

A WAY UP FOR LOW-INCOME STUDENTS

Two-year and four-year colleges should collaborate on a non-abandonment strategy.

By Donna Riley

Engineering promises access to white-collar jobs through a four-year professional degree. In reality, low-income and first-generation college (LIFG) students seeking to enter the profession face many obstacles that their wealthier counterparts do not.

Many low-income high schools lack access to a full set of STEM courses. According to the Department of Education, only half of high schools nationwide offer calculus, and 63 percent offer physics. These disparities disproportionately affect under-represented minorities; just 57 percent of African-American students have access to the full range of high school STEM courses, compared with 81 percent of Asians. The result: Students from low-income households are under-represented in college, and those who do enroll are far more likely to attend two-year colleges than high-income students. If engineering is to fulfill its promise of accessibility to LIFG students, it must empower two-year schools to lead the way.

Two-Year Colleges

Socioeconomic disparities affect study skills and ability to navigate one's education. Julie Martin's NSF CAREER study of over 1,400 first-generation engineering undergraduates revealed that LIFG students rely primarily on relationships with faculty and staff for their pathways into engineering, pointing to the importance of providing LIFG students with "resource-rich" (relationally if not monetarily) environments.

Lisa McLoughlin notes that two-year colleges are resource-rich, focusing on student learning and advising adapted to diverse needs. Despite the continuing pressure to track students into vocational programs, two-year schools can play a strong role in transferring engineering students to four-year in-

stitutions – an important pathway for LIFG, minority, veteran, and returning students.

Tribal Communities

A five-year project led by Oglala Lakota College (OLC) on the Pine Ridge Reservation in South Dakota demonstrates a model two-to-four-year pathway.

OSSPEEC, a partnership with South Dakota Mines and South Dakota State, is one of four Pre-Engineering Education Collaboratives (PEEC) jointly funded by the Tribal Colleges and Universities Program and the Engineering Directorate at the National Science Foundation. In just five years, these collaboratives built critical infrastructure for pre-engineering programs, enabling tribal college students to obtain engineering bachelor's degrees through transfer to four-year institutions. The mainstream institutions were transformed to address the specific needs of tribal college graduates, often far away from family support networks.

The Pine Ridge Reservation's poverty statistics are staggering: dead last in per capita income; 70 percent unemployment; high school graduation rates under 10 percent; 1 hour a week of high school science, delivered via a NASA outreach program. These are numbers engineers are trained to view as infeasible.

OLC's approach with OSSPEEC redefines constructivist experiential education in the Lakota context. Reservation-defined, community-based projects address real needs such as housing, food insecurity, and environmental justice, and provide research experiences alongside practical training. Students become certified in solar energy installation while they build low-cost, sustainable housing. This learning model is implemented in keeping with Lakota values, especially the concept of *tiospaye*, or extended family re-

sponsibility. Crucially, OLC practices a principle of non-abandonment: It will not terminate a student's education, finding resources to support students as long as it takes.

Shift the Balance of Power

OLC graduates succeed in engineering at mainstream partner institutions and beyond: The first OLC alumna ever to receive an NSF Graduate Research Fellowship and the first Mines student ever to receive a Udall Fellowship were OSSPEEC participants. In a broader sense, OLC transforms students' lives as non-traditional students build a pathway into engineering from every kind of background and life circumstance. There is no situation from which one can "never" become an engineer.

OSSPEEC's institutional transformations go far beyond articulation agreements. Change is borne by trust and by a new balance of power in which tribal college and community work together for tribe-defined goals, with mainstream institutions in a supporting role.

How can engineering practice non-abandonment? Four-year institutions must no longer cherry-pick students able to withstand engineering's "rigors," which are structurally impossible to meet alongside family responsibilities or multiple jobs. We must make the engineering bachelor's flexible, family-friendly, and resource-rich. We must shift the balance of power between two- and four-year schools: those who know LIFG students best must be the ones to lead four-year institutions in designing learning experiences, curricula, degree plans, and support structures to see them through to a career in engineering.

ASEE Sterling Olmsted Award winner Donna Riley is a National Science Foundation program director in the Engineering Education and Centers division. Her Revolutionizing Engineering Departments initiative was featured in the November 2014 Prism.

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