# Integrating Technology Enhanced Learning into a Non-technical Engineering Course

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**Abstract -***The core curriculum courses at Southern Illinois University at Carbondale are designed to "...provide students with analytical and imaginative abilities essential for a life of inquiry, creativity and informed civic participation". Within the College of Engineering, one core curriculum course is ENGR 301 Humans in Their Environment. This course is designed in part to introduce students to various aspects of environmental problems and solutions as addressed by engineers. However, the challenge is to present this information to non-technical students. This is done in part by integrating the delivery and access of the course material through technology enhanced learning. For many of the students currently in the class, as well as in the previous semester, this is the first course to integrate the different capabilities of the computer into the presentation and dissemination of information.*

*This paper outlines the approach used to present lecture material on Powerpoint, to disseminate information using a web site and to conduct research using the internet. In addition, the paper presents the use of an on-line discussion forum to post students summaries and reviews to in-class presentations on critical environmental ethics. The use of this open environment challenges the students to prepare their written work more thoughtfully than they would if only an instructor graded the work. Informal student surveys as well as university administered student evaluations are presented as assessment.*

## Introduction

As part of Southern Illinois University at Carbondale core curriculum, the College of Engineering offers *ENGR 301 Humans in Their Environment*. The author has been the instructor for this course in the Fall 1997 and Spring 1998 semester. Enrollment may come from any discipline. This course is team taught in conjunction with a faculty member from Plant and Soil Science. Of note, the instructor for Plant and Soil Science teaches a three week block in the 16 week course, without integrating technology enhanced learning.

The objective of this paper is to present the author's experience in using technology enhanced learning to disseminate course material as well as to stimulate learning. The overview will include the use of Powerpoint lecture notes, a web site, and an on-line discussion forum as well as assessment of these techniques.

## Technology Enhanced Learning

In order to successfully integrate technology enhanced learning, students must have access to computers. At SIUC, the Department of Information Technology sponsors four computing labs on the Carbondale campus, and more are on the way. They're available to SIUC students, faculty, and staff. Another forty-plus campus computing labs are sponsored by various colleges, departments, and other service units other than Information Technology. The computers in the main Information Technology labs have internet access as well as Microsoft software ( including Powerpoint ).

### Lecture Material Developed with Powerpoint

Class lectures are presented and prepared using the slide presentation software Powerpoint . One of the major advantage of this technology is the annotation of the thought process using the animation feature. For the instructor, it has the added advantage of providing a foundation for readily changing or modifying the lecture material. During lecture, a laptop computer and a projector are used to present the material.

Students have access to these notes outside of lecture through two means. The notes can be downloaded directly from the website described later in this paper. For students who do not have the Powerpoint software, a link is provided for students to download a viewer at no charge from Microsoft . The viewer allows students to view or print the files, but does not allow a user to write or modify files. As an alternative, the students can also review the notes directly from the website, since the notes are easily converted to HTML. Of note, the solution to example problems presented in class is not included in either of these notes. This encourages class attendance, in addition to providing the foundation for class discussion and participation.

## Web Site

A website is integrated into the course for the dissemination of class material and access to educational resources. In addition, it is used for posting student work. For some of the students, it is necessary to hold workshops at the beginning of the semester to introduce students to "surfing the web" to access information. At the beginning of the semester, students are told that the only hard copy of material will be the syllabus and exams. Students always have the option of printing material from the web if they still feel they need a hardcopy of the material. The material available at the website include, but is not limited to:

- Direct link to instructors email
- Grading Policy
- Link to Graduate Assistants- Resumes and email
- Links of interest
- Notes from Guest Lecturer
- Overview of text books
- Page of student links
- Research paper
- Solution to sample exam
- Tentative Schedule

This material is all listed within the main page of the website, shown in Figure 1. Of note, the illustration shown on the page can be "clicked" to go directly to the homepage for the World Wildlife Fund. Other links of interest are included later in the document. Further down the page, the user finds the table of content. "Clicking" on any of these topics links the user directly to a supporting page such as the one shown in Figure 2.

It is easy to see that a website is more dynamic than a text since course notes can be upgraded, changed, and presented to students as needed. For example, if during lecture the class requests an addition example, additional points of discussion, or clarification of concepts, the lecture notes can be reworked, and easily disseminated. A sample of the Powerpoint notes translated into HTML is shown in Figure 3.

