Stimulating Development of Technology Based Teaching/Learning Modules Through a Technical Elective

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12 June 1997

Abstract

It is generally agreed that computers coupled with multimedia technology offer great potential to improve curriculum delivery. Faculty understand this but are deterred by the tremendous amount of time/work required to develop technology based course materials. ENGR 4510 is a course developed and used in the College of Engineering at the University of Oklahoma to assist faculty in technology based courseware development by using student time, energy and talent. After three years, this course has proven very successful in improving the delivery of College of Engineering curricula by stimulating the production and use of multimedia technology for the teaching/learning environment.

Background:

It is generally agreed that computers coupled with multimedia technology offer great potential to improve curriculum delivery. There are many examples of faculty having created exciting academic modules which are being used to improve the teaching of subjects and/or concepts. If the teaching is better the student's learning experience is also. They tend to learn faster and learn more when good interactive computer technology is used. A review of 139 studies concluded that the benefits of computer based multimedia instruction include increased effectiveness and efficiency (students learn in about 30% less time), improved student attitudes and generally less costly teaching [1].

Most faculty are excited by the potential when shown what can be done with computers and multimedia technology to enhance teaching and learning. Unfortunately, they soon discover the enormous amount of time required to produce effective quality modules. Their enthusiasm wanes. Some experts estimate that it takes 300 to 500 hours of development for an hour of effective multimedia teaching/learning module [2].

The first year students (16 in all) performed above our expectations producing high quality modules that could have been expanded for use in our curriculum. To a student, they felt that the course was well worth their efforts. These first year modules, although made available on the network for student use, have not been used in class by faculty.

The first year experience with ENGR 4510 taught us that:

- the enormous amount of time required to produce good teaching/learning modules is not exaggerated.
- faculty participation in the development of the modules was necessary if we wanted to improve our curricula by using them in class.

Course design:

ENGR 4510 is an elective designed for senior and graduate students of the College of Engineering. It was created in response to our students' desire to learn how to use authoring software to develop engineering presentations. They recognized that knowledge and skill in this area can be of great benefit to them in industry - not to mention the potential for better grades when presentations are multimedia based.

The original course was constructed with the first few weeks dedicated to teaching and the choice by each student of a topic on which to base a teaching/learning module. Authorware is a complete course authoring package which allows the user to animate, simulate, use audio and video, and to jump out to other application packages in the development of courseware. The topics were limited to engineering subjects or concepts learned by the students in previous classes. The remainder of the course was used to develop the module. The final grade was given by a panel of faculty. It depended on the quality, efficacy and content of the completed teaching/learning module.

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students were exceptionally creative and industrious when working on these projects (they enjoyed the work).

Beginning in the second year students were required to find a faculty advisor to assist in defining the topic of the projects on which he/she would work. This advisor works with the student defining and reviewing projects throughout the semester for content and teaching objectives. Project specifications are open to the creative process between student and faculty advisor. The difficult part of picking an appropriate project is making it small enough to fit its development into the time allowed. Students and faculty are shown examples of what has been accomplished in previous classes and are cautioned to choose small projects that can be added to or more fully developed subsequent to the course. The idea is to produce expandable modules that the faculty define, help create, own, and use in subsequent teaching. Individual faculty advisors are the final authority on the project specifications, constraints and the grade that the student receives. The results of this approach have been relatively consistent with students putting about the same amount of development time into them and producing like (high) quality courseware.

We also added a second project, defined, constrained and graded as the one above, that utilizes the potential of the World Wide Web (WWW) to provide students easy access to information and knowledge. The current ENGR 4510 course consists of about two weeks of HTML instruction, a WWW project due at midterm, two weeks of Authorware instruction and an interactive Authorware teaching/learning module project due at the end of the semester. Grading is now done by the individual faculty advisors in collaboration with the ENGR 4510 instructor(s). Courseware projects are presented to the panel of academic advisors and ENGR 4510 instructors by students at midterm and during finals for grading purposes. Discussions about where the modules will be used by faculty advisors and what is planned for their expansion/improvement are conducted during the presentations.

We have now completed the second year of the revised ENGR 4510. The results of this newly structured course are very exciting:

