Students Teaching Students: Engineering 100

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Abstract

This paper describes an orientation course every first year student entering the College of Engineering at the University of Illinois, Urbana-Champaign participates in during the first six weeks of class, fall semester. The program is unique in that it is entirely organized and taught by third and fourth year engineering students, each of which facilitates one or two sections of the course, known as **Engineering 100**. Although the sections group students by department, much of the material in the course covers other areas as well, ranging from campus health services to web page construction. This paper will first provide an overview of the content and structure of the Engineering 100 program from the perspective of a first year student, then from the perspective of a student facilitator, and finally from an administrative point of view. In addition, it is a goal of this paper to convey some of the educational philosophy that has driven this program forward over the last six years and, in our opinion, made it so successful.

Introduction

Each fall at the University of Illinois, Urbana-Champaign (UIUC) over 1,100 new engineering students begin their careers as engineers. In their first semester, every engineering student participates in the Engineering 100 Program, which meets once a week for the first six weeks of the semester. Class sessions typically include icebreakers, team skills, interpersonal skills, introductions to campus computing facilities, web page design, use of UNIX operating systems, academic resources, international opportunities, department-specific information, and corporate speakers. In addition, this program is typically the first course students take with others from their department, and because of the small class size it also serves as a unique networking experience. The program replaced a more traditional faculty-run orientation program approximately six years ago.

The mission of Engineering 100, as articulated by the student facilitators of the course, is as follows:

> *Engineering 100 is a student directed program providing new engineering students with a head start in their educational and social development through an informal, dynamic, and fun environment which encourages learning, personal growth, and relationship building.*

Entirely student run, the Engineering 100 Program is led by two student co-directors and a staff of 35-40 undergraduate engineering students, known as Engineering Learning Assistants (ELAs). In the early spring—roughly 7 months before the onset of the course—the two co-directors and a committee of former ELAs select and train the new facilitators for the coming fall. Once selected, the new team of ELAs complete 30 hours of intense training, redesign and update a 90+

page student manual (known as the **Engineering Resource Book**), and prepare lesson plans before entering the classroom the following Fall. ELAs typically instruct one or two classes a week with an average of about 15 students per class. Student facilitators also meet with each other regularly outside of class to debrief on their experiences and brainstorm answers to problems and/or questions that may have arisen in the classroom throughout the week.

The Program: A Student's Perspective

Students first hear about Engineering 100 during course registration in the summer, at which time they sign up for a 3 or 4 o'clock session that will meet once a week on Tuesdays for the first six weeks of class. Grading is satisfactory/unsatisfactory, and is based primarily on attendance and the completion of one or two small projects. Section sizes vary from as small as 8 to as large as 25, with an average class size of about 15 students. Their major determines the section of Engineering 100 students register for; thus, Engineering 100 students are in class with peers from their department for the first time--their colleagues and classmates over the next 4 years. Effort is also made to match ELAs from a particular department with sections corresponding to that department. With incoming classes of approximately 1,100 engineering students annually, there are about 60 sections of engineering 100 taught by nearly 40 ELAs.

The objectives of the Engineering 100 Program are several fold: 1) to introduce students to the university environment, 2) to acquaint students with engineering resources, programs, and their particular department, 3) to develop student relationships and networks, and 4) to keep students abreast of campus/college events and activities.

As first year engineering students are not only new to the College of Engineering, but also the campus at large, Engineering 100 attempts to provide an introduction to the whole university environment. Thus, the typical Engineering 100 class might include everything from explanations of the campus bus system or locations of important student services buildings, to an interactive lesson on using Engineering Work Stations or constructing a web page. In an effort to better acquaint students with their own department, several ELAs facilitating sections of a particular major will typically organize at least one "joint" class where faculty and staff from that department can come and introduce themselves and some of the opportunities specifically geared towards that major.   For a comprehensive list of major topics covered in Engineering 100, **see Table 1**.

First hand advice about the best and most active student organizations, what classes to register for, or where to see a movie are just a few of the topics informally discussed in Engineering 100 classes on a regular basis. Because most students have questions about internships, jobs, and research opportunities, classroom activities are targeted specifically to prepare students for interviews and to help them draft a resume. As upperclassmen currently going through the job interview process, ELAs often have the best grasp of what sorts of activities employers are searching for.   Students are highly encouraged by their ELAs to pursue internships, study abroad experiences, extracurricular activities, and research opportunities, not only as ways to strengthen their resumes, but as an important means for developing leadership skills and expanding their education. In pursuit of these activities, students have a powerful resource in their ELA, as he or

she is connected to a larger network ELAs, all of whom represent energetic, involved students in their department and across campus.