Book publishers are beginning to support their text using websites. During the Fall 1997 semester, the text by G.T Miller [1] was used for the course. The publishers, Wadsworth, provided a supporting website [2] that includes online quizzes, an overview of additional internet resources for each chapter and topics for critical thinking. The instructor who previously taught the course also utilized a website[3]. A link is provided for students to review this material as a supplement to the course material presented in class. As opposed to providing Powerpoint lecture notes, Dr. Ray's material is effectively presented entirely in HTML. Another dynamic aspect of the website is the use of an on-line discussion forum, as described in the following section.

## On-line Discussion Forum

The class is structured to have two hours of lecture and one hour of smaller discussion groups each week. In the discussion groups, students are required to present cases in environmental ethics [4]. In addition to their presentation, students are also required to post a written summary of their presentation on an internet bulletin board (Figure 4). This format provides the structure for an on-line discussion forum. Students are also requested to post a response to a summary other than their own presentation. As opposed to writing summaries that a professor or graduate assistant will read, students are preparing summaries for their peers, as well as any curious internet browser, to read. This brings a level of accountability students are not typically use to. At times, the bulletin would often look rather messy as students learned how to submit material (i.e. triple submissions from students uncertain if their initial posting was accepted). The entire website is designed to have a certain amount of professionalism, which was not reflected when the bulletin board became cluttered. During the first semester, the bulletin board was created and managed through library personnel. This made editing the page extremely difficult. Currently however, the bulletin board is managed by the author, which allows for easy maintenance.

## Assessment

Assessment to date is based on an informal student survey as well as the formal course evaluation of the university known as the ICE scores during the first semester. Results of the informal survey are shown in Table 1. The questions were scored on a 4 point scale in order to remain equivalent to the grade point average students are scored with. The scores show a rating between average and good. Table 2 show the results of a similar survey given by the instructor in engineering courses were technology enhanced learning was also integrated [5]. The engineering courses were *CE 310 Introduction to Environmental Engineering* and *ENGR 351 Numerical Methods*. Here the ratings are between good and excellent. This difference may be due to the diversity of the disciplines represented in the core curriculum classes compared to classes with engineering students as well as the fact that a portion of the course was taught without the technology enhanced learning.

Instructor Course Evaluation (ICE) are the formal evaluations of instructors administered by the university. Although it is difficult to compare courses directly using these score, an overview can provide a degree of assessment. Table 3 shows the ICE scores, which are based on a scale of 5, as opposed to 4. As with the earlier discussion, it is difficult to compare these results directly against each other. However, there is evidence to suggest that nontechnical students may not be as enthusiastic about integrating technology into the class room.

## Conclusion

Technology enhanced learning provides a new format for the dissemination and presentation of information. Within the framework used, students were given choices on learning. For example, students were given the option of taking notes in class, reading the lecture notes in advance, reviewing lecture notes after class, accessing information stored at a website, or making a hardcopy of all class material. From discussions with a small number of students, having these

choices was sometimes overwhelming. For other students, transitioning into classes that required the use of computers was difficult. However, there seems to be a general appreciation for being exposed to the technology, with the recognition that computers and technology are becoming more advanced and integrated into our lives.

## References

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3) Ray, B.T., 1998. "Humans and Their Environment", http://civil.engr.siu.edu/ray/ class/ENGR301I/engr301i.htm (February 1998).
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*Table 1: Results of student survey for ENGR 301 Humans in Their Environment.*

| Question | Score |
|---|---|
| How would you rate the lecture notes posted on the internet | 3.3 |
| In comparison to other classes, this class made use of the internet much less (0), average (2), or more (4)? | 3.9 |
| Do you feel the use of the internet is helpful to your overall education? | 2.9 |
| Do you feel the use of the internet helped support this course? | 2.9 |
| How would you compare this course to other core curriculum courses that you have taken? | 3.0 |

*Table 2: Results of survey rating the use of various aspects of computer usage for engineering courses(Scale: 0=useless, 4=very useful).*

| Question | CE 310 | ENGR 351 |
|---|---|---|
| Overall use of computers | 3.7 | 3.7 |
| Overall use of computers in society | 3.6 | 3.7 |
| Overall use of a web site with this course | 3.6 | 3.7 |

*Table 3. Comparing ICE scores (5 point scale).*

| Semester | F96 | | S97 | Su97 | F97 | |
|---|---|---|---|---|---|---|
| Course | CE 310 | ENGR 351 | ENGR 351 | ENGR 351 | ENGR 301 | ENGR 351 |
| ICE | 4.47 | 4.34 | 4.41 | 4.53 | 3.90 | 4.39 |