A Student Mentoring and Development Program for Underrepresented Groups in Engineering

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Abstract - The Graduate, Undergraduate Initiative for Development and Enhancement (GUIDE) program creates a supportive environment for first year engineering students from underrepresented groups. This 4 year NSF program has just completed its second year of funding. GUIDE provides first year students with student mentors, financial assistance and faculty advisors to assist them with the transition to university life. In addition, the GUIDE scholars attend engineering seminars and career workshops. This paper describes the GUIDE program and the skills students gain from participating in the program. It also outlines the logistics involved in a student mentoring program that is coupled with seminars and workshops.

Index Terms – First year engineering, Peer mentoring, Underrepresented groups in engineering.

INTRODUCTION

The challenges for someone transitioning from high school to college can be significant. These challenges can be even greater when the student is entering into engineering and is from an underrepresented group. In addition to adjusting to engineering school, women and minority students can face feelings of isolation because there are few students like them. [1, 2] Many students also face concerns regarding the funding of their education. These factors can overwhelm students to the point where they decide to leave the university instead of finding ways to address the difficulties. Within Michigan Technological University’s (MTU) College of Engineering (COE), there are approximately 3,700 students. Women and minorities comprise less than 30% of this population. [3] To encourage these people to enter engineering and to remain at engineering school, these concerns need to be addressed.

Engineering is a career that historically men have selected. Therefore, there exists a need for women and minorities to enter this field. Unfortunately, women and minorities choose engineering careers at a much lower rate than men and have lower retention rates in engineering school. The retention rates for first year women and minorities in engineering at MTU have been increasing over the past four years. In 1999, the rate was 76%; in 2002, the overall rate had increased to almost 90%. Unfortunately, within the COE, only 23% of the population are women and 6% are minorities. [3] Secondly, students from underrepresented groups leave the university at a higher rate than non-minority males. This phenomenon also occurs at the national level. [4] The reasons these students leave campus are not due just to the rigors of an engineering curriculum. Women and minorities also leave engineering school because they:

• Feel isolated (the campus climate is not “friendly” towards them)
• Lack role models
• Are reluctant to seek academic assistance
• Have difficulties with finances [5]

To address these issues at MTU, the Graduate, Undergraduate Initiative for Development and Enhancement (GUIDE) program was started in October, 2002. This program is funded by the National Science Foundation (DUE-0220500) and targets first year students who are underrepresented in engineering. The focus of this program is to increase retention of these students beyond the first year of college. Therefore, the GUIDE activities are meant to prevent the major reasons that students leave the university: academic difficulties, problems with resolving educational and career goals, and the lack of a community within the university setting. [5] Ultimately, the GUIDE program prepares for the scholars to become engineers and to use that knowledge within technology fields.

GUIDE OVERVIEW

The GUIDE program was started to help undergraduate students from underrepresented groups succeed in engineering through providing financial and personal support. Using the skills acquired in the program, the students replace the scholarship funds with co-ops or internships to fund the remainder of schooling.
As part of the GUIDE program, first year engineering students are awarded scholarships (up to $2500) for a maximum of two years. To assist students with funding their remaining education and to learn about engineering career options, career center workshops and engineering seminars are held. Additionally, GUIDE has a peer mentoring program.

The mentoring involves three person student teams consisting of a first year student, sophomore student and graduate student. Because the GUIDE program’s primary focus is to increase the retention of underrepresented groups in engineering, the two mentors perform different roles.

During a student’s second year in the program, s/he mentors a first year student. The sophomore mentors typically are in their second year at MTU and participated in the GUIDE program the previous year. They also have successfully completed their first year of engineering school. The undergraduate (second year) mentor provides the first year student with information regarding how to succeed in their first year classes. They assist the students with homework and help them access the learning centers. The undergraduate mentors are instrumental in helping the first year student adjust to being away from home and learning how to be an effective college student.

