

An Overview of a Web-based Course: From Design to Evaluation

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ABSTRACT

With emerging technologies, Web-based teaching and learning has become one of the revolutionary directions in state-of-the-art education. In September 2001, we launched a Web-based course, "ESCE 500 Introductory Environmental Chemistry and Microbiology" at the Hong Kong University of Science and Technology (HKUST). This course was a collaborative work with the University's Center for Enhanced Learning & Teaching (CELT) and was implemented through the WebCT platform. Of all the courses offered at HKUST, ESCE 500 employs the highest percentage of Web-based teaching, with only the final written examination not delivered online.

ESCE 500 was a password-protected course targeting MSc Environmental Science and Engineering students who did not have sufficient background in chemistry, biochemistry, and microbiology for the Core Course "ESCE 520 Environmental Chemistry and Microbiology". Our Web-based teaching facilitated traditional classroom education by providing the students with a flexible learning environment without temporal and physical barriers. This flexibility was exceptionally important for the part-time students who were the majority in the MSc Program. They could

only spend limited time on campus due to the constraints of their full-time jobs. In addition, students were encouraged to learn in an independent and collaborative environment. At the same time, the instructor maintained active interactions with the students through the built-in Email Box and Discussion Forum, as well as through telephone calls.

A preliminary survey showed that the students highly appreciated this kind of innovative teaching environment. The materials in the Web-based course were considered very useful in making up their deficiency in related fields. As expected, the students mainly relied on the printouts downloaded from the course for study purposes, yet most of them still visited the Website frequently for the figures in the course content and the messages in the Discussion Forum (the printout files of the course content were figure-free because most of the figures are copyright-protected). The students enjoyed articles (in the Discussion Forum) that were related to real-life issues, such as the topic of "Biological and Chemical Weapons", after the 911 terrorist attack on US. In rare situations, the students voluntarily offered their feedback or initiated discussions among themselves.

In summary, ESCE 500 was an HKUST pioneer course in delivering instruction purely through the Web, except for the final examination. The course is in line with the University's intention of making greater use of the Internet in teaching. We anticipate that our experience and findings may facilitate other instructors in designing their Web-based teaching.

INTRODUCTION

With emerging technologies, the Hong Kong University of Science and Technology (HKUST) has been advocating the wider use of the Internet in teaching. Web-based teaching was selected as a practical solution to meet the challenge of the multi-disciplinary Environmental Science and Engineering MSc program. In this MSc program, the students come from diverse backgrounds (in various fields of engineering or science), and most of them are part-timers.

Working collaboratively with the University's Centre for Enhanced Learning and Teaching (CELT), the Teaching Team launched the Web-based course "ESCE 500 Introductory Environmental Chemistry and Microbiology" in September 2001 as a pre-requisite or co-requisite course in the MSc curriculum, targeting students who do not have sufficient background in chemistry, biochemistry, and microbiology to cope with the MSc Core Course "ESCE 520 Environmental Chemistry and Microbiology" (a regular postgraduate course). The Web-based course contained three Modules: I) Chemistry of Matter, II) Introductory Biochemistry, and III) The Microbes/Microorganisms.

In this paper, the major innovative components of ESCE 500 were introduced and the preliminary findings were presented. It should be noted that the course is still in progress and that this is the debut offering of the course. The discussions in this paper

only represent the findings from 6 September to 24 October 2001, during which more than half the course was completed.

MAJOR INNOVATIVE COMPONENTS OF ESCE 500

ESCE 500 is a Web-based course in HKUST and is supported by WebCT, a course delivery system employed by the University. This course contains the highest percentage of online teaching of all the courses in HKUST. Only the final examination was not delivered online and the students were required to take a written examination. We discussed the course with CELT in detail and agreed that a written examination was the most reliable way of assessing the students, and that this also could avoid possible computer problems encountered during online examinations.

