The Freshman Engineering Experience At West Virginia University

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Abstract

The freshman year of most engineering programs is confounded with mathematics and chemistry courses. The students are rarely in contact with actual engineering situations. Therefore, students in the College of Engineering do not develop an understanding of the engineering profession during their freshman year. Since most students entering the university have unsophisticated backgrounds, it is felt that introducing rigorous design projects at this early stage in their careers is not effective. Many freshman engineering programs consist of a one hour course where the student gets only a superficial exposure to the various engineering disciplines taught at that university. At West Virginia University, our freshman students are required to complete two, three-hour freshman engineering design courses which are modeled after the traditional Guided Design concept developed by Dr. Charles Wales [1,2]. The primary focus of the courses is on the engineering problem solving method with added emphasis on computer software usage and computer language programming.

Freshman engineering courses can serve a multitude of important functions including the development of good study skills and academic survival strategies, orientation to the engineering disciplines, and the development of team working skills. The primary goals of freshman courses at West Virginia University are to develop problem solving and decision making skills and to develop skills in oral, written and mathematical communication. The Freshman Engineering Program recently implemented a number of changes both in and out of the classroom. A Live and Learn Program was developed in which students live on the same floor of the residence hall and attend classes together. Based on the success of this program, it has been expanded into a university wide program. Social events and seminar presentations are organized to enhance the students contact with the College of Engineering and to introduce students to the engineering disciplines. Preliminary evaluations indicate an increase in retention of students within the engineering programs from 66% to 75% [3].

Introduction

As with many engineering programs, the first year at West Virginia University is spent building the science and mathematics background needed for a successful career in any engineering field. Unfortunately, this may mean that the engineering students have little or no contact with the faculty and facilities of the College of Engineering. At West Virginia freshman students become involved in the College of Engineering and Mineral Resources by including in the curriculum two freshman engineering courses. Each is a three-hour course and they are taken sequentially during the first year. These courses include many important and exciting programs [4] that aid

the student in making the transition from a high school student to a college student. These courses also begin to prepare the student for a professional career.

The first step toward a career in engineering is to choose a specific discipline to study. This choice is not easy and many first year college students are not yet ready to make a decision that will so completely affect the remainder of their lives. The College recognizes this fact and categorizes the freshman engineering student as a general engineering major. This allows the student to explore the different options during the first year, with the aid of a seminar series organized for them. At the end of the first year the student will be required to choose a specific engineering major and begin taking courses in that field.

To aid the students in their academic adjustment to college, the first weeks of the first course are focused on time management, differences between high school and college, and the various learning styles [5]. There is also a program of review sessions scheduled through the WVU learning centers that correspond with the examinations being taken in their mathematics and chemistry classes. The students are introduced to various forms of communication, educated on the different engineering fields available at WVU, and involved in design projects that require them to work in a group. Students are also encouraged to interact personally with other freshman students and faculty through several social activities.

Academic Environment

Many of these students have never been away from home and had a relatively easy time in high school. A review of the freshman engineering students entering the College of Engineering & Mineral Resources at West Virginia University over the past three years indicates an average high school grade point average of 3.35 in 1996, 3.49 in 1997, and 3.4 in 1998. It is vital for these students to realize the level of preparation needed for successful performance in college courses before they fall too far behind. At the beginning of the first semester, topics such as time management, learning styles, study habits, the art of test taking, and the advantages of study groups are discussed with the students. The College of Engineering and Mineral Resources recognizes that the calculus and chemistry courses are more academically challenging than their freshman engineering design course and arranges review sessions in these courses through the WVU Learning Center. These sessions are scheduled prior to the calculus and chemistry exams. In addition to the specially arranged review sessions, the Learning Center also provides the students with free tutoring in any course, six days a week in the evening hours.

