

DELIVERING ELECTRICAL ENGINEERING SUBJECTS THROUGH THE INTERNET - A CASE STUDY

Norbert C. Cheung

Department of Electrical Engineering,
Hong Kong Polytechnic University,
Hung Hom, Kowloon
HONG KONG

Abstract

The Internet and the personal computer can be a powerful medium for the teaching and learning of electrical engineering subjects in universities [1, 2, 3]. During the last few years, there has been an accelerated pace in the development of teaching and learning computer packages at the Hong Kong Polytechnic University.

This paper reviews the experienced gained from a web-based teaching-and-learning project that lasted for two years. The project aims to create a web based information centre on the Internet to explore the teaching and learning of Electrical Engineering subjects in a tertiary education programme. The web site includes (i) multi-media live coverage on the course material, arranged in a non-sequential form, (ii) assignments and laboratory exercises adopted to individual student's progress, (iii) quick feedback on students' overall

progress and test/assignments marks, (iii) open forum discussion on the subject matters, and (iv) channels for the students to seek help and advice from the lecturer.

The web does not intend to replace conventional lecturing and tutorial; but rather, it aims to strengthen the students' learning during normal lecturing sessions. It also aims to provide a quick, effective, and powerful media for student-lecturer communications and feedbacks. The paper describes the design, the implementation, the results and the experiences drawn from such an exercise.

Keywords

Web-based teaching and learning, WebCT, information centre

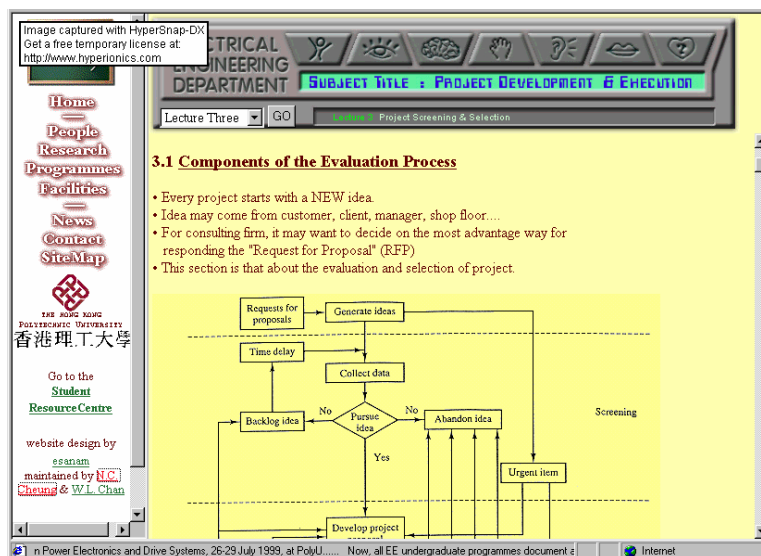


Fig. 1 Appearance of the EE web page for the subject "Project Development and Management"

1 INTRODUCTION

This paper describes a teaching and learning project which aims to use the web as an information centre to supplement normal classroom lectures. Initially, three undergraduate electrical engineering subjects were put on trial. In these subjects, the lecturer used the web site as an addition to the normal lecture. The lecturer posted the subject material before the commence of each lecture; the students asked questions and participate in chats and virtual tutorials regarding the subject contents. After each tests or tutorial works, the solutions and the most common mistakes were posted on the web site; students used the Internet to submit their homework and presentations, and received grades and personal comments from the lecturer. Towards the end of the teaching semester, each student was given a questionnaire to comment on the usefulness of the electrical engineering subjects web site.

2. THE DESIGN OF THE WEBPAGES

Three approaches were used. The first approach was to use a self-developed and designed website. The website included all the essential teaching and learning functions described earlier in the paper. The second approach was to use a powerful commercial teaching and learning package (WebCT) as the web server. WebCT contains many powerful features for the delivering of the subjects. The third approach was to post the subject material on the web, and use other third party software for student communications, chatting, and self-assessments.

2.1 The first approach - building a dedicate Teaching & Learning site

The appearance of the electrical engineering subject home page is shown in figure 1. The essential toolbar is conveniently located on the top of the screen, showing the subject title, and various functions of the web site. The top tool bar, shown in figure 2, is divided into 6 major categories, and it uses part of the human body to categorize the functions:

Body - The overall 'body' of the course, it includes the syllabus and the schedule of lectures. This is the introduction section. It gives an outline on the importance of this course, and a summary of events associated with this course.

Eye - The place in which students can 'look' for the detail course material. The course material is sub-divided into lecture topics. Usually, a typical electrical engineering subject is sub-divided into 12 lectures/tutorials, and each lecture talks about a different topic.

Brain - The 'deep thinking' section. It includes tutorial questions and answers, is categorised into lecture topics. Each topic is further subdivided into 2 sections: (i) past exam papers and exercises; and (ii) tutorial homework for the class. The tutorial homework is posted onto the web before the assignment distribution day. The solutions will be posted onto the web after the students' hand in their work.

Hand - The 'hands-on' session. It includes all the information on the practical laboratory sessions. It also includes the group assignments and tips on the laboratory exercises.

Ear - The notice board. The listening area. Students can freely put messages on this area, so that other students or the lecturer can listen to him. The 'ear' can be just the lecturer, one student, a group of students, or the whole class.

Mouth - The chat forum. Students and staff can have on line chat on a particular topic. Usually, staff will post a message up on the notice board, stating the topic and time of the chat.

Heart - The frequently asked questions area. All frequently asked questions and matters which concern the students most, will be put in this area.

The web site is designed in a generic manner; most subjects in Electrical Engineering can use the same web design. The only thing it needs to do is to input different subject material into the web site for different subjects.

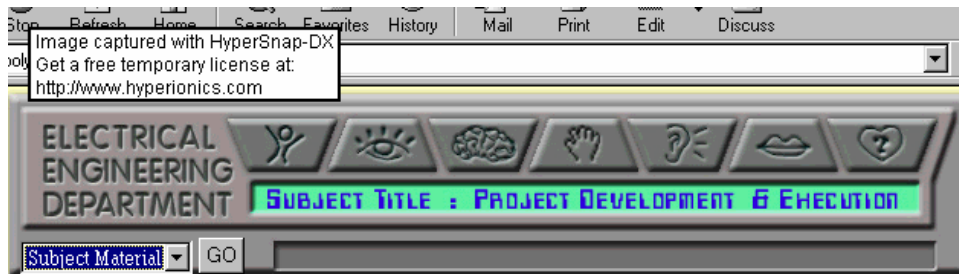


Fig. 2 The seven major functions of the EE dedicated Teaching & Learning site



Fig. 3 The login page for HK Polytechnic University's WebCT site

2.2 The second approach - using WebCT

Since 1998, the Hong Kong Polytechnic University has started a university wide campaign to centralise the web-based teaching methodology. A high-speed server, and a teaching and learning package, called WebCT were adopted as the core platform.

WebCT is an e-Learning platform for online teaching. It does not require the lecturer to do any computer programming. All the essential functions for interactive teaching/learning through Internet are built-in as standard features. These include:

1. e-Learning portal
2. password authentication
3. syllabus tool
4. content assistant and online glossary
5. online bulletin board, chat room, & whiteboard
6. student homepage
7. student online presentation
8. online calendar
9. assignment drop box
10. interactive quiz (no programming required)
11. automatic grade book
12. electronic survey (no programming required)
13. internal email system
14. database for class management and student performance tracking
15. synchronization of student record with central database of Academic Secretary

Besides English, both Traditional Chinese (Big5 code) and Simplified Chinese (GB code) are supported. Any common multimedia components such as digital video, digital sound, computer graphics and animations can be imported into WebCT for creating online lessons.

WebCT, being a fully commercial package, is certainly more powerful than the dedicated T&L site described in section 2.1.

2.3 The third approach - using a suite of third party software

The third method is to use a suite of commonly available freeware to implement Web based teaching. According to the nature of the teaching and learning functions,

different types of "freeware" can be used. At the beginning of the semester, each student is given a CD-ROM. The CD-ROM contains:

1. The essential "freeware" for the web-based teaching
2. The animation files and other long programs for the subject.
3. An introduction on the subject and an explanation on the web-based teaching methodology.

The suite of software includes a variety of software. This includes a web browser, a email program, a FTP program, ICQ, a web-based chat room, a web based quiz site, a picture/video viewer, and an MP3 audio player. Instead of centralising on a particular package, the student and the lecturer will use a collection of software to implement web-based teaching.

3 IMPLEMENTATION

In all three cases, Web-based teaching was used as a supplement to the normal classroom teaching. The students were told to browse through the web pages before the lecture commence. During the lecture, selected topics were brought up for teaching and discussion. The teaching material would be projected on the video screen, and the teaching material would be accessed from the Internet.

Assignments were given to the students electronically and the students would return their work to the departmental server. After each tests or tutorial works, the solutions and the most common mistakes are posted on the web site. Students receive grades and personal comments from the lecturer for the email. For two evenings in a week, the students could conduct on-line chat with the lecturer, if they so wished.

The following subjects were used to test the 3 cases:

Delivery Method	Subject	Mode of study	Level	No of Students
Dedicated T&L s/w	Project Development & Execution	Full-time	BEng final year	45
WebCT platform	Circuits and Linear Systems	Part-time	BEng first year	38
A suite of 3 rd party s/w	Circuits and Linear Systems	Part-time	BEng first year	35

4 RESULTS

Careful analysis on the results and the participation rate reviews that most students welcomed the web based

learning as an addition to the conventional classroom teaching, especially for part-time students. The overall feedback result was very encouraging; the students reviewed that the visualization of difficult concepts [4] on the web was especially helpful.

However, the 2-year web project also reviewed many problems and, the most serious ones are in the preparation of the web material, the network technical problems, and the students' concept of classroom teaching. The following section describes the students' feedback on the web-based teaching questionnaire.