ESCE 500 was designed to take full advantage of online components. Below is a list of the major innovative elements in this course:

Calendar with Due Dates

In order to facilitate the students' self-learning, a calendar was devised for the students to keep pace with progress. Students were expected to finish the modules, complete and submit the online quizzes (one quiz for each module) by the due dates set. Despite these set dates, the students were given the flexibility to learn at their own pace, either on-campus or off-campus, provided that they submitted the quiz answers on time. This flexible learning environment, without temporal and physical barriers, was especially constructive for the part-time students.

Visual Presentations

Being Web-based, the course had the advantage of offering interactive and interesting materials such as animated presentations. For example, an animation was placed at the start of each module, explaining certain subject matter covered. In addition, the students could access "Extra Information" that popped out when they clicked the designated buttons.

Self-assessed Tests

In order to help the students keep track of their progress, a self-assessed test was designed for each module. The students could check their scores and the correct answers immediately after they had submitted the answers online. This self-assessment exercise proved attractive to the students because they could obtain an instant evaluation of their performance. In order to direct the students to where they could find the correct answers, we also listed the relevant sections of the course content along with the correct answers.

At the same time, the self-assessed tests could also serve as a tool to identify "weak points". If the students had done the tests before they studied the modules, they could

then focus on their weak subjects. This helped the students to plan their studies to best fit their own needs.

Online Quizzes

The self-assessments did not count towards the final course grade and the students could skip them without alerting the instructor. Therefore, it was essential to devise an assessment mechanism to keep students on track. An online quiz for each module and a final written examination were included in the course for this purpose. Both of them counted towards the final course grade. According to the course schedule, a quiz paper was posted online when students were expected to finish a module. Students were required to submit their answers through the built-in Email Box by the due dates. In order to use the quizzes for additional teaching and interaction, the instructor sent the marks and individualized comments to every student through the built-in Email Box. In addition, a detailed key to each quiz was posted on the Discussion Forum. By reading the comments and the keys, the students were provided an opportunity to reinforce their knowledge of the subjects.

Hyperlinks

An online glossary was included to help the students. In addition, hyperlinks of selected Websites for extension and in-depth analysis of certain subjects were added in. Further, to better illustrate relevant topics, these hyperlinks guided the students to the wealth of scientific information available from the Worldwide Web. This exercise also reinforced their skills in searching for useful information from the Web, skills crucial not only to their study but also to their jobs.

Photographs Taken

In most reference books or ordinary classes, students were shown photographs of non-local biological entities. To make our course content more interesting and relevant to real life, the instructor and CELT took a number of photographs of local fungi and algae (most were taken in the HKUST campus) for the course and students were alerted to the sources of these photographs (Figure 1). By doing so, they could gain an appreciation of the diversity of biological entities in the neighborhood.

Print Version of the Module Content

A text-only version of each module was prepared for the students to print out for study purposes. Due to copyright protection, figures (the publishers permitted us to use a number of them) were excluded from printing. This design also encouraged the students to re-visit the course online even after getting hold of the print version.

Active Interaction

This Web-based teaching does not call for face-to-face classes. Active interactions between the instructor and the students were therefore a crucial element to eradicate

the students' feelings of helplessness and isolation. In ESCE 500, the instructor took advantage of the following built-in components of WebCT to interact with the students:

- Discussion forum: posting announcements and keeping students alert to the course progress; posting relevant and interesting articles that were related to real-life and timely issues; disseminating the keys to the quizzes,
- Email box: keeping personal contact with students; giving immediate feedback to students' suggestions and questions; sending marks and individualized comments on the Quizzes to each student.

Phone calls: keeping direct contact and a friendly relationship with the students; checking whether they were keeping pace with class progress; reminding them of important items (such as the due dates of the quizzes and the date of the final examination).

Findings

The students welcomed the calls from the instructor and often grabbed the chance to ask questions. Generally speaking, the students enjoyed the articles posted in the Discussion Forum, especially those about real-life and timely issues. For example, the students welcomed the idea of posting an article about biological and chemical weapons, after the 911 terrorist attacks on the US. Yet, even with the instructor's encouragement, only in rare situations did they give feedback or initiate discussion through the Forum. This finding seemed to agree with research studies reported by other online instructors: if the students were required to post messages and actively participate in the Forum, they would be more positive about online discussion and realize that they could learn more through reading other students' messages. In future, this kind of required participation will be employed as part of the course assessment in order to encourage more online interaction.

Course Evaluation

Course evaluation is a fundamental way of understanding the success of a course, and it is especially important to this kind of innovative paradigm. ESCE 500 course evaluation was carried out in two stages:

- A questionnaire of 19 questions was given to the students on 12 October, after they had finished about half of the course and had gone through different kinds of learning activities. The questionnaire was designed by the course instructor together with the CELT, and was delivered and collected through the platform "OSTEI" (Online System of Teaching Evaluation for Instructors). The feedback was anonymous so the students could feel free to give comments.
- After the completion of the course, students will be invited to a personal interview with CELT staff.

Findings

Results from the questionnaire revealed that students were positive about Web-based learning and they followed the course schedule without much difficulty. The course content was found relevant to the Core Course and the Web-based course was highly comprehensible. All students considered the keys to the quizzes as helpful tools in reinforcing their knowledge. After they had printed the text-only version for study, they still visited the course online frequently to access the figures, the Discussion Forum, and the Extra Information.

Students made contributions to the course through the questionnaire, by proposing topics of interest for articles to be posted in the Discussion Forum, as well as stating the topics that they found insufficient in the Web-based course. This has proved that course evaluation is a useful tool enabling students to reflect their thoughts.

Tracking Data

A wide variety of data was generated through a built-in component of WebCT, such as the dates and times of individual student's logging on to the course. This helped the instructor to understand more about the students' learning behavior in such a new teaching environment.

Findings

It was found that Saturdays, especially those falling within the quiz periods, were high-density periods when more students visited the course online (Figure 2). This could be due to the fact that most of the students are part-timers. Apparently students visited the course online to access the figures while they prepared for the quizzes. There was a significantly higher hit rate on the Saturday before the first quiz (6 October, this quiz was for Module III), compared with the second quiz (20 October, this quiz was for Module I), partially because Module III has substantially more figures than Module I. There was a remarkably high hit rate on 8 September (Saturday), because at that time the print version was not yet ready (Figure 2).

In general, students visited the course mainly in the evenings and at night. Full-time students had more time flexibility when visiting the course online. It had been expected that the part-time students would only visit the course at night, yet they sometimes did so during the daytime as well.

CONCLUSION

Web-based teaching is a new paradigm in teaching. It provides students with a flexible environment, without physical and temporal barriers, to learn at their own pace. The flexibility is remarkably important to part-time students. This new paradigm is also a useful solution for equipping students in multi-disciplinary programs, where students need background knowledge from diverse areas.

In order to effectively deliver a Web-based course, instructors need to motivate the students, encourage interactions, respond promptly to their questions, remind them to keep up with the pace of the course, and provide them with a productive learning environment through various learning activities. Without these elements, the success of Web-based teaching will be compromised. We hope that this course sets a prototype for other instructors when they plan Web-based teaching in the future.

ACKNOWLEDGEMENTS

The ESCE 500 Teaching Team thanks the Instructional Development Unit and the Teaching Technologies Unit of the Center for Enhanced Learning and Teaching, Hong Kong University of Science and Technology, for their expertise and advice throughout the construction and delivery of the course. We are grateful to the Academic Committee of the Environmental Science and Engineering MSc Program, for the idea of developing the Web-based course and their support so far. We also thank Prof Po-Lock Yue, Director of the MSc Program, for nominating the course to the University's Teaching Innovation Awards 2001, and his unfailing support and advice.

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