Building An Engineering Technology Workforce: A Sequential Program for Reaching Young People

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Building An Engineering Technology Workforce is a comprehensive recruiting project designed to increase the number of people who prepare to enter engineering and engineering technology careers, with special emphasis on the work of engineering technicians. Developed at Illinois Valley Community College (IVCC) and funded by a National Science Foundation (NSF) grant, the project addresses the barriers that prevent young people from selecting engineering careers. Project initiatives are offered in a sequence to create and then build interest in and commitment to careers in engineering.

Addressing Barriers to Selecting an Engineering Career

Research has identified perceived difficulty as the major barrier preventing young people from selecting engineering careers.[1] Many young people are particularly uncomfortable with and unprepared for math and science requirements.[2]

For young women, additional barriers are perceptions of engineering as not-feminine, not relevant to their lives, not helpful to society, and lacking a sense of community.[3] Young women also lack technical experience and technical confidence.[4]

This project addresses those barriers.

- For young people, the perceived difficulty of engineering programs is being addressed by engaging middle school and high school students in inquiry-based activities that integrate science, technology, engineering and math (STEM) to make them more aware of the practical applications of math and science, make them more comfortable with math and science, and encourage them to pursue further study.
- For young women, the perceptions that engineering careers are not feminine and lack relevance are being addressed by engaging them in team exercises that result in tangible products and through interactions with women in engineering careers. Those activities are being designed to demonstrate the relevance and rewards of engineering. Their lack of technical confidence is being addressed by limiting some activities to women and by providing the technical background necessary for the activities.

Since parents, teachers and counselors not only share but also contribute to the misperceptions young people have of engineering,[5] project organizers are also attempting to reach those adults through promotional and informational materials and sessions.

Providing sequential activities

In a previous NSF-funded project at IVCC[6], recruiting activities offered to middle school and high school students did increase the students' awareness of and interest in engineering careers, but the activities were sporadic. The interest generated by those isolated activities did not result in increased enrollments in engineering or engineering technology, at least in part, because overcoming the barriers to selecting an engineering career demands efforts that are substantial, coordinated and sustained. Lessons learned as well as successes of that earlier project have been utilized in developing the sequence of activities in this project.

The sequence begins with short-term, high interest special activities offered to a broad base of students at middle schools and high schools. To capitalize on interest generated by those events, longer-term, more intense activities are then offered to build on and sustain that interest. During this first year of the three-year project, sequential activities are being offered at the high school level. Middle school initiatives are limited to one- and two-hour special events this year, but will include more intense and career-specific activities, such as week-long inventor's camps, next year.

The high school sequence

The high school sequence of activities is being piloted at LaSalle-Peru Township High School (LP), which is also the site of the Area Career Center, a vocational education consortium that provides vocational and technical courses to juniors and seniors from eight area high schools, including LP. Involving Career Center students in project activities should help later in expanding the project to other high schools. Additionally, LP High School and the Career Center participate in High Schools That Work and Project Lead The Way, programs that are complemented by this project's objectives and initiatives.

The planning committee for the LP High School activities includes a broad base of representatives.

- The high school – Curriculum Director, Math Department Chair, Science Department Chair, and Counseling Department Chair
- The career center – Director
- The Regional Education For Employment Office – representative who works with high schools in developing career awareness and work-based learning experience
- The community college – Program Director of CAD/CAE and Program Director of Electronics, who are Principal Investigators of the NSF grant.

The Education For Employment representative on this committee is in charge of all high school initiatives in the NSF grant project and thus will head future efforts to adapt these initiatives to other high schools.

The high school initiatives include:

- Special events. Hands-on, high interest activities are being offered, with some to be open to all students and some either limited to young women or with special categories for women participants. Those events, such as an Edible Car Contest in

which teams build vehicles from food items, are designed to demonstrate: (1) the creativity and teamwork in engineering, (2) the practical applications of math and science in engineering, (3) the impact engineering has on their lives, and, (4) the opportunities in engineering-related careers.

- A Tech Club. Open to all students with an interest in science, technology, engineering or math (STEM), the club is co-advised by a female science instructor from the high school and a male engineering graphics instructor from the Career Center. Special efforts are made to reach students in math, science and technology-related courses. The club is affiliated with the national Technology Student Association[7], and provides members with field trips, participation in hands-on, inquiry-based activities, and leadership development opportunities. Future plans call for members to participate in contests.
- A Taste of Engineering Course (TEC). Open to high school juniors and seniors who are members of the Tech Club, the project-based course is for community college credit. Students are exploring the engineering field by building a guitar, a project that emerges from the e-CREATE program of the Midwest Coalition for Comprehensive Design Education headquartered at Purdue University[8]. Working from a course outline provided by R. Mark French, assistant professor in the Department of Mechanical Engineering Technology at Purdue[9], teachers from the high school and the community college are team teaching the course.
- A Leadership Team. Members of the Tech Club who demonstrate leadership potential will be selected for a Leadership Team, modeled after the highly successful Leadership Team for technical students at IVCC[10]. Promising high school students will be provided with opportunities for developing and practicing their leadership skills and will assist with activities provided to middle school students. One or two Leadership Team members will receive a scholarship to attend a project-based engineering camp hosted by a university.
- Science, technology, engineering and math (STEM) modules. Science, technology and math exercises are being integrated into all initiatives; and science, math and technology instructors are being encouraged to integrate hands-on engineering activities into their courses. STEM modules already developed, such as those provided through the ASEE K-12 Center[11], are being provided to the high school instructors, and they are being paid a stipend to develop their own. The modules they develop will be made available on the web site for this project[12] and the web sites of NSF centers.

Special efforts are made to encourage young women to participate in the special events, club, class and Leadership Team.

Next Steps

Since high school activities are being piloted during the spring 2009 semester, it is too early to evaluate the effectiveness of this project. All activities are being assessed and will be evaluated on the basis of whether they improve/increase the students' awareness, perceptions, and intentions relative to a career in engineering and to eventual enrollment in an engineering or engineering technology program. In the meantime, preliminary indications are promising. Early activities have received positive evaluations; and

administrators, teachers and counselors at the first high school have been enthusiastic in their support of project activities. Knowing that faculty/staff "buy in" is crucial to the success of the program, project organizers are discussing ways to export that enthusiasm as the project expands to other schools.

Once project activities have been fully assessed, the activities which are more effective in producing positive changes and generating greater enrollment will be identified. The outcome will be a comprehensive, replicable recruitment plan for building an engineering technology workforce.

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