A Class of Freshmen Get Dirty

Craig James Gunn Michigan State University East Lansing, MI

Abstract

Perhaps the words “getting dirty” have become archaic with the advent of computers that have allowed individuals to design, build, and test every conceivable item without leaving the comfort of their homes. Students entering the university today are much more unlikely to have taken apart an engine and much more likely to have never opened the hoods on their cars. With that in mind, one of the principle activities in the Residential Option for Science and Engineering Students (ROSES) course at Michigan State University is to give students a chance to delve into the world of design through activities that allow teamwork, investigation, and a certain amount of fun. The activities include tower construction and analysis, disassembly activities, and a unique activity called “Disassembling the University.” In most cases, they are not really “getting dirty,” but they are being allowed to put their hands and minds in places they have never seen before.

Introduction

A plan was inaugurated six years ago to give incoming freshmen a chance to investigate the engineering program in the College of Engineering at Michigan State University well before their junior year (the point at which students are accepted into engineering programs.) The course of action was taken because when students find a connection with their major early in their college careers, they stand a greater chance of actually graduating in that major. The Residential Option for Science and Engineering Students (ROSES) program provides students with not only close proximity to fellow engineers through centralized housing, but classes that group these students together in math, physics, and chemistry. The students are also required to enroll for a customized engineering course housed in the College of Engineering. This course addresses issues that are commonly experienced by most freshmen, but it also focuses on highly specialized topics involving engineering in particular. Topics range from introductory material on their chosen majors to ethics. It is an important time in which to make clear the necessities of studying, time management, networking, and coping with the normally difficult engineering freshman's course load.

It is also a critical time to introduce students, sometimes in a very rudimentary way, to important aspects of engineering. One of these aspects is the hands-on nature of engineering and the importance of experiencing not only the vitally important computer world but also the world of physical contact. With that in mind the ROSES students investigate design and hands-on activities in and out of the classroom.

Discussion

One of the first activities in which the students participate is a university wide scavenger hunt (selective questions shown below.) Here the students are given the chance to see what Michigan State University and the College of Engineering are really like. Working alone or in groups they can discover much more than the typical freshman student who simply concentrates on course work and does not spend any time exploring the environment of the university.

Scavenger Hunt - Selective Questions

A mistake you find in **The State News**
(You define what a mistake is).
Obtain the following:
a bookmark, plastic bag, or receipt from the bookstore of your choice.
a pamphlet from Olin Health Center.
a leaf from the most prevalent tree on campus.
a bicycle registration form or a copy of one you filled out for your bicycle.
a pamphlet on bicycle security.
a map of bicycle routes on campus.
a ride on Craig Gunn's special bicycle.
What is the procedure for reporting sexual harassment?
Get the name of an MSU bus driver.
Who built the Bogue Street Bridge?
Where is the Red Cedar Yacht Club?
When were the following buildings built?
Ag Hall
Dorms (Eastern, Northern, and Western)
Administration Building
Where was the Administration building located before the present one was built?
Some people say the present Administration building looks the way it does because of the time period in which it was built. Why?
Where is the largest ceramic sculpture on campus/world?
Find a number of sculptures on campus. Where are they?
Where is the original Engineering Building?

Sent to all reaches of the campus, students dredge the archives for information about the institution that they have chosen to attend. They discover how the university works and who can open doors that seem to be locked to them. In their first weeks on campus they discover more information than most juniors and seniors ever discover. Since the scavenger hunt requires contact with engineering faculty and staff, freshmen students are able to talk to actual engineering personnel, an activity that in the past may have not occurred until two years had passed after entry to the university. The hunt also provides a jumping off point for questions about the university and their role in it. One student after spending a great deal of time collecting information across campus commented, "I really discovered in a short period that what I have always wanted to be is a veterinarian and not an engineer. I got to talk to people (in the veterinary school) who really gave me insights into the program and where I want to go." Here

the goal of retaining students in the engineering programs seems to be violated, but it really isn't. An underlying goal of the entire ROSES program is to make students aware of all the avenues open to them. They need to be happy in the careers that they have chosen. If fine-tuning these students places them in career paths that will make them both successful and happy, the program has been worthwhile.

As the scavenger hunt is under way, students are also collecting information on engineering and their impressions of it. One assignment, "The Engineer as Hero," forces participants to look at the real world and see the engineer's place in it. Students collect as much data as possible to form a picture of how the real world sees engineering. Material collected may range from disasters concerning a wide range of products to feats in mechanical engineering. Movies like China Syndrome and Falling Down, when found by the students, may create some very lively conversation. Coupled with the scavenger hunt, it is a learning experience that most students have never attempted. They have never looked at how they and the world look at engineering.

This new perspective on engineering is enhanced by a variety of activities that are used to utilize the interest of students in hands-on engineering with the need to build their team-working skills. One such activity requires the students to look at a simple problem of building a tower from straws and masking tape. They must build the tallest tower possible that will support a full can of soda. This activity requires that the group discuss the natural steps in the design process. Each person is encouraged to express his/her ideas in regard to the problem. After discussion, the best solutions are selected, the final course of action is set, and the building begins. The whole activity from beginning to end encompasses only 40 minutes. Students need to get all members of the group involved or the project cannot be competitive with the other teams. The responses from the students are very positive. One female commented, "This is the first time anyone listened to my ideas concerning something related to engineering." Another student was heard over the general noise, "Let's go. We have to have everybody on this thing or we won't get done!" The activity itself fosters learning. The students become their own teachers concerning teamwork.

