requirements, Mr. Cerkovnik acknowledges. But if the statewide plan is ratified, it will give those institutions guidance to develop their courses, Mr. Cerkovnik and other participants say. And eventually that could produce a bigger pipeline to four-year degrees.

Effective Advising Needed

It will, that is, if students in that pipeline get adequate financial aid and effective mentors and academic counselors. Clear rules about course work and credits are not enough, according to a 2005 report from the National Academy of Engineering on community-college transfers.

Donald K. Day, a professor of physics and engineering at Montgomery College, tries to be such a mentor. Mr. Day traveled to Atlanta in 2006 to visit seven of his former students who had transferred to the Georgia Institute of Technology, with which Montgomery maintains an articulation agreement. He took them out for dinner to catch up on their progress.

"I made it clear that Montgomery College remembers them and is proud of their achievements," he says.

Back in Maryland, he frequently badgers his counterparts at College Park to admit his students when their grade-point averages are mediocre because of some low marks in nonengineering courses.

A Model in California

The 2005 National Academy report also praised efforts that help build support networks among students. That is one hallmark of a program developed by community colleges in California since 1993 that garnered corporate partners and has gone on to inspire similar programs in several other states.

The MESA Community College Program now operates in 31 of the state's 109 community colleges. The program pays colleges to run academic workshops and supports industry advisory boards. On each campus, it equips a "student study

center" where engineering and science students are encouraged to study together, which research has shown tends to bolster their grades.

Each campus in the program gets \$81,500 annually from the California Community Colleges Chancellor's Office and must match that money with its own funds.

More than 500 participating students annually transfer to four-year institutions, mostly California's public ones; nearly 40 percent of them study engineering. The 500 represent 5 percent of all transfers from community colleges to four-year institutions in engineering and science statewide.

Impressed with that result, Hewlett-Packard provided \$658,000 in 2004 to replicate the model at eight two-year colleges in five states. The grants ran out last year, but those institutions have continued to finance them. Money for this kind of program remains hard to find, however.

In California, each campus's award of \$81,500 has remained flat even as the number of students who could benefit has increased. Mr. Porter, executive director of the program's parent, the Mathematics, Engineering, Science Achievement program, tried to look for federal financing. But he says he wasn't able to get money from the National Science Foundation for his project because it lacked key elements that the NSF usually looks for: a lead campus and a principal investigator seeking to test innovations in education.