While the freshman engineering students are taking the required mathematics and chemistry courses, they are also required to take two three-hour engineering courses. These courses help the student to feel some level of connection with the College of Engineering and Mineral Resources and to begin their professional development towards a career in engineering. The primary function of an engineer is to solve problems. Because these problems require decision making skills that are not often possessed by freshman students, the primary goal of the freshman engineering courses at WVU is to develop, in each student, a successful process of decision making and problem solving. Additional goals of these courses are the introduction to various forms for communication, as well as the exposure to alternative tools that can be used to generate the problem solutions.

A theme of the freshman engineering courses is to prepare the student for a career and this includes developing the ability to function successfully as a member of a team. Most engineers work in teams when formulating a workable solution to a problem, and many freshman students have no experience in this type of working environment. All of the projects during the first semester are completed as team projects and must be communicated to the instructor appropriately.

Students are required to present the problem solutions both in an oral and a written format. The Microsoft Office package of software is used. Microsoft Excel is used in developing a mathematical model of the problem. This mathematical communication must be included in the project report that requires the use of Microsoft Word. All projects require visual representation of the final design, and this must be included in the project report as well. Many students have already been exposed to these software packages but need to be shown the more sophisticated capabilities required when communicating technical information. Once a written report has been completed the students must prepare and present the solution orally to the instructor and the class. Most professional engineers require oral presentation skills and it takes time and practice to perfect them. Microsoft PowerPoint is used for visual aids in the oral communication portion of the project.

Another important aspect of a student's life is the scheduling of classes. As has been mentioned, the first year in the general engineering program includes a common curriculum for all engineering majors. These students are therefore advised by one of two (sometimes three) assigned advisors.

Professional Development

Students beginning their education in an engineering field often are unaware of an engineer's duties and responsibilities. In order to help them clarify their perception of the field, two seminar series are organized and attendance is required. The West Virginia University College of Engineering and Mineral Resources consists of nine engineering degree-granting programs, as well as an accredited Cooperative Education Program. Therefore, there are a total of ten different seminars. Each of these programs presents a seminar during each semester.

In the fall semester these seminars are conducted over a three-week period on Monday and Tuesday evenings. Each engineering program presents its seminar twice in one evening. Some choose to present on multiple evenings. Attendance at four of the ten different seminars is required as part of the participation grade in the freshman engineering course. Each program is responsible for the material and format of the seminar. The most popular seminars are ones that utilize seniors and alumni to speak about their experiences. The intent of these seminars is to familiarize the students with the fields of engineering and aid them in their choice of a specific engineering major. This choice must be made at the end of the student's freshman year.

In the spring semester, it is assumed that the students have narrowed their choice to two engineering majors and thus they are only required to attend two of the ten seminars. Due to this, the total time frame is condensed to one week of seminars on Monday and Tuesday evening. Each program is again presented two times in one evening. The focus during this semester is to

show the students the laboratory facilities and some of the current research, however the actual program content is again left to the individual engineering department.

Many of the everyday classroom experiences can also be related to corresponding events in professional life. For example, the students may be required to start a resume. There may be a lengthy discussion of how this resume will change over time. Also, there are always due dates on assignments. When students request to turn an assignment in late or to have the due date changed, the instructor can relate that to an industrial application where due dates are tied to more strict events and a late project can mean losing an account which costs the company money. The communication forms are particularly applicable to professional career obligations. There are conference presentations, journal publications, client presentation, and many other necessary forms of communication that the students will encounter after graduation.

Social Environment

It is desirable that freshman-engineering students get to know each other. The students in a particular section of freshman engineering will be required to work together in teams. The value of study groups is also emphasized and thus they need to know students from other engineering sections who may have the same mathematics or chemistry course. In order to encourage this interaction of students, there are two social activities planned during the first year.

Early in the fall semester the students are brought together in order to meet each other and to interact with the engineering faculty. The location of this event is in front of the Engineering Science Building in order to attract as many engineering faculty members as possible and because this site allows the different departments to present displays. These displays would include senior design projects or other current research projects. The student chapters of the various professional societies also participate. By exposing the students to these displays, they begin to determine their areas of interest and start to form opinions on the field that they may wish to pursue. Refreshments follow a welcome by the dean and a brief program describing the Learning Centers and other important information.