The 40 minutes of frenzied activity is not the end of the team-working exercise. Students leave the classroom, but their towers follow them. All towers are delivered to their dormitory and within the next week, each team is required to arrange meeting times, investigate a tower built by another group, make recommendations for improvements, and produce a document that could be given to the other tower's builders. The exercise gives the students an opportunity to investigate design but also to evaluate their experiences in teamwork. The insights that they gained are shared with the entire class and the learning that takes place shows that a hands-on experience is exceedingly valuable in showing students the value and pitfalls of teams.

Students find that this out-of-class activity provides them with a set of new tools to use in their next team activities. They can discuss any methods that are learned in other classes that come to bear in the final design. Here students are not involved in the frantic activity to build the actual tower, they talk about the thought processes that went into the design, what went well, and what failed to be achieved. A wide variety of activities are incorporated into these assignments. Activities that do not require a great deal of time but do initiate thought in future engineering issues are quite valuable. Design techniques are discussed. Problem definitions are created in

relation to the projects, whether they are large or small. The importance of time lines is expressed. And lastly written documents in the form of Gantt charts, progress reports, preliminary reports, and final documents are discussed and produced. These reports, created around real world activities (large or small) will be remembered by the students.

It is important to state at this point that programs that only allow students to enter their programs in their junior year must be mindful of teamwork and its importance to design in the early days of the students' lives. If colleges and universities expect to retain students, there is a distinct need to give them a correlation between the real world and the required courses that they are taking in their early years before they are fully immersed in engineering. Hands-on design activities incorporating teamwork can help to perform this task.

Directing students within the classroom setting with activities such as tower building allows for immediate explanation of why a particular course of study is being required. Issues that will never be raised in a mathematics course can be tied to the study of particular angles that may or may not produce a workable structure. Designing reports can also make the student aware that design neither simply revolves around mechanical devices or is best done alone. Students can be drawn into the world of communication and how the particular design of a report can make or break the acceptance of a proposed project with fellow team members.

Design out of class allows the students to formulate ideas over the dinner table, in the dorm room, or out under a favorite tree as a group. Working into the late hours of the night trying to come up with a team oriented design that can be demonstrated in class will have a much greater effect upon the student than the commonplace lecture. The act of planning, researching, and building keeps the minds of the students active and interested. There is reality in design, reality that is sometimes in very short supply in many courses. These freshmen, then, are constantly made aware of the relationship of the courses in which they are enrolled and the world in which they will eventually work.

The tower activity is fast and furious and does allow for a certain depth of design. The next step in the process starts to focus the students' attention on not just the fun of design but the reasons for design. In a very simple exercise each student in the class takes apart a simple light switch. Although seeming to contain very few parts, the light switch when disassembled, does actually have a number of required parts. Each step in the disassembly is projected on a screen and no student has to feel uncomfortable about having difficulties getting the switch apart. As the process unfolds, discussion begins on the purpose of each part in the switch and what will happen if the part is left out. The light switch is completely disassembled, discussion takes place, and the switch is reassembled. At this point, each switch is tested to see if it works; and those not working create a moment of discussion on why they don't work. The few moments devoted to this activity provide many insights into the number of students who find this their first experience with a real hands-on project.

The simple disassembly of the light switch leads to the last major activity in the course. Student teams choose some device from a toaster to a telephone, from a vacuum to a cell phone to disassemble, investigate, and prepare a presentation that shows the rest of the class the intricate details of their device. The students must gather as a team to decide how the specific parts work

together to function as a working unit. Some of these functions may require research, and others may require speculation. In each case the students are moving into uncharted areas, areas that will spark further interest in engineering. When the disassembly is finished, the teams gather to explain to the class their findings. These presentations begin again the discussion of design. Teams vie to see who can ask the most insightful questions about the individual devices. Here are freshmen beginning to see their place in the world of engineering. It is a small beginning but one that really starts the process of the hand-on activities.

Conclusions

One single-credit course presents to freshmen students a variety of hands-on activities, activities that do not require a great deal of time or effort. These activities - delving into the university and college that they have chosen, building towers, class disassembly of a light switch, and a focused engineering disassembly project that requires a team to bring to completion – allow for a new perspective to be drawn by the students. Students are really not “getting dirty” in the true sense of the word, but they are putting their hands and their minds in areas that are required in the field of engineering.

CRAIG JAMES GUNN
Craig James Gunn is Director of the Communication Program in the Department of Mechanical Engineering at Michigan State University. In this role he directs the integrated communication program in mechanical engineering while providing help to the cooperative engineering education division of the College of Engineering. He has spent thirteen years of teaching in the public school system and fifteen years at Michigan State University. He serves as editor for the CED Newsbriefs and MCCE Co-op Courier.