ACADEMICS	STUDENT SERVICES
-College Offices & Personnel	-Campus Career Centers
-Department Offices & Personnel	-University Health Center
-Advising & Registration Strategies	-Tutoring
-Other Majors/Minors/Options	-Student Legal Services
-General Education Requirements	-Financial Aid/Grants/Scholarships
-Special Academic Programs	-Student Counseling Center
COMPUTING	**CAMPUS RESOURCES**
-Web page Construction	-Libraries
-Email	-Research Facilities
-Intro to UNIX Operating System	-Metro Bus System
-Engineer vs. Student Account	-Shopping Locations
-Class Registration	-Dining Locations
-Campus Computing Locations	-Theater Locations
CAREER	**EXTRACURRICULARS**
-Engineering Placement Office	-Intramural Sports
-Job Fairs	-Student Union
-Resumes	-Sporting Events
-Co-ops & Internships	-Registered Student Organizations
-Interviewing Skills	-Performing Arts Center
-Corporate Etiquette	-Athletic Facilities
-Networking Skills	-Cultural Centers

Table 1: Sample Classroom Topics

As one of the first academic experiences for engineering students, Engineering 100 often introduces them to their first 'working network' of friends. Students frequently form study groups and build strong relationships with their peers during Engineering 100. Because the engineering curriculum at UIUC is fairly generic for most students during their first two semesters on campus, new engineers rarely take more than one course--if any--exclusively with students for their department. As a result, many engineers lack a firm grasp of what their major is about after their first year. Engineering 100 provides a unique opportunity for students to learn more about their department as well as form a relationship with their ELA (who is typically an upper classman from their department). And, since most first year engineers are facing challenges similar to those of their classmates in Engineering 100, this course provides a unique way for students to share personal challenges and discoveries with others.

The high priority on networking in Engineering 100 means important steps must be taken by ELAs to incorporate teambuilding activities into their lesson plans. These activities help students get to know one another while aiding in the development of important teamwork skills. Many of the activities students participate in challenge them to reveal things about themselves to others and to work in groups on different small projects. Sample activities frequently used by ELAs to help make students more comfortable with each other can be found in **Table 2.**

ICE BREAKERS

- **Human Knot**- *students stand in a circle and reach across to grasp hands; they then attempt to untangle themselves without letting go*
- **Flash**- *students sit in a circle and take turns asking quick, easy questions which everyone must quickly go around and answer*
- **The Name Game**- *students sit in a circle and take turns saying an adjective that describes them and starts with the same first letter as their first name, as well as everyone's name/adjective who has gone before them*
- **2 Truths & a Lie**- *each student takes a turn sharing three "facts" about him or her self, with the class then guessing the falsehood*
- **Introduce Your Partner**- *students pair up and take turns introducing themselves to their partners; everyone then introduces their partner to the class.*

GROUP PROJECTS

- **5 Minute Tower**- *small groups are given 5 minutes to build the tallest tower they can using only materials they brought with them to class*
- **5 Minute Group Presentation**- *small groups choose a topic in the resource book that their team will be responsible for presenting the following week*
- **Scavenger Hunt**- *small groups are given a short list of items they must find across campus using only their resource book*
- **Sport/Game**- *examples include soccer, softball, and ultimate Frisbee*
- **Quiz Show**- *small groups compete against each other to answer trivia questions based on material in the resource book*

OTHER

- **Study-Buddy Sheet**- *students share with each other what classes they're taking and frequently form study groups*
- **Field Trip**- *ELAs frequently schedule at least one group trip*
- **Class Assignments**- *for some class assignments, students are encouraged to work together (e.g., their web page or resume)*
- **Picnic**- *this fall, Engineering 100 students may have an opportunity to participate in an all Engineering 100 picnic*
- **Office Hours**- *ELAs hold regular, weekly office hours, which students are encouraged to attend*

Table 2: Sample Teambuilding Activities

Engineering 100 classes serve as important tools for communicating to students information about upcoming engineering events on campus. By directly encouraging student involvement in engineering activities early on, the likelihood that they will continue to be involved throughout their college career is dramatically increased.

Every year more and more people want to use the Engineering 100 program to communicate with students. These efforts have included skill assessment or placement tests for common engineering freshman courses like physics, information about study abroad programs, or

potential courses of interest like *Entrepreneurial Engineering*, *Learning Through Inquiry*, and *Engineering Emotional Intelligence*. Companies visiting campus are interested in speaking to freshmen students and getting them thinking about the possible opportunities for internships and jobs after they graduate.