The graduate mentor keeps the undergrads focused and assists the students in meeting their educational goals. The graduate student mentor provides mentoring to both undergraduates and is the team leader. The graduate student mentors provide different skills. Because they have completed an engineering degree, they give insight regarding the overall view of engineering school. As Peace Corps Masters International students, they have an interest in societal and campus issues. They were selected as the team leaders for this program because they want to become involved with people. This interest is evident in the GUIDE program because the graduate student mentors are the ones who get the teams out into the community. They have helped the undergraduates become involved in volunteer activities, in exploring the off-campus community (cultural, hiking, biking). They have encouraged the undergraduates to participate in cultural (symphony, dance performances, plays) activities on campus.

To ease the financial burden of attending graduate school, the program provides up to $3,125 for a year to the graduate student mentors. The mentors help a first year student in many ways:

- adjusting to college life
- coursework tutoring
- finding and accessing resources at MTU (i.e., things to do outside of classes, learning centers, student organizations). [6]

In the fall semester, the students attend seminars where engineering faculty discuss topics regarding career paths, opportunities in engineering, balancing career with a personal life, and other topics related to an engineering career. During the spring semester, students attend a series of workshops at the Harold Meese University Career Center where they:

- learn about the services the Career Center offers
- create a résumé
- have mock interviews
- receive tips on how to find co-op or internship positions.

GUIDE SEMINARS AND WORKSHOPS

A unique aspect of the GUIDE program is the Engineering Seminars and Career Center Workshops. These activities are designed to show students different aspects of engineering and how to “engineer” the perfect job opportunity. The seminars and workshops are described in detail in Monte and Hein. [3] The engineering seminar series introduces the GUIDE scholars to different facets of engineering. These seminars also allow the scholars to meet faculty from different engineering departments. This past year many of the topics focused on the societal benefits of engineering (i.e.: social activism, local/regional/national policy) and on different types of careers (i.e.: consulting, advanced degrees, benefits of co-ops/internships). Two undergraduate panel discussions were held: Student Organizations and Undergraduate Research Experiences. Career development workshops focused on skills students need to obtain co-ops or internships after they complete the GUIDE program. In these workshops, students have the opportunity to have their résumé, cover letters and interviewing techniques critiqued by the University Career Center staff.

PROGRAM RECRUITING AND SELECTION

One of the major challenges when this program was implemented was how to inform incoming students about this opportunity. For instance, the intent of this program is to assist students who would normally be ineligible for most academic scholarships. The scholarship application and notification letter have been developed to evaluate the applicants mainly on their interest in being a mentor and having a mentor. From discussions with current GUIDE students, it was learned that students did not apply if they thought their grades were too low or if they were male. Therefore, although high school transcripts are required for the application the students’ GPA is deemphasized.

PROGRAM NOTIFICATION/APPLICATION/REVIEW

The GUIDE program faced several challenges when it began regarding how to organize the application and review process. Throughout the two years of the program this process has been modified to reflect student needs and incorporate student comments. The first challenge faced was how to let students and parents know about the program. Secondly, after the students were notified, the application forms and process had to be defined. The mechanisms for application review and student selection were also outlined.
Lastly, the process of student placement into mentor teams and the training of the mentors were developed.

Several mechanisms are used to notify students and parents about this program. First, in January, letters are sent to the students who will be attending MTU and meet the target criteria. Although students are notified of the program via mail, they do not communicate this information to their parents. In mid-February, ParentNet [7] (a Web-based newsletter for parents of prospective and current MTU students) briefly described the GUIDE program. Several parents have called requesting information regarding this program. Another avenue used was the MTU Portal. This system uses the web to notify specific groups of admitted students about different university programs and opportunities. Students who met the program criteria were sent "portlets" regarding the program. These "portlets" were customized for the following groups of students: women, minority women and minority men. Each of these groups was broken down further into two areas: students who excelled in high school and students who faced some academic challenges. MTU also publishes a newsletter for high school guidance counselors three times throughout the academic year. Next winter, a brief description of GUIDE will be included in the winter and spring editions. Lastly, a brochure describing the GUIDE program was created. [8] This brochure was distributed with the mass mailing and was sent to MTU Recruiting, Admissions and Educational Opportunities. A copy of the brochure is on the GUIDE Web site (http://www.geneng.mtu.edu/GUIDE.html). These notification mechanisms have resulted in an increase in applications for the program.

