

2006-139: THE EDGE SUMMER PROGRAM IN ITS THIRD YEAR

Dan Dimitriu, San Antonio College

DAN G. DIMITRIU has been practicing engineering since 1970 and taught engineering courses concurrently for over 20 years. He has been involved with several engineering societies and was elected vice-chair of the Two-Year College Division of ASEE in 2005. He has been the coordinator of the Engineering Program at San Antonio College since 2001. His research interests are: alternative fuels, fuel cells, plastics, and engineering education.

Jerry O'Connor, San Antonio College

JERRY O'CONNOR has been teaching physics (and a few engineering courses) at San Antonio College since 1987. He was the Campus Coordinator for the Texas Alliance for Minority Participation program from 1993 to 2002, and is currently the Department Chairperson for Physics, Engineering, & Architecture. He has been involved in numerous initiatives to integrate the findings of physics and engineering education research with education practice.

THE *EDGE* SUMMER PROGRAM IN ITS THIRD YEAR

This paper presents the results of the third cycle of the EDGE (Early Development of General Engineering) Summer Bridge Program that was initiated in 2003¹. This project was partially funded by the National Science Foundation and by the Alamo Community College District Foundation.

Brief History of the Program

The original design of our program was geared toward well-prepared high school students in the 10th and 11th grades, many of whom would have participated in the San Antonio Pre-freshman Engineering Program (PREP). EDGE would introduce them to college level course work as a learning community, provide activities to help them develop independent learning and teamwork skills, and thereby increase their likelihood of earning a college degree in engineering, science, math, or other related field. The learning community courses were Introduction to Engineering and College Algebra.

Despite the warm reception to the program shown by teachers, counselors, and school administrators, the number of applications received was disappointingly low. We initially ascribed this to the novelty of the program and our learning curve for promoting it. The small fraction of applicants eligible for College Algebra was also a disappointment. This prompted us to change the way we advertised and structured the program for the second year².

In 2004 we marketed the program more to school district administrators and less to teachers, counselors, and principals. We also established a dual-track program in which one track followed the original program concept (College Algebra and Introduction to Engineering) and the other track was composed of Computer Literacy and Introduction to Engineering. Both tracks provided five college credit hours upon successful completion of the program.

The change in marketing strategy was effective, and applications went up by 250% from the first year. However, only half of these applicants met college admission requirements, and an even smaller fraction of them qualified for College Algebra. While the academic achievement measures for the 2004 Program were good, they were not quite as good as for the 2003 Program, and many students who were not sufficiently challenged by the Computer Literacy course ended up testing the capacity and commitment of the program management and staff to enforce rules established for student conduct^{1,2}.

This prompted a return to our original program concept for 2005, with a single track offering College Algebra and Introduction to Engineering, and adding 12th graders to our targeted student population in order to increase the pool of students who would be qualified for college algebra.

The results of this strategy also fell short of our expectations. The number of applications received dropped by 54% from 2004, and although the qualifying rates for college admission and college algebra were somewhat higher, the numbers were down across the board. From the initial 52 applications received, only 35 students met college admissions standards and only three qualified for College Algebra.

At this point we abandoned the original program model and set up two parallel learning community (LC) cohorts with a slightly more rigorous version of Computer Literacy and the Introduction to Engineering course. In the afternoon sessions students were required to participate in the PLATO Fastrack Advantage program to improve their math proficiency and also had problem solving sessions guided by their study group leaders. Only 26 of the 35 students who were accepted actually started the program, some because of the change in the courses offered.

Program Details

EDGE students were required to meet the same admission requirements as other college-level students, and paid only a \$25 entry fee. As in the previous years, students attended the two classes in the morning from 9:00 AM to noon, Monday through Friday for eight weeks. The afternoon activities consisting of supervised study (SS1) and student success (SS2) sessions were held from 1:00 to 4:00 pm. Each class cohort was split into two smaller study groups, each with a designated Study Leader trained in group learning methods (similar to Supplemental Instruction) prior to the start of the program. The training also emphasized the value of collaborative learning and peer support, and explained the purpose and function of Learning Communities. The SS1 sessions provided a supportive environment for students to work together on homework and group projects while building a sense of community and shared success. The SS2 sessions were one hour long and included the entire class, along with the SS1 Leaders. These sessions included workshops on study techniques, test taking, guest speakers, and special presentations on topics pertaining to the field of engineering. At least one half hour every day was reserved for the PLATO Fastrack Advantage program. There were also four field trips conducted to introduce students to engineering activities in two privately owned local companies, one quasi-governmental agency, and the San Antonio College planetarium.

One faculty member taught both sections of the Engineering course and one faculty member taught both sections of the Computer Literacy course. The consistency of faculty helped in the development of the learning communities, and aided in the management of the supervised study sessions. The faculty held weekly meetings to coordinate the course material and testing schedules between the two courses.

Program Results

All students completing the EDGE 2005 Program received productive grades and college credit for both courses. The distribution of final grades is presented in Table 1 below.

A	B	C	D	F	W	Productive Grade Rates
ENGR 1201						
14	10	1	0	0	1	96%
COSC 1301						
15	9	1	0	0	1	96%

Table 1: Final Grades posted for the entire group

The PLATO Fastrack Advantage program provided an assessment of students' math skills at the beginning and again at the end of the eight week session. The scores indicate a substantial gain in math skills for most of the students. The initial assessment indicated that 6 students were above the 6th grade Math level and 19 were below. The exit test showed a marked improvement: only two students remained below the 6th grade Math level and four students were above 9th grade Math level with the rest ranking in between. The average grade level improvement is shown in Table 2.

Initial grade level	Final grade level	Grade level increase
3.78	7.58	3.80

Table 2: Average PLATO Assessed Math Level Results

The achievement of desired program outcomes was assessed through three surveys conducted during the eight week session. The first was administered the first day of the program to assess students' existing knowledge of engineering and their familiarity with campus life. The second was a field trip evaluation questionnaire administered after the last field trip, and a final questionnaire was administered the day before the closing ceremony to evaluate the entire program. The survey results are presented in the Appendix and summarized below in association with related program outcomes.

1) Students will develop a good understanding of student life and the particularities of being an engineering student, the nature of engineering work, and become familiar with the various engineering fields.

Results: Initially only seven students had an excellent or very good knowledge of engineering profession and only four had a very good knowledge of college life. The final survey shows that 18 students learned a great deal and more than expected from the program.

2) The course materials and activities utilized in the program will be well correlated and useful in preparing students for success in mathematics, engineering, technology, and the sciences.

Results: At the end of the EDGE Program the students as a group showed a substantial gain in average math skill grade level. Although the two courses were well suited for linkage in a learning community designed to provide knowledge, skills, and the peer support needed for academic success and a technical career, many students had already attained mastery of some course content (computer literacy). In the final survey most of the students considered the courses well coordinated and interconnected, and all declared that they would recommend the EDGE Program to other students.

3) Students will experience academic success and student life in a college environment and begin to accumulate college course credits towards an Associate's degree at San Antonio College.

Results: All but one student enrolled in the EDGE 2005 Program received productive grades and college credit for both courses.

4) The EDGE Program will be effective in attracting and retaining high school students into the study of engineering and other technical fields (preferably at San Antonio College).

Results: In the final survey 19 students expressed their interest in continuing their technical studies through a second level of EDGE Program, if there was one available, as definite or highly probable.

The number of students returning to San Antonio College after attending previous EDGE Summer Programs is being monitored as an indicator of program's effectiveness. Of the 20 students who successfully completed EDGE in 2003, 8 were enrolled at San Antonio College in Fall 2005 semester, 6 with a declared major in Engineering and 1 in Engineering Technology. Of the 54 students completing the EDGE 2004 Program, 13 were enrolled at San Antonio College in Fall 2005 semester. Nine of these have declared a major in Engineering, one in Computer Science, and three in Liberal Arts. Three of the 25 students that finished EDGE 2005 continued their studies at San Antonio College in fall of 2005.

Conclusions

A brief review of other recruitment and retention programs for engineering around the country shows that similar problems have been encountered to various degrees and similar results have been achieved^{3,4,5,6,7,8,9}. This gives us confidence to continue refining our program model in order to improve our ability to attract and retain more students in math, engineering, science, and technology.

An overview of the application and enrollment history of the EDGE Program is presented in Table 3. The trend in student participation reflects an evolving focus on the composition of the curriculum and the readiness of our target population.

EDGE Cohort Year:	2003	2004	2005
Applications received	32	112	52
Students accepted into the program	20	62	35
Students enrolled in the program	20	58	26
Students qualified for College Algebra	7	6	3

Table 3: EDGE Program Participation History

Although a strong positive response continues to be received after presentations at local high schools, the number of applications received and the academic preparation of students has remained below expectations. There has thus been a perceived pressure to extend application deadlines to obtain a better pool of qualified students and to compensate for disparities in the timely reception of program information at some high schools. Although this leniency has enabled us to enroll a few more students in the program, the overall results do not seem to justify the extra work and uncertainties involved.

Another ongoing challenge we continue to face in conducting this program is in recruiting and retaining competent group study leaders. This effort has become a year-round process, and we are expanding our search to include pre-service science and math teachers.

