

ACCESS: Advancing Community College Engineering Student's Success

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Abstract: Project ACCESS aims to increase the number of associate's and bachelor's degrees in Engineering granted to minorities in South Central Texas. With NSF funding, San Antonio College (SAC) developed a Summer Bridge for predominantly Hispanic high school students interested in becoming engineers, providing college credit for engineering-related coursework. SAC also developed new engineering and math courses, converted courses to online format, and infused engineering/math courses with new methodology/technology. Two-plus-two course articulation agreements have been implemented with several 4-year engineering programs. ACCESS has significantly increased the number of students in SAC's Engineering Program and the number receiving associates degrees in engineering.

Goals and Objectives:

The goal of Project ACCESS was to increase the number of associate's and bachelor's degrees in Engineering granted to minority residents of South Central Texas.

The **objectives** included: the establishment of dual credit engineering courses in at least five area high schools; training for Engineering faculty at San Antonio College (SAC) in distance education and new engineering education methodology; infusion of state-of-the-art technology into engineering curricula; conversion of Engineering Courses into Internet format; the creation of a new engineering course, "Engineering Mathematics;" development of articulation agreements for 2 + 2 transfers with at least three 4-year Engineering programs in the South and Central Texas area; local regional state and national dissemination of the results of this project to other educators.

The expected **outcomes** were to enroll at least 40 high school students, more than 50% of them minority, in dual credit Engineering or pre-Engineering courses at SAC each year, to enroll at least 20 students each semester in Web-based Engineering courses; to increase the numbers of minority Engineering majors at SAC who transfer to Engineering programs at four-year institutions by at least 200%; to increase the numbers of minority students graduating from SAC with an Associate's Degree in Engineering by at least 200%.

This project was funded through a Discretionary Education Grant from the National Science Foundation.

Program Results 2002-2005:

The Principal Investigator discovered early on in the project that it was not possible to create Dual Credit offerings for the high schools in engineering courses because the state did not offer credit for engineering to high school students. As a result, he developed a program which would give College Credit for engineering and other core college courses to pre-engineering

students while they were still in high school.

The EDGE Summer Bridge, developed through the ACCESS grant, provides college credit in math and engineering to 10th -12th graders academically prepared for introductory college courses. EDGE takes place during an eight-week summer session at San Antonio College. During the summer program, a learning community of 20-25 10th through 12th grade high school students is enrolled in two college courses, Introduction to Engineering and a math course, which meet mornings, Monday through Friday. Students also receive information on college strategies for success and peer-led Supplemental Instruction, and participate in several field trips to area engineering-related industries and businesses.

In **2003**, of 32 applicants, 20 met the standard college admission requirements, and seven qualified to enroll in College Algebra. All 20 students were enrolled in an Introduction to Engineering course along with 10 college students. Seven students were enrolled in College Algebra with 19 other regular college students, and 13 participated in supervised math learning activities in the Basic Skills Enrichment Program. All 20 EDGE students received college credit for the Engineering course, and their academic performance was comparable with college-level classmates. The productive grade rate (PGR) for the EDGE students was higher than the class rate and the withdrawal rate for EDGE was lower.

In **2004** there were 112 applicants, with 58 meeting college admission requirements. Although 10 of the applicants had a productive high school grade in Pre-Calculus, only 6 qualified for College Algebra on SAC's Accuplacer test. Twelve additional students close to the math cut-off score were allowed to enroll in College Algebra. Thirty-six students in two separate cohorts were enrolled in Introduction to Engineering and Computer Literacy. 93% of EDGE students (50) got college credit for Engineering 1201 in 2004, and 73% (13) of those taking College Algebra got college credit, while 100% (36) of those taking the computer literacy course offered passed the course with college credit. The 2004 EDGE students performed as well or better in their course work as college-level students.

Secondary track students who also participated in the PLATO Fastrack Advantage program were assessed in math skills at the beginning and at the end of the eight week session. The initial assessment results indicated that 10 students were above the 9th grade Math level and 26 were below. The exit test showed a marked improvement: 29 students were above 9th grade Math level and only 7 were below. The average grade level increased 46.82%, from a 6.6 average grade level to 9.69.

Of the students participating in EDGE during the first two years, 76% were from school districts designated as "Economically Disadvantaged," and 82% were minority; 74% were Hispanic, 4% were African American, and 4% were Asian/Pacific Islander.

For **2005** the increase in popularity of the EDGE program prompted us to return to our original program design for 2005, with a single track offering College Algebra and Introduction to Engineering, and to add 12th graders to our targeted student population. The results of this strategy fell far short of our expectations. The number of applications dropped by 63% from 2004, and although the qualifying rates for college admission and college algebra were slightly higher, the total numbers were down. From the initial 52 applications received only 35 students qualified for enrollment. We abandoned the original model and offered only two sections of a slightly more rigorous version of Computer Literacy with the Introduction to Engineering course in the morning. In the afternoons the students also participated in the PLATO Fastrack Advantage program to improve their math proficiency and had problem solving sessions guided by their Supplemental Instruction Leaders. Students were divided into two learning communities. Although only 26 students started the program (principally due to summer

employment) two learning communities of 13 students were maintained because of lab occupancy limitations.