A similar program is presented in the spring where information on off-campus housing and other topics relevant to starting the sophomore year are included. This event is planned for later in the spring as the students prepare to leave for the summer.

Live-and-Learn Program

West Virginia University is committed to helping its students succeed in college and has recently initiated several programs aimed at the freshman students. The College of Engineering and Mineral Resources pioneered one of these programs now known as the Live-and-Learn program. Based on the success of a trial program performed at the College, this has been expanded to include other Colleges at the University.

As the name implies, the program is one in which students who live on the same floor in the residence hall attend the same sections of their major classes. For freshman engineering students these courses include mathematics, chemistry, English, and engineering. Attending class

together aids the students in the formation of study groups. The ultimate goal of the program is to build a community in which students can excel. There is also an ability to plan social activities that involve the students outside of the classroom environment. One such activity in the planning stage is the viewing and discussion of the movie "Apollo 13". This movie is fairly unique as it portrays engineers as heroes.

The Fall Semester

As previously mentioned, the first social event is planned for early in the fall semester. At this time the students are busy adjusting to their new living arrangements and beginning to become aware of the academic requirements of their major. These first weeks are reserved for topics that aid in this process. The students are also made aware of other useful resources located on the different campuses at West Virginia University. Once this orientation period has passed, the students begin the first of many team building exercises. Survival School is an activity designed by Dr. Charles Wales [6] that shows the class the significant benefit of working as a group to overcome a difficult situation. This exercise places the students on a deserted island with only limited provisions. They then rate the importance of each item with respect to their survival. The group is then led through a series of discussions requiring decisions. The group must then agree on a ranking of the same list of items and these are compared to the individual rankings. In almost every case the group ranking is closer to the "expert" ranking that is discussed after the completion of the exercise. This provides the class an example of the benefit of working as a team and an emphasis is placed on teamwork in the next series of projects.

During the semester two team projects will be completed and it is especially helpful if they can be coordinated with the subjects being covered in the other courses. The instructor will help the students solve the mathematical aspects of the project using the Microsoft Excel spreadsheet program. The instructor guides the students through the design process and to a solution. Each group submits a final written report and presents the results orally to the instructor and the class. More detail on this process and specific examples can be seen in the second paper in this series[7].

Spring Semester

The theme of problem solving and decision making is continued in the second semester. This semester, however, is focussed on using computer programs as a tool when solving problems. The students are taught to program in the language C and also MATLAB. The logic required to formulate a problem solution into a procedure that is solvable by these tools is the goal of this course. The approach to teaching this material is to begin with a problem that is sufficiently difficult so as to require all of the programming techniques of the course for its solution. Once the problem is understood, the students are eager to learn the techniques needed to complete the assignment. The problem is then separated into steps and the actual programming syntax introduced. If necessary, other related examples are used to reinforce individual concepts. Once the initial problem is completed, a final report is submitted to the instructor. A similar technique is used for the MATLAB portion of the course. More detail on this process can be obtained from the authors directly.

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DR. SCOTT WAYNE

Scott Wayne received his Ph.D. in May 1997 and is presently a Research Assistant Professor in the Mechanical and Aerospace Engineering Department. Dr. Wayne has taught in the freshman program for the past two years and has worked closely with Drs. Alfred Stiller, Afzel Noore and Kristine Craven to improve the freshman-engineering experience at the University.

DR. KRISTINE CRAVEN

Kris Craven also received her Ph.D. in May 1997. Since that time she has served as the Freshman Engineering Program Coordinator for the College of Engineering and Mineral Resources. In her present position, Dr. Craven instructs three sections of the freshman-engineering courses each semester and performs administrative functions as the Program Coordinator.

DR. ALFRED STILLER

Al Stiller is a professor of Chemical Engineering who has been involved with the freshman engineering students and their learning for over a decade. His approach is very different from the traditional style familiar to most teachers. He is extremely well received by his students and a number of freshman instructors have requested him to train them with his successful techniques.