4.1 Student questionnaire and feedback

Towards the end of the teaching semester, each student is given a questionnaire to comment on the usefulness of the electrical engineering subjects web site. Below are the questions and the feedback results from the students:

Abbreviations:

- I - Case I, using a dedicated T&L Web site
- II - Case II, using the WebCT platform
- III - Case III, using a suite of 3rd party software

(i) The web site is helpful to the learning of the subject.

	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
I	25 56%	7 16%	4 9%	4 9%	2 4%
II	10 26%	15 39%	7 18%	4 11%	0 0%
III	12 34%	12 34%	5 14%	3 9%	1 3%

(ii) The web site can replace conventional classroom teaching.

	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
I	3 7%	6 13%	15 33%	9 20%	10 22%
II	4 11%	4 11%	9 24%	8 21%	11 29%
III	0 0%	3 9%	6 17%	11 31%	13 37%

(iii) The web site has shortened my learning time on a particular topic.

	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
I	9 20%	12 27%	15 33%	4 9%	3 7%
II	8 21%	15 39%	7 18%	4 11%	2 5%
III	10 29%	9 26%	5 14%	5 14%	4 11%

(iv) I tend to spend more time on this course.

	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
I	11 24%	10 22%	16 36%	6 13%	1 2%
II	10 26%	12 32%	7 18%	5 13%	3 8%
III	9 26%	11 31%	5 14%	5 14%	4 11%

(v) Discussion on advantages and disadvantages of the EE Subjects web

4.2 Interpretation of the results

From the student questionnaire results, the overall picture is very clear. The students do not want to abandon conventional classroom teaching, but rather, they want the electrical engineering subjects web site to be their learning aid. The other interesting thing is that, while the students admit that the web site can shorten their learning time, they tend to spend more time on the web site. Though the actual numbers are different on cases I, II, and III, they all convey the same message.

From the teacher's perspective, the observations are: (i) the students tend to develop more interest in the learning of the subject, (ii) they are willing to spend more time doing in-depth learning, and (iii) they can understand difficult concepts better with the web site.

From question (v) of the questionnaire, most students think that the advantages of the web site are (i) more interesting and lively description of learning topics, (ii) better interactive chatting, Q & As, and teacher-to-learner communication, and (iii) more accessible database on the solutions and tutorials. The disadvantages are mainly on the technical matters (very difficult to start a particular plug-in, etc.), and the inadequacy of the web. Overall most students think that the web site is a useful aid for learning their electrical engineering subjects, but they want more improvements on the web site.

Both the students and the lecturers prefer to use a collection of software suite to implement web-based teaching. They dislike the WebCT platform most. The main reason was because students and lectures have the most control by using a collection of third party software. WebCT runs on a centralised server, both the material, student assignment record, and the actual storage of the web material are controlled by the Information Technology Department of the University.

4.3 Difficulties in promoting web teaching

In spite of the encouraging result, there are still a lot of difficulties to overcome before web-based teaching is a common practice in the University.

The difficulties include the following:

- (i) Most students still have a firm belief that hardcopy material is essential in their study process. They think that paper is better than computer in terms of jogging down notes, making referencing, and book marking. Most students still request the lecturer to distribute the lecture material in hardcopy form.
- (ii) Developing effective web based teaching material is a time consuming task. Most lecturers cannot afford so much time in doing this preparation work.
- (iii) Many lecturers do not possess much knowledge on web authoring, Internet teaching and learning, and multi-media programming.
- (iv) The Internet services in domestic homes are still hopelessly slow. To run an effective multi-media software through the Internet is very time consuming. Wide band Internet should be made more common to domestic users.
- (iv) The personal computer and the Internet should be made readily accessible to students. The ultimate solution is to provide notebook computers to each student, and to use wideband wireless network in the campus and the student's halls of residence.

5. CONCLUSION

This paper described the design, development and implementation of an Internet web site for the teaching and learning of electrical engineering subjects for higher

degree students. The implementation result shows that most students welcome the Internet learning initiative and they think that the web is helpful to their learning. Furthermore, they would like to expand and improve the web service. The lecturer observes that the student has developed more learning interest through the use of the Internet web site, and they tend to do more in depth learning. In spite of a lot of difficulties and hurdles, Internet learning should be promoted much further.

ACKNOWLEDGEMENTS

The authors would like to thank the Learning and Teaching Grant (LTG98-99/EE009) from the Hong Kong Polytechnic University on supporting this project.

REFERENCES

- [1] A. Sloane, "Learning with the web: experience of using the World Wide Web in a learning environment", *Computers and Education*, Vol 28, Iss 4, pp 207-212, May 1997.
- [2] S. Kapar, G. Stillman, "Teaching and learning using the World Wide Web: a case study", *Innovations in Education and Training International*, Vol 34, Iss 4, pp 316-322, Nov. 1997.
- [3] D. Dion Jr., A. Escobar, J. Tremblay, D. Laurendeau, "Development of Education tools: a web-oriented approach", *Frontiers in Education 1997, 27th Annual Conference*, Vol. 2, pp 842-7, Nov. 1997
- [4] D. Tibury, W. Messner, "Development and integration of web-based software tutorials for MATLAB", *Frontiers in Education 1997, 27th Annual Conference*, Vol. 2, pp 1070-5, Nov. 1997