In terms of raw numbers, the number of students academically prepared for College Algebra has continued to decline. Facing this reality, we are considering another course to replace College Algebra. The Computer Literacy course provided neither sufficient academic challenge for the majority of students nor did it provide a physical context for the development of desired math skills. We hope to effectively address these shortcomings by linking the Introduction to Engineering course with the conceptual level Introductory Physics course, and adding some hands-on lab activities for enhancing math skills and broadening students' familiarity with the application of technology. The value of the Plato Fastrack Advantage Program seems to be well established, and it may also play a role in EDGE 2006, which will remain open to all high school students.

Because of the difficulties encountered with College Algebra, one of the original program goals that has remained out of reach is the development of a second phase EDGE Program that would allow students to complete the bridge between their high school and college studies. If we can bring them to readiness for College Algebra with the 2006 Program, we will be happy to report on a new proposal for a second-generation EDGE program that can be more fully integrated with continuing college course work.

As in previous years, we remain indebted to the other members of our EDGE Executive Team, the program faculty, and our college administration. Their participation and support has enabled us to continue offering this program, and to make continuing improvements to help increase the number of high school students entering college with the intention and capability of achieving a degree in Engineering, Science, or Mathematics.

References:

1. Getting an *EDGE* in Engineering Education, by Jerry O'Connor and Dan G. Dimitriu, ASEE Conference, Salt Lake City, UT, June 2004
2. A Strategy for Success: The *EDGE* Program in the Second Year, by Dan G. Dimitriu and Jerry O'Connor, ASEE Conference, Portland, OR, June 2005
3. PREP – PreEngineering Program, URL: < www.prep-usa.org/portal/texprep/ >
4. < www.msoe.edu/admiss/summer/index.shtml >
5. < <http://studentservices.engr.wisc.edu/diversity/esp/> >
6. < www.engr.ncsu.edu/summerprograms/index2.html >
7. < www.seas.virginia.edu/minority/ite.htm >
8. < www.engineering.cornell.edu/diversity/office-diversity-programs/summer-programs/index.cfm >
9. Bringing “Engineering Forward” To The High Schools: One University’s Experience In Starting An Engineering Summer Camp Program, by Bryen E. Lorenz, Frontiers in Education Conference, Savannah, GA, October 2004.

APPENDIX

Survey Results:

#	<i>INITIAL SURVEY - 26</i>	<i>OUTSTANDING</i>	<i>VERY GOOD</i>	<i>AVERAGE</i>	<i>MARGINAL</i>	<i>NONE</i>	<i>YES</i>	<i>NO</i>
1	Knowledge Of The EDGE Program		1	9	12	4		
2	Knowledge Of College Life		4	13	7	2		
3	Knowledge Of The Engineering Profession	2	5	8	8	3		
4	Interest In An Engineering Career	2	8	9	6	1		
5	Participant In Similar Programs						15	11

#	<i>FINAL SURVEY - 25</i>	<i>OUTSTANDING</i>	<i>VERY GOOD</i>	<i>SATISFACTORY</i>	<i>MARGINAL</i>	<i>UNSTSF</i>	<i>YES</i>	<i>NO</i>
1	EDGE Program	6	17	2				
2	PLATO Instructional Materials	2	8	8	5	2		
3	S. I. Leader's Knowledge & Leadership	13	5	3	2	2		
4	S. I. Leader's Willingness To Help	9	9	3	3	1		
5	S. I. Leader	12	5	4	2	2		
6	Recommend EDGE Program						25	
7	Classes Were Well Coordinated & Interconnected						22	3
<input type="checkbox"/>	<input type="checkbox"/>	<i>MORE THAN EXPECTED</i>	<i>A GREAT DEAL</i>	<i>ENOUGH</i>	<i>VERY LITTLE</i>	<i>NOTHING</i>		
8	Learned	5	13	7				
<input type="checkbox"/>	<input type="checkbox"/>	<i>DEFINITELY</i>	<i>HIGHLY PROBABLE</i>	<i>MAYBE</i>	<i>NOT LIKELY</i>	<i>NO</i>		
9	Interested In A Second Level EDGE Program	12	7	6				

#	<i>FIELD TRIPS SURVEY - 25</i>	<i>STRONGLY DISAGREE</i>	<i>DISAGREE</i>	<i>NEUTRAL</i>	<i>AGREE</i>	<i>STRONGLY AGREE</i>
1	Trips Were Informative	1	1	4	16	3
2	Site Guides Were Knowledgeable & Helpful	1	0	9	10	5
3	Trips Supported The EDGE Program Objectives	1	2	1	18	3
4	Trips Supported Continuing A College Education	1	2	7	11	4
5	Trips Were Satisfactory	2	2	2	17	2