As it stands, student feedback about their experiences in Engineering 100 has been very positive, and all indications suggest that changes to the format and content of the course over the last 6 years have dramatically improved the experiences of first year students. This conclusion has been based on student evaluation forms distributed over the last 3 years; however, a more quantitative means of assessing the benefits of the Engineering 100 program for students is being explored in order to further improve the course and its utility for first-year students. Nevertheless, it can safely be said that students consistently report Engineering 100 as an important part of their transition into their department, college, and the university at large.

The Program: An Engineering Learning Assistant's Perspective

Ultimately responsible for the ELA program are two co-directors who have participated in the program the previous year. The primary responsibilities of the directors include: 1) organizing the ELA recruitment and selection process in the spring; 2) planning/facilitating the 30 hours of training each ELA participates in; and 3) holding weekly debriefing sessions during the six weeks of class in the fall.

Each spring at UIUC, the two student co-directors of the Engineering 100 Program, along with a committee of 5-7 former ELAs, begin the process of selecting and training facilitators for the following fall. Roughly fifty percent of the ELAs from the previous year return, leaving 20-25 more to be selected. Recruitment methods range from flyers and emails to formal recruitment nights; however, the most effective means of recruitment is undoubtedly person recommendation and word-of-mouth. All sophomores and juniors are eligible to apply (as they will be juniors and seniors in the fall). Typically 75-100+ students submit applications online or in hardcopy, and from this pool approximately 40 (or roughly twice as many people as there are spots) are selected for interviews. At the application stage, the committee typically looks for qualities such as enthusiasm, involvement in the college and campus community, and an ability to relate to first year students--among other things. At the interview stage, more specific questions are asked targeting these same areas as well as interpersonal skills (such as the ability to deal with conflict, work in a team environment, and effectively "teach" material) and responsibility (such as the ability to budget time, follow through on commitments, and go the extra mile to produce a quality product).

One of the most challenging aspects of the Engineering 100 Program is the selection process, in large part because of the exceptional quality of the applicants and the strong, close-knit community found among similarly involved students (representing the bulk of those who apply.) While the applications are reviewed anonymously, an attempt is made during the final selection to insure diversity in majors, genders, and ethnicities, as well as provide a strong base of young applicants (the group that ultimately represents the future leadership of the program).

In preparation for facilitating the fall course, every ELA participates in a (paid) 30 hour training program that serves three main purposes: 1) to develop working relationships between all the ELAs through team development activities; 2) to further develop classroom presentation and organization skills; and 3) to sharpen ELAs' knowledge of any and all information that might be relevant to the successful orientation of new students. These objectives are accomplished through exercises such as those found in **Table 3**.

Once class starts in the fall, ELAs are compensated up to 5 hours a week beginning in the fall for class time, class prep time, debriefing, and a weekly (required) office hour. As a group, ELAs participate in a short, weekly debriefing session facilitated by the ELA co-directors. During these sessions, ELAs have an opportunity to share with each other any concerns or frustrations they have encountered in the classroom, as well as a good number of humorous anecdotes and warm fuzzies. These sessions also serve as opportunities to discuss program logistics, align lesson plans, organize joint class sessions, and have staff and faculty introduce ELAs to courses they would like to recommend their students participate in after Engineering 100 ends.

TEAMBUILDING ACTIVITIES

- ✓ Low Ropes Course (Half Day Retreat)
- ✓ Ice Breakers (Primary focus for first two weeks of training)
- ✓ Group Events
- ✓ Regular, Informal Meetings

CLASSROOM FACILITATION SKILLS

- ✓ Lesson Plan Writing
- ✓ Classroom Presentation Simulations
- ✓ Role Playing of Conflict Scenarios
- ✓ Presentations on Learning Styles & Active Learning Techniques

GENERAL KNOWLEDGE

- ✓ Comfort with the other ELAs and an understanding of the Resources/Experiences they bring to the program.
- ✓ Familiarity with the *Engineering 100 Resource Book*
- ✓ Knowledge of Campus Resources
    - ▪ University
    - ▪ College
    - ▪ Department
    - ▪ Campus Community
    - ▪ Career/Business World

Table 3: ELA Training Topics

The additional education, leadership experience, and camaraderie that ELAs participate in improves the program attractiveness in a way that most part time jobs or teaching assistantships fail to compare to. Engineering Learning Assistants have a special opportunity to become a

successful leader in the college community and to guide other students along the paths of their academic (and frequently non-academic) careers. Perhaps most notable is the fact that nearly every ELA states as a reason for their interest in the Engineering 100 the respect they had for their ELA when they took the course.

The Program: The College's Perspective

As Engineering 100 has become more established, so has a "network" of courses with complimentary content and scheduling. Students benefit from the fact that Engineering 100 serves as a means of introducing them to other valuable courses—some department specific, and some completely independent. In the past these have included departmental orientation programs such as Computer Science 100 and Mechanical Engineering 199, as well as broader, more thematic introductory courses such as *Learning Through Inquiry* and *Engineering Emotional Intelligence*.

