

Giving the world a “NEW” Approach to Engineering Education

Steve Wells, Dr. T. Al Austin
Old Dominion University (ODU) / Iowa State University (ISU)

Abstract

In providing for the professional/vocational training of our students, the best use of our allotted educational hours and dollars would be to invest them in a program specifically designed to use the acquisition of knowledge as the vehicle with which to train them to utilize their God given skills. The distinction here is that knowledge is not an end in itself but a means to an end. The technology explosion we have witnessed in the past decade is providing a new paradigm for students to learn without the time and financial investment of attending the “traditional” university classroom. While the traditional classroom method has certain advantages, new technologies open up whole new student populations whose educational needs can be met by universities. Distance learning is not an attempt to replace the traditional university approach, but rather to broaden the ability of universities to fulfill their mission to provide quality education to a more diverse group of students. Providing students with the needed resource books, software and weekly guidance, professors are able to teach with the same effectiveness as if they were teaching in the classroom, while students can take the course from anywhere in the world. While this method is in its infancy, its potential to dramatically increase enrollment and to service students globally recommend it for serious consideration and development.

Purpose

- The purposes for offering courses via the Internet are myriad. To list the most salient:
- ▶ To enable the student to take classes on his own schedule and within certain limitations at his own pace.
 - ▶ To provide a viable alternative to the traditional university education to students who need it.
 - ▶ To allow the university to expand its outreach across state and national borders.
 - ▶ To enable the university to increase its enrollment.
 - ▶ To keep the university competitive in the ever changing educational market.

Overview

In the past three semesters 5 courses were taught using the Internet as the primary medium of communication. These courses were developed and taught through a joint effort between a Mechanical Engineering Technology faculty member at ODU and a Civil and Construction Engineering faculty member from ISU. The majority of the students enrolled in the courses were from a home education organization called the Advanced Training Institute International. The students ages ranged from 16 to 38 years old. The table below illustrates the frequency of courses offered, the total number of states from which the students were taking the course and the last column indicates the number of students that have successfully completed them.

Course	# of Classes	# of States	Total # of Students
Introduction to Engineering	3	16	29
AutoCAD Drawing	2	19	23
Chemistry	2	12	13
Surveying	1	4	4
Calculus	1	5	5

Four of the five courses listed above included students from 2 provinces in Canada. These pilot courses have been so successful that further courses are being developed and active recruitment is planned for the Fall 97 semester.

Method of Delivery

At present five courses have been developed that are suitable for study at home or industry. The following methods of delivery have been implemented.

1. **Course Packs.** Each course is accompanied by a text book, computer software (where applicable) and the following written material:
 - a. Syllabus
 - b. Course outline
 - c. Instructors notes and special questions
 - d. Sample problems with solutions
 - e. Practical assignments
 - f. Projects (where applicable). Projects are practical assignments that simulate “real world” applications.
 - g. Case studies
 - h. Tests, and final exam (sent separately).

2. **Phone connection.** It is imperative that distance learning students have easy and adequate access to faculty. A full time faculty member would set aside 4 hours per week per 10 students for answering questions and grading homework.

3. **Computer interface.** Transferring documents via e-mail is the primary method of communication with these classes. To do this effectively it is imperative that the student and faculty have compatible software. Each student is required to obtain a copy of Pegasus Mail software (free off the Internet) to use as the method of transferring these files. In the courses which required math assignments, students created and submitted their work using Mathcad Student version 6.0 software. Students encountering problems either e-mailed their questions or phoned the professor during specified telephone office hours. By using an e-mail group directory questions and the professors responses were sent to each student in the class. Take home tests were scheduled and sent and collected at specific times. This could be accomplished more efficiently using a web site. Grading on the computer required an inordinate amount of time.

While grading hard copies of homework and tests was faster it was still a time consuming effort and incurred the cost of sending the work back to the students via postal service.

Computer technology allows for active video communication through the phone lines. Future plans include acquiring the proper equipment so that faculty and students can speak and see each other as they are working on different problems. The cost of a computer with these capabilities is substantial. "White boarding", a method of communicating from one computer to another, like having a chalkboard for illustrating could also be incorporated with the computer interface. This technology is expensive, but it allows for staying at home or work. There are other methods of communicating via computers that can be accomplished for less than \$200.00.

4. **Video tapes.** Several industries provide training tapes that illustrate the practical application to engineering principles. These tapes can aide the student in understanding and better equip him to apply the subject on the job. Video tapes also have the ability to demonstrate the application of the engineering principles in industry which is also helpful.

5. **Laboratory work.** Since hands on laboratory exercises are not practical for the distance learner, students will need to meet with faculty for a concentrated two or three week lab exercise period one to two times each year. This lab work is best conducted at a local industry such as a power plant when learning about the principles of Thermodynamics, for example. Lab work will be based on an extended work day with a six day work week. Each day would require six hours of conducting the lab exercises and 6 hours of developing the report of each lab exercise. It is estimated that one lab course could be completed each week.

6. **Local Apprenticeship.** Recognizing the tremendous benefit of seeing principles being applied in real life settings, distance students would be required to fulfill an apprenticeship period. All students would have a well defined project approved by the engineering faculty prior to commencing the apprenticeship period. Flexibility to accommodate students who work in engineering related fields would be up to individual faculty.

Plan of Action

In order for a university to develop a distance learning program, it would need to follow through on several points.

1. Count the cost. Developing this form of education is a major adventure incurring certain costs, and a great number of man hours would be required to achieve excellence. Release time of 25% per semester proved to be adequate to develop the necessary materials for one course. Additional funding is needed for training materials such as videos on how to create a web page or how to produce CD's.

2. Pull together a planning team. The planning team would need representatives from engineering and administration to stay on course. The team leaders responsibilities will be to:

- a. Recruit interested faculty and delegate specific responsibilities.
- b. Set time frames for development deadlines.
- c. Work out kinks and follow up on deadlines

- d. Keep communication lines open.
 - e. Call meetings as needed.
 - f. Acquire and administer funding
3. The planning team would delegate the development of courses. Realistically this will require the most time. Professionals with expertise in each course would need to take time to:
- a. Put their notes in a course pack format.
 - b. Format their computer for the specific software they'll use.
 - c. Become familiar with the specific software they will use.
 - d. Determine the particular guidelines for submitting homework and tests.
 - e. Train secretarial support staff.
4. Determine admission standards and procedures. Admission standards should seek to discourage students without personal initiative. Distance learning students do not have the peer pressure motivation that you find with the students in the classroom. Determining which students would excel in distance learning could be achieved by offering an Introduction course to initiate the student to the new paradigm.
5. Communicate with the Accreditation Board for Engineering and Technology (ABET) requesting guideline information.

Conclusion

Distance learning is no longer on the academic horizon, it is a part of the educational strategy of many universities. This paradigm has been proven successful in providing quality education for students choosing the distance option. It has also been observed that the distance learning student develops the same or better level of proficiency as the student in the traditional classroom. With proper administration and development, distance learning can become a very strong part of any university.

STEVE WELLS is the coordinator of the Advanced Training Institute International's engineering program. He is presently a 13 year Mechanical Engineering Technology faculty member at Old Dominion University. Prior to teaching, Mr Wells was in the engineering department of Sperry Marine Systems for four years.

Dr. T. AL AUSTIN is the co-coordinator of the Advanced Training Institute International's engineering program. He serves on the faculty of Iowa State University as the Graduate Program Director for the Civil and Construction Engineering Department.