Students apply for the program using the forms they received via the mass mailing or they can be downloaded from the GUIDE Web Site listed previously. The application process consists of completing the application form, writing a short essay regarding mentoring and submitting a copy of their high school transcript. The students also complete the FAFSA forms on-line so the university can determine their financial need. A similar application process is used for the graduate students.

After the applications are received, a four person faculty and administrative committee review the applications. Students are selected based on the activities they participated in and their perceived interest in mentoring and being mentored. From the applicants, up to 11 first year scholars are selected. At this time, the graduate student scholars are also selected. The graduate students are selected from the students accepted into the MTU Peace Corps Masters International Program in Civil and Environmental Engineering. These students are active within their community and enjoy working with others. They have a high tendency to want to help others and typically have a high percentage of women and minority students. Once the students have accepted the scholarship, the mentoring teams are established.

To determine which students will be on a team together, information regarding each student is needed. The students complete an interest survey. Wherever possible, students are placed with students who have the same or similar engineering majors. If this is not possible, students are placed on teams of people with similar interests and/or hobbies. Also, to determine which students are likely to be introverted or extraverted, the students are asked if they like to call people to do an activity or if they like to be called. From the first year of the program, it was learned that a team of introverted students was not optimum. This past year, there were no teams with exclusively introverted members.

Before meeting with the first year student, the mentors receive mentor training. During this one day training session, the undergraduate and graduate student mentor pairs become acquainted with each other and the other teams. The training covers a wide range of topics including university services (learning centers, counseling centers, and academic logistics), university and community activities, and how to encourage interactions with the first year student.

**GUIDE Scholar Achievements**

The GUIDE students have been gaining useful engineering work experience. Table 1 summarizes the co-op and internships the GUIDE students have completed. From the 25 students who have participated in the program, 7 students have completed 9 co-ops or internships. Across the MTU campus, only 9% of the students participate in the co-op program. Nationally, only 7% of undergraduate students complete a co-op. [8] For the two years of the GUIDE program, 16% have had co-op experiences, 16% have participated in internships and one scholar has completed research. Overall, 36% of the GUIDE scholars have had some type of engineering work experience. Therefore, the GUIDE scholars are greatly exceeding both the MTU and national averages for co-op work experience.

The ability of the GUIDE scholars to find employment is a direct result of their participation in the Career Center Workshops. These workshops help the students become familiar with the Career Center staff and the services that the center offers. Therefore, the GUIDE scholars are more comfortable with the Career Center and will go to the office for help and assistance. The first year students, as part of the workshop series, are required to create a résumé and have it critiqued by the Career Center staff. After the résumé is corrected, the students post it to the on-line Career Center eRecruiting service. Once their résumé is on-line, employers can request to interview them. Most students do not post their résumé until they are sophomore or junior engineering students. During their second year in the program, the GUIDE scholars update their résumé and resubmit them. All of the undergraduate GUIDE scholars complete a mock interview with the Career Center staff each year they participate in the program. Less than 7% of the MTU undergraduate students have mock interviews. These interviews help the students learn how to address questions from potential employers, what to bring to an interview and how to handle a stressful interview.
TABLE I
GUIDE UNDERGRADUATE STUDENT WORK EXPERIENCES