Departmental "Engineering 100" type programs serve to carry on the mission of Engineering 100 by further familiarizing students with the department faculty, by providing design projects (e.g., a small model solar car project), and by having students work together on other projects or interesting problems. Most of these classes meet one hour a week in the second half of the semester during the same time slot as the original Engineering 100 class. In addition, most of the departments staff these complimentary programs by hiring Engineering 100 ELAs.

Engineering 100 has become an accepted, supported, and vital part of the first-year engineer's college experience. ELAs have become recognized as a source of talented engineers touting strong interpersonal skills, good teaching experience, and genuine concern for the success of other students. Student leaders, faculty, and administrators seek out ELAs to work on programs, projects, and courses—among other things.

Issues and Opportunities

As the program continues there are several important issues to address. **Can we continue to attract outstanding ELAs?** As the program reputation grows and the benefits to the ELAs increase the opportunity to have outstanding ELAs seems very viable. Even then success can be very fragile. One poor effort in recruiting and developing new ELAs could weaken the program significantly. Any decrease in performance greatly reduces the reputation of the program and the ability to attract the best students. We are also asking more and more of the students. We are asking them to build relationships in a variety a ways (ELA-Department, ELA-ELA, ELA-student, etc.) that will stretch their talent and their available time and energy.

While we are reaping the benefits of a student-run, student-organized program, can we maintain it at that level? As the program becomes more successful and more integrated in to the college will it be "allowed" to remain student-run? Or will the stakes get so high that it can no longer be free and spontaneous? These are difficult questions. It seems that as long as the outcomes are continuously improving and there is strong, positive feedback, the program will continue operating as is. The challenge to independence will come if the outcomes are not as good as expected by all parties.

The next challenge is associated with continuous program improvement--how far can a student program go? While there is good continuity between program directors from one year to the next and there are expectations for reasonable transitions and transfer of information, is continuous improvement viable. Anytime new people take over any tasks there is opportunity for improvement and there is opportunity for regression to the mean. Which will we get? Student organizations are very good at achieving innovation and creativity and notoriously week at sustained improvement. Our challenge is to strengthen the transitions and the continuity—no small task.

Finally, as we are more successful and become more integrated into the college, more people will want to attach their programs, courses, and ideas onto Engineering 100. **Can it sustain the extra efforts—should the program even try to expand its influence?**

Conclusion

The Engineering 100 Program at UIUC serves two primary purposes, each reflecting an important concern for the College of Engineering. Born out of a need for a better orientation program for new engineering students, Engineering 100 also offered new leadership opportunities for a fewer number of more experienced upperclassmen. With new programming comes a need for new resources that, invariably, are linked to the college as a central funding source. This connection presents unique challenges to keeping the program dynamic enough to meet student needs, yet grounded enough to support the growth and transitional leadership necessary to carry the program forward into the future.

First and foremost, Engineering 100 is an orientation program for first year engineering students. Anything improving the transition of engineering-bound high school students into the rigors of university life contributes to the effectiveness of this mission. What is most important in this transition, both in content and capsule, changes sporadically--representing perfectly the dynamic challenges that perhaps only a student-directed program will be able to best meet.

Secondly, and perhaps equally important, Engineering 100 has become a key leadership development tool for the college. With the added responsibility of carrying this mission comes the need for engineering undergraduates to keep their fingers on the pulse of recent high school graduates--(from which they are fortunately not too far removed). Maintaining this rather organic, student-centered vision is going to require continued attentiveness to the recognition of values of such labors. Although ELAs are compensated for a portion of the time they invest in the Engineering 100 Program, none do it for the pay alone (nearly all could work better paying jobs). What drives this program, then, and sets it apart from others, is the extrinsic value students receive from the camaraderie of fellow ELAs and the hands-on leadership skills being developed. Together with the intrinsic recognition that, as a learning assistant, one is performing an invaluable service to the College of Engineering should come the equally important recognition that the successes of the Engineering 100 Program also relies heavily on the financial and administrative support of the college. At the end of the day, as long as a level of mutual respect is maintained between the university and the students, the program will continue to be successful.

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RAY PRICE
Ray Price is a Professor of General Engineering and Severns Chair of Human Relations at the University of Illinois, Urbana-Champaign. He was invested in the spring of 1999 and has advised the Engineering 100 Program for one year. Professor Price is currently teaching a course on Engineering Emotional Intelligence and has laid the groundwork for a new Center for Entrepreneurship at UIUC.