One faculty member taught both sections of Engineering and one faculty member taught both sections of Computer Literacy. At the conclusion of the first class period, each cohort switched subjects. The consistency of faculty helped in the development of Learning Communities and aided in the management of the supervised study sessions. The faculty had weekly meeting to coordinate the subjects between the two classes (Engineering and Computers), synchronize the material to be covered, combine appropriate assignments, and correlate the testing schedules.

All students enrolled in EDGE 2005 Program received productive grades and college credit for both courses and all participating students showed an average gain in their math skills of 3.8 grade levels.

In the area of **curriculum development**, the Principal Investigator completed training in distance education and website development, and WebCT lecturing. An engineering course was revised and updated to include international aspects of engineering activities including global standardization. Intro to Engineering was updated with PowerPoint presentations, and Engineering Graphics II was upgraded to include AutoCAD 2004 and Inventor 7. "Engineering Problems" was adapted to be offered on line. The previously retired "Introduction to Surveying" course was updated and revived as "Engineering Plane Surveying", and accepted by University of Texas at San Antonio and the Texas Higher Education Coordinating Board (THECB).

Intro to Electrical Engineering was created and offered in Fall 2004. Two additional new courses, "Applied Engineering Mathematics" and "Introduction to Environmental Engineering" were developed through ACCESS, but because these courses had equivalencies only at the third-year level, only University of Texas at San Antonio agreed to recommend these courses for acceptance by the THECB. The University of Incarnate Word and Texas A& M at Corpus Christi said that they could not accept them as sophomore equivalents.

ACCESS articulation efforts were very successful. SAC obtained a 2+2 articulation agreement with the University of Texas at San Antonio in the first period of this grant which was later revised to include the new "Engineering Plane Surveying" Course, ENGR 1407. In 2004, SAC officially signed an articulation agreement with Texas A&M Kingsville that provided the ground for San Antonio College to begin offering junior-level Engineering courses through A & M **on our campus**. Texas A&M – Corpus Christi University sent us a letter of acceptance for transfer for all of our Engineering courses. For Texas A&M - College Station two new 2+2 articulation formats, for Civil Engineering and Ocean Engineering, were adopted.

In the area of **dissemination**, the Principal Investigator co-authored and presented two papers, "Forging Stronger Ties Between Community Colleges and Four Year Universities" and "Getting an EDGE in Engineering Education" at the 2004 ASEE Annual Conference and Exposition. Another paper, "A Strategy for Success: The EDGE Program in the Second Year", has been presented at the 2005 ASEE Annual Conference and Exposition. The program has been presented by the principal investigator at Texas Engineering and Technology Consortium Conference in 2002, Mexican American Engineers Society national conference in 2002, Texas Association of Schools of Engineering Technology (TASET) conference in 2003, National Science Foundation grantees meeting in 2003, Hispanic Association of Colleges and Universities conference in 2005. Articles and press releases about ACCESS activities were published in the San Antonio Express News, and college and District newspapers and newsletters. The Principal Investigator made presentations about EDGE at all independent school districts from surrounding area. As a result of the above activities, Dr. Dimitriu also participated as a member

of the steering committee for Enhancing Community College Pathways into Engineering Careers, a collaborative effort between the National Academy of Engineering Committee on Engineering Education and the National Research Council Board on Higher Education and Workforce.

Outcomes:

ACCESS grant activities have resulted in an increase in the number of students taking engineering courses at SAC from 45 to 129 over three years. The number of students with Engineering as their declared major has also increased from 238 students in Fall of 2001 to 383 students in Fall 2004. The number of students getting associate's degrees in Engineering has gone from 1 in 2002 to 7 in 2004, and the number of students who received certificates has gone from none to 5 in that time period. Of the 20 students who successfully completed EDGE in 2003, 8 are enrolled presently at SAC, and 6 of those declared Engineering as their major, while one entered Engineering Technology. Of the 54 students enrolled in EDGE 2004, 13 are enrolled at SAC. Nine of these 13 are in Engineering, one is in Computer Science, and three are in Liberal Arts. Three students from the 25 students that finished EDGE 2005 are presently enrolled at SAC.

Future Developments

In previous years, the two college level courses offered in the EDGE Summer Bridge for high school students were College Algebra and Introduction to Engineering. However, it was found that most of the students applying to the program were in need of remedial math skills, and it is generally acknowledged that placement in remedial math for STEM majors is correlated with increased attrition rates. As a result, the College Algebra course was replaced with a Computer Literacy course and supplemental activities utilizing Plato Fastrack Advantage computer aided instruction.

Recognizing the significance of this "math barrier" to the retention of STEM majors, we piloted an accelerated math course during the 2005 Summer EDGE Program, and will fully develop it during the Spring 2006 semester. This new course is based on findings that students do better in intensive classes that meet every day. It substitutes for the three current remedial math courses, Math 0301, 0302, and 0303, and consists of a one-semester, five-credit-hour course of one hour a day of self-paced, computer-guided instruction in remedial math and one hour a day of faculty instruction that applies mathematical concepts to real-world examples in engineering and other STEM fields. The course will be piloted for SAC students in Spring 2006 and for EDGE participants in Summer 2006. If results of the test runs are significant, we will move to get the course approved for SAC undergraduate STEM students and also high school STEM students starting in Fall 2006.

During the last year of the ACCESS grant, the project also plans to improve its Website and link STEM students in high school and college, as well as their instructors, to STEM activities, resources and opportunities through the Website.