- Project modules produced in ENGR 4510 are usually ready for use in class with little or no additional work. Most of the modules produced over the past two years have been used in classes taught by the faculty advisors or their teaching assistants. Many have been expanded and improved to make them more effective. The course modules are available on the Internet so that students have ready access to them. The IRL (http://www.coe.ou.edu/courses) can be used to view the growing depth and breadth of the courseware produced and/or stimulated by this one class. All the courseware at this site was developed in ENGR 4510 or produced as a result of the stimulus of this class.
- Most advisors involved with the course want to do it again. They either use ENGR 4510 again or go off on their own to expand the quality and number of multimedia based courseware modules.
- Most advisors have plans to refine and/or expand the work done by "their" student. The same students often continue work on their modules after ENGR 4510 as Research or Graduate Assistants. Grants have been found to assist faculty in this further development. Proposals for more are in the works.
- We have no shortage of faculty who desire to be involved with ENGR 4510. They seek out students to advise. A growing number of faculty (other than early adapters) are showing interest in developing interactive teaching/learning modules to enhance courses they teach.
- We have faculty and staff from other colleges wanting to take advantage of the class.
- The benefits of ENGR 4510 are proving to be broad; modules have been developed by the CoE Advising, CoE Minority Engineering Programs, and campus Career Planning Office directly supporting student needs.
- ENGR 4510 has become a very popular course with students.
- Faculty are actively using the knowledge gained from involvement in ENGR 4510 to improve courses they teach on their own and to create proposals (some already funded) seeking funding for further work.
- Students reap extra rewards from their experience in ENGR 4510. Several have been hired in well paying jobs in industry because of what they learned in this class. Many have continued work on improving courseware with multimedia with the same or other faculty. Most use the skills they learn in ENGR 4510 on the Internet and in the classroom as they present their final design projects and defend their dissertations.

**Modules in Use Today:**

For a closer look at the ENGR 4510 developed/stimulated courseware modules that are available today, our web pages may be accessed at http://www.coe.ou.edu/courses. One example that typifies what is being done through this course can be found at: http://www.coe.ou.edu/courses/engr/1112/02/choose.html.

This WWW based courseware contains course information (for ENGR 1112, “Introduction To Engineering”), including: course content and goals, grading policies, homework and design project due dates, exam dates, instructor and teaching assistant data, and two downloadable Authorware based tutorials. The entire
A few more typical examples of the modules made available or stimulated by this course are:

- for ENGR 1112 Introduction to Engineering, a module that assists students in calculating the trajectory of a projectile using problem solving method;
- for IE 4673/IE 5673, Simulation of an industrial system;
- for AME 3112 Solid Mechanics Laboratory, Stress Analysis and Mohr's Circle;
- for ENGR 1112 Introduction to Engineering, Units & Dimensions, Mechanics, etc.;
- for ENGR 1213 Graphics and Design, Introduction to AutoCAD;
- for CHE 3432, The Distillation Process.

This "short list" gives a flavor of the type and variety of courseware modules available and being used in classes today. The quality is there too; students are learning more faster with the use of these modules by faculty as teaching tools and students as learning tools.

Faculty treat the teaching/learning modules developed because of ENGR 4510 as projects in-work. They are never complete. They are modified and improved or replaced constantly to meet the needs of our students and to rid them of real and perceived weaknesses. All the modules produced in the past two years have been used in classes or as models for other modules because the faculty advisors are directly involved with the choice and content of the modules produced. Weaknesses are taken care of as they are discovered. That is a one of the clear strengths of the process ENGR 4510 has set in motion.

Faculty Thoughts:

Involved faculty have been enthusiastic in their support of ENGR 4510. Here are a few of their comments:

Dr. Herrmann Gruenwald: "We are using the web site and learning module for the mobile computing class, without it we would have to start over. This is a great course. Look forward to working with you in the future"

Dr. Baxter Vieux: "Very helpful course and we need to continue this."

Dr. Michael Mooney: "...please let me know if any students enroll for the Spring course and need a faculty sponsor - I have plenty for them to do!!"

Dr. Davis Egle: "It appears to be an effective course for introducing students to multimedia and Internet. Keep it up."

Dr. K. K. Muraleetharan: "I think it is great in the sense that, we, the faculty, do not have to worry about the details. Students can work with the ECN staff in implementing our vision for a teaching module.

Furthermore, ENGR 4510 also provides valuable training for our graduate and undergraduate students in latest multimedia and hypermedia technology."

Conclusions:

ENGR 4510 has been a success in teaching students multimedia development and as a means to improve our curricula with technology in the classroom. Faculty and students are benefiting from this course. After three years of teaching ENGR 4510 we have built up a solid base of multimedia/hypermedia teaching/learning modules. More importantly, they are being used in classes and built upon to improve the entire curricula. It is our experience that students learn more faster because the technology based courseware is effective and they enjoy it. More is being taught in less time. Just as significant, we have produced a solid cadre of knowledgeable and experienced faculty who continue to develop and use technology to deliver course work. Because the students do most of the work, our faculty can undertake interactive teaching/learning module development without worrying so much about the tremendous time commitment that kept so many from bringing technology to the classroom in the past.

As a side effect, there have been four proposed and funded programs, by ENGR 4510 stimulated faculty based on using multimedia to improve curriculum deliver, two funded internally by the University of Oklahoma, one funded by the National Science Foundation and one by the Haliburton Company. These, in turn, will stimulate even more growth in this area.

Bibliography: