Design Competition – A Meaningful Experience for Underclassmen in Engineering

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Introduction

Collaboration between industry and engineering programs routinely provides opportunities and challenges for senior design projects. In the General Engineering (GE) program at the University of Wisconsin-Platteville (UW-Platteville) freshmen and sophomore are introduced to engineering topics from a variety of engineering majors that are available in the college. Efforts are made to provide introductory information on different engineering disciplines to help students decide on an engineering major. A one credit course is offered to students in their second semester that requires students to work on at least four interdisciplinary projects put together by faculty from the degree granting departments. But until they reach their senior year and work on their senior design capstone projects, there is little scope of 'innovation' and broad exposure to open-ended design problems.

The GE Program is designed to prepare students for admission into one of seven professional engineering programs available in the college. All new freshman engineering students and transfer students who do not immediately qualify for a professional program must begin their studies in the GE Department. The program has the following continuing goals, which directly support the mission of the College and the University:

a. Prepare students for entrance into the professional engineering programs;
b. Smooth the transition from high school to college for new freshmen in engineering through proper advising, schedule-building, counseling and monitoring;
c. Assist freshmen and transfer students in career counseling related to both engineering and non-engineering fields;
d. Recruit and retain high quality high school and transfer students interested in majoring in engineering with special emphasis on attracting women and minorities; and
e. Maintain the high quality of instruction and professional development necessary to ensure the accreditation of the professional programs.

Entering freshmen students have varied backgrounds; some are better prepared for the rigor of college studies than others. The GE program offers students an opportunity to correct academic deficiencies and ensures that students enter the professional programs with suitable preparation. The program also allows students several semesters to finalize their choice of major.

As mentioned above, the GE Department offers two courses that are designed to help students make a smooth transition into college life as well as getting to know about engineering disciplines. These two courses are required of all engineering majors on campus during their first two semesters. The first one, a half semester one credit course called

Engineering Success Skills, provides a review of fundamentals of engineering and math skills. The following semester the students take a one credit course entitled Introduction to Engineering Projects. In this course students primarily work on a number of interdisciplinary projects in a group setting under the guidance of an engineering instructor. These projects are designed by a group of experienced instructors recruited from the various degree granting engineering programs in the college. Instructors can pick and choose a number of projects from the repository. We believe that these two courses help our students in the areas of team building, cooperative learning, exploring engineering majors, and retention. We are seeing good results, but need to find even better ways to capture interest of the freshmen.

In collaboration with General Electric HealthCare, the GE department at the UW-Platteville established an annual design competition. In 2005, General Electric funded the seed money for the project. This presented us with an opportunity to try to improve the situation. The response from the students and faculty was extremely positive.

The geographic location of the institution has always been a big challenge. Platteville, a typical rural and small Midwestern community has to struggle to offer any meaningful professional experience with diversity. Trying to get the point across that engineering is going global – engineers have to be aware of and be able to function well in a diverse environment at the workplace – is cumbersome. When General Electric offered to fund an activity to help us improve retention of students, we decided that an open-ended design competition involving primarily underclassmen would be the way to proceed. GE HealthCare went along with the idea with the hope that this would also enhance their visibility in the engineering community. The competition allows us to introduce team composition rules which force students to get out of their comfort zone and seek out students at different levels to get involved and interact with.

The Design Competition

Promotion of the design competition began in September followed by the formal announcement in early October, 2005. The local papers including the campus newspaper carried the story along with interviews with faculty and students involved. Two General Electric Healthcare scientists and engineers presented a seminar on campus showcasing their current research and development activities. The details with regard to eligibility, team composition, procedure, and deadlines were publicized on posters and on the web. Among others, emphasis was on the formation of groups entering the competition. The following requirements had to be satisfied on team composition:

a. The number of students within each team should be between three to five students.
b. Each team should involve at least two engineering disciplines. Each team should include a student of freshman standing within its members.
c. Each team should include one student that is a member of an under represented minority group or a female.

One of our main objectives was to ensure that we would promote involvement of female and under represented minorities in the formation of these teams. We found out later that by not

yielding to the demands of relaxing the rules forced the students to work harder to communicate with others and seek out the required membership for their teams.

Eight teams entered the competition, and submitted their initial proposals by the early December deadline. Five of the proposals made through the preliminary round. Based on the recommendations by the panel consisting of General Electric engineers and managers these teams were allocated $750 each to cover the cost of materials and parts needed. The teams submitted their final design by the April deadline and in early May they were invited to present their designs to a panel of General Electric judges at the GE Healthcare headquarters. The teams were also required to give an oral presentation.

Discussion

A survey instrument was developed and sent out to participating students and their advisors. Comments on team formation, meeting schedules, group dynamics, availability of campus resources, budget and benefits, etc. were solicited.

It came as no surprise that teams were formed by groups of people who mostly knew one another either by living in the same dorms or having common classes or having other common connections. Most teams had only one under represented minority member in their group – an African American, Native American, or a woman. There was one team with three minority members – two African American and one woman. As explained earlier, because of our geographical location, it takes considerable effort to offer our students any measure of exposure to diverse populations at this campus. Because team composition rules forced students into seeking minority involvement, there was some minor resistance – although not common. For example, one student stated in an email that "he knew only white male students" and, therefore, his team could not include any minority students. Needless to say, such teams were not allowed to enter the competition until the requirements were met.

Because the students chose their own team members, there were very few problems with group dynamics. Common complaints were about distribution of job responsibilities and uneven workloads. When asked if they would participate again, the response was mostly positive. There is one team that is entering the competition again this year with a slight change in team composition – they have to add a freshman as a team requirement.

When asked about what aspect of the competition was most appealing to them, the responses were overwhelmingly positive. Following are a couple of student comments:
a. "The whole process from start to finish. Learning what goes into a product: from the brainstorming stage, to creating a logical prototype, to ordering parts, and putting it all together, and then trying to sell it to someone. It is an experience that I will never forget, and it really opened my eyes."
b. "The process of creation. It is fun to see an idea come to life. To see the idea materialize from our heads, and to see what it's actually like to be a part of a real product. I also liked the process of being critiqued by real engineers. It shows how plausible of an idea it was."

In response to the question "If you were to name one real benefit from this experience, what would that be?", all the responses were very positive. Again, a couple of comments:

a. "Learning how to work with others, and seeing what goes into making a product that truly can help others. That was the most rewarding, knowing that we made a product that could really help people, there is no better feeling."
b. "Actually building the product and presenting in front of GE engineers. It opened our eyes and showed me what engineers have to think about everyday and presenting gave us real life presenting experience that can never be obtained from classroom presentations."

It is interesting to note that all the women and minority participants are competing again this year, either in their original group or with new team mates.

The issue that we are dealing with here in Platteville is not uncommon for colleges located in communities with similar demographics. Introducing a team activity like we did is not going to solve it magically – much more needs to be done. But we believe that this is one small step in the right direction.