<table>
<thead>
<tr>
<th>Engineering Major</th>
<th>Experience</th>
<th>Organization</th>
</tr>
</thead>
<tbody>
<tr>
<td>Civil</td>
<td>Internship</td>
<td>Engineering Resource Associates, Inc.</td>
</tr>
<tr>
<td>Civil</td>
<td>Co-Op</td>
<td>SME (Soil &amp; Materials Engineers, Inc.)</td>
</tr>
<tr>
<td>Civil</td>
<td>Internship</td>
<td>Gould Engineering</td>
</tr>
<tr>
<td>Chemical</td>
<td>Co-Op</td>
<td>Kimberly Clark, Inc.</td>
</tr>
<tr>
<td>Electrical</td>
<td>Co-Op</td>
<td>Marathon Ashland Petroleum LCC</td>
</tr>
<tr>
<td>Environmental</td>
<td>Internship</td>
<td>Round Mountain Gold Company</td>
</tr>
<tr>
<td>Environmental</td>
<td>Research</td>
<td>MTU Department of Civil and Environmental Engineering</td>
</tr>
<tr>
<td>Mechanical</td>
<td>Internship</td>
<td>Caterpillar Inc.</td>
</tr>
<tr>
<td>Mechanical</td>
<td>Co-Op</td>
<td>John Deere &amp; Co.</td>
</tr>
</tbody>
</table>

As the overall mentor for their team, they have the responsibility of ensuring that both undergraduate students are succeeding academically and socially at MTU. The graduate students learn that they must be active listeners when talking with the undergraduates. They quickly realize that they must ask direct questions to the undergraduates. For example, instead of asking the students how classes are going, they must ask the undergraduates how they are doing in “Calculus” or how did they do on their last engineering exam. These questions address academic progress. One team had a first year student who faced academic challenges due to the lack of effective study skills. This young woman needed guidance regarding how to study and where to study. Her graduate mentor began studying with her. Her mentor also suggested that she study away from her computer, put a note on her residence hall door that she was studying and to play “homework” music to create a better study environment. The first year student commented that these methods have helped her this semester. Another graduate mentor learned how to deal with non-academic difficulties. One student faced and overcame personal challenges because his graduate mentor would talk with him one-on-one. This mentor spent many hours being a listener. He learned that sometimes an ear is all a person needs to help them stay on track. These examples illustrate that the graduate mentors are assisting the undergraduates. They also show that the graduate student mentors are gaining skills that will help them work with other people from diverse backgrounds. The mentoring aspects of this program are described in greater detail in a paper written by one of the GUIDE graduate mentors [6].

**TABLE II**
GUIDE UNDERGRADUATE SCHOLAR CUMULATIVE GPA (4.0 SCALE)

<table>
<thead>
<tr>
<th></th>
<th>GUIDE</th>
<th>College of Engineering (~ 800 Students)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Fall</td>
<td>Spring</td>
</tr>
<tr>
<td>GPA Std Dev #</td>
<td>GPA Std Dev #</td>
<td></td>
</tr>
<tr>
<td>First Year Students</td>
<td>3.17 0.45 8</td>
<td>3.29 0.41 8</td>
</tr>
<tr>
<td>Undergraduate Mentors</td>
<td>3.32 0.33 9</td>
<td>3.46 0.22 8</td>
</tr>
<tr>
<td>(Sophomores Only)</td>
<td>3.06 0.53</td>
<td></td>
</tr>
</tbody>
</table>

The GUIDE undergraduates are also being retained at MTU. The success of the GUIDE undergraduates as attributed to the peer mentoring program. All 25 undergraduates who have been in the program are working towards degrees at MTU. Four students have left the program. Two students received co-op positions during the scholarship period. They will have the opportunity to return to the program after their co-op is completed. One student had to leave the program due to a low GPA. He is continuing with his engineering degree and his GPA has been improving. The fourth student decided that he did not want to be an engineer or obtain a degree in a technical field. Instead he switched to the School of Business where he is enjoying his coursework and his grades are improving. This student did receive guidance from his mentors regarding his decision. He also spoke extensively with the program advisors while he was considering this change.

The GUIDE program helps graduate students gain skills that they will use during their Peace Corps work experience.

**CONCLUSIONS**

The MTU GUIDE program is helping undergraduate students from underrepresented groups succeed in engineering school. The peer mentoring the students receive helps them to form a community at the university. This community provides support personally and academically. The GUIDE undergraduates have higher GPA’s than their counterparts within the College of Engineering. Furthermore, these students are receiving co-op positions at twice the national and university rates.

**ACKNOWLEDGMENT**

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REFERENCES


