Energizing your Engineering program through competitions and team-based projects

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Engineering faculty members Paul Gordy and Steve Ezzell had been looking for opportunities to get their students involved in more than just coursework as they pursued their degrees. The Engineering curriculum at Tidewater Community College was a solid two-year transfer program, but Gordy and Ezzell felt that students didn't have the same opportunities as four-year students to experience the excitement of engineering projects. Four-year colleges and universities have numerous labs with intriguing experiments, research projects involving new ideas and applications in engineering, and student organizations with exciting competitions that give students a taste of working on real engineering projects. How could the community college offer such experiences? Gordy and Ezzell began on a journey when they formed the TCC Engineering Club that led to opportunities, successes, and benefits that they never anticipated.

The TCC Engineering Club

The TCC Engineering Club was formed as a student chapter of NSPE, the National Society of Professional Engineers. After considering several engineering societies, NSPE seemed to be a good choice for including students interested in all engineering disciplines. The club began with some of the usual activities – field trips, speakers, and service projects. But Gordy and Ezzell were looking for competitions to really get the students involved.

Campus Competitions

Gordy and Ezzell began with a campus competition each February during National Engineer's Week. Prizes were often awarded for the best designs and participation was excellent with as many as 40 students entering each event. These competitions included:

- <u>Truss-busting competition</u> Students designed and built balsa wood trusses that were loaded until failure.
- <u>Cable car competition</u> Students designed and built vehicles to travel on a 150' cable across TCC's lake as quickly as possible using a battery and specified motor.
- <u>Water tower competition</u> Students designed and built balsa wood towers that supported a large water tank that was pumped full of water until the tower collapsed.

Gordy and Ezzell invited structural engineers from local engineering firms to judge the trussbusting competition. Students were very interested in the judges' comments about the various designs. An unexpected benefit as been that some of TCC's engineering students have been hired into co-op positions from the firms that provided the judges. Additionally, articles on the competitions have appeared in local newspapers.

Regional Competitions

The TCC Engineering Club next ventured into a regional competition: CANstruction. This is a competition sponsored by the American Institute of Architects and other engineering organizations. In 2002 the competition was held in 51 cities nationwide, including the Tidewater region. The goal of the competition is for engineering and architectural groups to build structures out of canned and pre-packaged food items that are later donated to the local food bank to help the needy. Participants join in a spirited competition for various awards. TCC has participated for each of the last six years and has won three awards for their entries. One entry

was a 14' model of the Hatteras lighthouse build using over 4000 cans. The two-ton model of the lighthouse included the characteristic diagonal striping and octagonal base as well as an interactive rotating beacon and foghorn. The lighthouse was on display in the Virginia Beach Marine Science Museum for almost one month.

Unexpected benefits also developed from the TCC Engineering Club's successes in CANstruction. Farm Fresh, a local grocery store, has sponsored the club's entry for the last five years. They donated over 7000 cans of food for TCC's 2002 entry. Several of TCC's administrators have been invited to the prestigious award ceremonies that helped to boost the club's internal support and funding within the college. Several newspaper articles again reported on our successes.

National Competitions

In 1998 Gordy and Ezzell heard about the 1st annual ASEE (American Society for Engineering Education) Model Design Competition and encouraged their students to participate. Student teams design small, autonomous, battery-powered vehicles in this competition, which is open to engineering and engineering technology students at two-year colleges or students in the first two years at a four-year college. The competition takes place during the ASEE Annual Convention each year in June. The 1998 competition was in nearby Charlotte, NC, so the club was able to scrape together enough funding to build a car and to send Gordy, Ezzell, and two students to the competition. The students were ecstatic as the captured first place in the competition. The benefits of our participation in these competitions have been numerous, including:

- Several articles in local newspapers and in ASEE's Prism magazine about the event.
- The local chapter of NSPE has supported TCC's team financially.
- TCC has provided funds for Gordy and Ezzell to attend the ASEE Annual Convention for the last 4 years.
- TCC has provided funding for many students to travel to competitions in St. Louis, Albuquerque, Montreal, and Nashville.
- TCC has provided funding for the purchase of a trophy case to display our vehicles and awards. Vehicles have been operated on test tracks during open houses to generate interest in the program.
- Gordy has now serves as the chair of the ASEE Two Year College Division
- Through contacts made at the ASEE conventions, Gordy was asked to serve as a planning team member for an NSF sponsored grant on engineering education. Similar contacts led to Gordy's participation in reviewing grants for NSF on two occasions.
- Ezzell now participates in board meetings for the local NSPE chapter and was voted as 1999 Engineering of the Year.
- Gordy was voted 2002 Professor of the Year at TCC.

Integrating Team Projects into the Engineering Curriculum

TCC's involvement in competitions has been highly beneficial to the program, but not all students have been directly affected as participation has been primarily on a volunteer basis. Gordy and Ezzell feel that the next step is to provide similar opportunities to all TCC Engineering students by integrating design projects and competitions into their Introduction to Engineering class – EGR 120.

Nationally there has been a move to make introductory engineering courses more exciting through hands-on activities and to introduce students to team-based projects. Many of these

courses involve robotics. Some colleges have used robot kits such as the Lego MindStorm or the BOEBOT based on the Parallax Basic Stamp microprocessor. Several of the teams that have competed in the ASEE Model Design Competition have built vehicles as part of an assigned project for an introductory engineering course.

In Fall 2003 Gordy decided to take a single section of EGR 120 and to revise the course so that teams of students will use the engineering design process to build vehicles that could potentially compete in the June 2004 ASEE Model Design Competition. Experiments involving the Basic Stamp microprocessor, servos, optical sensor, and motors are planned. Hopefully, the successful results of this class will be incorporated into other sections of EGR 120 in future semesters. Additionally, Gordy and Ezzell have recently received funding to purchase 20 BOEBOT robots for use in this course.

Future initiatives

Additional initiatives have resulted from TCC's focus on competitions and team-based projects. Recent meetings with local high schools have shown that there is a great interest in offering EGR 120 as a dual-enrollment course for both high school and community college students. A current NSF grant through TCC's Advanced Technology Center (ATC) is helping to fund the development of the curriculum for this initiative.

Gordy and Ezzell have also considered how their campus competitions could be used for recruitment among high school students. TCC is planning another cable car competition for February 2004 where high school students will be invited to compete.

In summary, the efforts to form an engineering club and to get students involved in competitions had numerous unexpected benefits. Students were given an opportunity to travel and compete against other colleges. The college showed tremendous support financially. Local engineering groups and even grocery stores have supported our students enthusiastically. Participation in ASEE conferences has led to valuable contacts and opportunities for TCC faculty. Local media has published reports of our successes. New recruitment opportunities are opening up with local high school students. And, finally, the engineering curriculum at TCC is undergoing changes to incorporate some of these ideas so that all students can benefit. Engineering faculty always remember that engineering is a challenging discipline, but they sometimes forget or lack the means of showing that it is a fun and exciting discipline as well. Providing students with opportunities to experience the fun of engineering can energize an engineering program.