

FORGING STRONGER TIES BETWEEN COMMUNITY COLLEGES AND FOUR YEAR UNIVERSITIES

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This paper is based on a work in progress funded by the National Science Foundation, initiated to address common problems faced by Engineering Programs in Community Colleges.

In order for the U.S. to remain competitive in a global, technology-based economy, there is a pressing need for more students to prepare for careers in engineering and technology. It is widely known that engineers are essential to both the private and public sectors, and that it is in the national interest to vigorously pursue the development of domestic science, technology, and engineering workers from all ethnic and gender groups.

At the same time, less than 15 percent of high school graduates have enough math and science to pursue scientific/technical degrees in college, and almost half who begin engineering courses either do not complete their education or choose a different field before graduation. Less than 2 percent of U.S. high school graduates go on to earn engineering degrees, and five years after graduation, 80 percent of those are working in some other field.⁽¹⁾

Community Colleges (sometimes called Junior Colleges), face similar problems in the recruitment and retention of engineering students as Four Year Universities. In addition to the challenges noted above, community colleges generally (or often) lack recognition, guidance, assistance, and cooperation from Four Year Universities that would facilitate the offering of appropriate course work and transfer of credit hours, generating a substantial loss of potential students. This situation calls for Community Colleges to reach out for support and collaboration with Four Year Universities to develop new strategies to attract, prepare, and retain students in technical fields.

San Antonio College has received two grants from the National Science Foundation that will be used to improve this situation. The first is a CSEMS Grant that provides for up to 50 student scholarships every year for four years (Project META - Math, Engineering, and Technology Award). The second grant is an Engineering Education Discretionary Grant (Project ACCESS) which is aimed at curriculum development, high school outreach, articulation agreements with surrounding area universities, creation of web-based engineering courses, and infusion of engineering curricula with state-of-the-art technology over a period of three years.

After the first year of grant implementation, four elements have emerged as vital for recruiting and retaining students in a Community College Engineering Program and preparing them to be successful after transfer to a Four Year University:

1. An aggressive high school outreach program to attract qualified students to the engineering profession that involves Community Colleges as well as Four Year Universities.

Many engineering educators propose infusing K-12 education more aggressively with outreach activities such as frequent faculty visits, field trips to surrounding area companies, engaging programs, engineering clubs, Career Day presentations, and other activities designed to introduce high school students to Engineering careers. The efforts to bolster engineering education at the K-12 level are just beginning to provide useful models, but each institution has its own unique conditions that may inhibit successful adoption, and more can still be done to link existing programs and resources.

For example, a new program called EDGE (Early Development of General Engineering) was initiated last year at San Antonio College. The program was designed to create a bridge between the first two years of high school and the first year in college by introducing 10th and 11th grade students to college level coursework as a learning community and providing them with activities and projects to develop independent learning and teamwork skills. Based upon last year's experience and current interest in the program, the EDGE Summer Program is expected to begin growing at a steady pace.⁽²⁾

2. An intensive remediation program at the Community College level to boost proficiency in Math and Science of under prepared high school students.

As mentioned previously, the quantity of qualified high school students has declined over the last decades and that affects the number of eligible students that enter the higher education system. Many of them lack knowledge, focus, discipline, purpose, as well as good verbal and study skills. Some of them also lack financial resources. Any combination of these attributes might block students from attaining a degree in engineering.⁽³⁾ Community Colleges are better prepared to handle the remediation task since they often have a closer relationship with their surrounding high schools, and the costs of remedial classes are usually less.

3. Infuse engineering courses with state-of-the-art technology and supplement the education process with a variety of interesting programs in order to motivate students to continue the study of Engineering towards a Bachelor's degree.

NASA and the state of Texas have recognized the importance of Community Colleges for attracting more students into Science and Engineering fields by sponsoring programs aimed specifically at these institutions. Community College Aerospace Scholars (CAS) is one example of a direct experience program funded by the State of Texas and administered by NASA's Johnson Space Center (JSC). Community college districts across Texas each select a group of 10 SMET students to travel together to JSC for a two-day engineering immersion experience. This opportunity includes a "behind the scenes" visit of JSC and a hands-on project highlighting various elements of engineering tasks.⁽⁴⁾

4. Increase coordination of curriculum between Community Colleges and Four Year Universities by obtaining articulation agreements with surrounding area institutions.

In order to achieve a successful integration of Community College Engineering Programs with Four Year Universities several key elements were found to be necessary:

- Mutual respect and trust between the participating institutions at all levels
- Open and continuous dialogue between faculty and administrators
- Common objectives, strategies, and advertising
- Coordination of programs and activities involving joint projects and cultural activities
- A continuous effort to refine and align the lower level course offering at the community college level
- Visible presence of partners on each campus
- Facilities and faculty sharing

As a result of applying these key elements, San Antonio College has been able to obtain articulation agreements with Engineering Programs at the University of Texas at San Antonio, maintain an agreement with Texas A& M College Station, and is in the final stages of signing new articulation agreements with Texas A & M Corpus Christi, Texas State University in San Marcos, and University of Incarnate Word in San Antonio.

In the long range this kind of academic cooperation and partnership between Community Colleges and Four Year Universities could have the following benefits:

- The quality of Engineering Programs at the Community College level will improve and this will increase the supply of students who are motivated and prepared to obtain degrees in engineering.
- Community Colleges with their small size classes, scheduled at a wider range of times, offer more flexible schedules for working students and allow for a more personalized interaction between students and faculty in the beginning years, when it is most needed.
- The lower cost of education at Community Colleges will attract more students to introductory level engineering education and engaging hands-on programs could encourage more undecided students to select an engineering career. All these aspects could also help attract more minorities and economically disadvantaged students into an engineering career that otherwise might have skipped higher education altogether as an unattainable goal.
- Successive levels of education would require students to make only a two or three year commitment at a time. This may help increase student retention and might be more appealing in uncertain economic times. For students with financial limitations, it may offer an opportunity to obtain engineering related work with an Associate's Degree in Engineering and continue studying for a higher degree possibly with the employer's cooperation and assistance.

- The academic coordination and alignment between Community Colleges and Four Year Universities would offer students a broader range of academic experience by involving them in a greater diversity of academic cultures.
- Essential resources (time, space, financial, and personnel) could be released at the University level that could be better and more productively focused on more advanced topics and research. At the same time more students would benefit from developmental courses offered at a Community College where the costs are lower and students can receive more personal attention.
- The community can benefit from a greater variety of supplementary opportunities for practicing professionals in the engineering field. Those having a wealth of industry related experience and willingness to share it with students could teach at a Community College. Those more interested in research activities would be able to collaborate with a Four Year University focusing on research with potential teaching responsibilities limited to advanced topics, where audience interest is less dependent on pedagogic skills. This integration of professional and academic experience could help improve the complex relationship between engineering education and industry.

A cooperative effort directed at building a unified approach for attracting and retaining students in engineering and the development of a seamless engineering curriculum for a continuum of learning from high school all the way to the Bachelor's degree and beyond will fortify and diversify technical education for the new millennium.

References:

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Biographical Information:

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, most recently as vice-president of the SPE - Central Texas Section. 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 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.