

ENSURING QUALITY IN AN ONLINE DISTANCE COMPUTING COURSE

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ABSTRACT

This article describes an illustrative case of an online distance education course in introductory computing which aimed to empower learners by facilitating active learning in an innovative, high quality, and student-centered learning environment. This course was offered to 180 non-computing science students at a university in Hong Kong. In this article, this computing course will be first evaluated against the benchmarks established by The Institute for Higher Education Policy for ensuring quality in Internet-based distance education. Secondly, the effectiveness of the course was examined in two student tracking studies conducted before the mid-term and final examinations, respectively. Results showed that towards the end of the course, statistically significant differences in learners' behaviors were found, e.g., the use of self-assessment activities rose from an average of 1.27 hours per week prior to mid-term examination to 2.63 hours per week prior to final examination. It was also observed that students adjusted their studying methods and their attitudes towards the course over time. It is expected that by documenting this experience, some good practice in technology-mediated instruction can be identified.

Key words: facilitate active learning, internet-base distance education, online distance education course, quality

Higher education is continuously being reshaped in this Internet age. Online delivery of coursework and various aspects of academic programs is the fastest growing form of education all over the world. Coupled with the sharply rising demand for alternative possibilities in higher education, most institutions in Hong Kong, regardless of distance or traditional universities, have begun to offer some form of e-learning courses.

Although modern technologies have transformed the landscape of courses that are not campus-based (Novak, 2002), the quality of learning needs to be ensured. Non-traditional courses must establish and maintain quality assurance mechanisms that meet the same high standards that exist for traditional face-to-face education and address outcomes of higher learning in such a way as to be transparent and easily open to third party assessment.

Recently, the Institute for Higher Education Policy (2000) has identified 24 benchmarks that are essential to ensure quality in Web-based distance learning. These benchmarks can be grouped into seven categories. They include *Institutional Support, Course Development, Teaching/Learning process, Course Structure, Student Support, Faculty Support, and Evaluation and Assessment*.

These benchmarks are among the most inclusive and accurate recommendations regarding quality in distance education. In a recent survey, Yeung (2003) asked 87 local university students who had experience in Web-based learning to rate the importance of 20 benchmarks (not including the benchmarks of "Faculty Support") identified by the Institute for Higher Education Policy (2000) in ensuring quality distance learning. Relatively high ratings on all these benchmarks were obtained, ranging from 3.37 to 4.1 on a 5-point Likert Scale where 5 means very important. It seems that most of these quality benchmarks are also applicable to the higher institutions in Hong Kong. As more comprehensive studies have not been conducted in the local context, and that standardized approach to quality improvement in Web-based distance learning in Hong Kong is yet to be developed, these benchmarks will serve as a frame of reference for quality issues in this paper.

To have a closer look at the practice of technology-mediated instruction in Hong Kong, the aim of the this paper is to describe and evaluate an online distance education course in introductory computing offered by a university in Hong Kong based on the benchmarks developed by the Institute for Higher Education Policy (2000).

ABOUT THE COURSE

The present course under investigation, Introduction to Computing, was offered to 180 non-computing fresh undergraduates in the School of Science in every academic semester. The course aim was to improve students' computer literacy and essential computing skills. It was the first standalone Web-based course developed by this university for an experimental purpose. This course aimed to facilitate active learning in an innovative, high quality, and student-centered learning environment.

It was expected that this course could be later made available for more students with reduced cost by replacing face-to-face lecturing with self-directed study of students. Because of its introductory nature, it could be relatively easier to be delivered to a wider audience in the future. Students might also be more receptive to learning a technology-related course through the use of the technology. Further, the experience gained from this course would be of great importance to the development of future online courses.

This course was developed by a specialized taskforce consisting of the faculty member, instructional designer, and a team of multimedia designers and Web experts. It was delivered in the form of e-learning modules. Thirteen modules were designed for explaining concepts. Another 12 modules were for practical skills, e.g., demonstrations and examples. These modules were implemented using Macromedia Flash and accessed from the LearningSpace course delivery platform. Interactive multimedia techniques such as self-assessment exercises, video clips, hyperlinks and animations were widely employed throughout the modules.

ANALYTICAL APPROACH

This paper reports on a single case study, which is a descriptive and evaluative examination of a unique instance - an online course offered by a university in Hong Kong, in terms of quality assurance mechanisms for Internet-based distance education. According to Yin (1994), "a

case study is an empirical inquiry that investigates a contemporary phenomenon within its real-life context, especially when the boundaries between phenomenon and context are not clearly evident”.

The present course was offered to a large group of Hong Kong Chinese students. Instances in this context in the educational literature are limited. It was expected that this particular case would help build on the existing research about quality in distance Web-based learning by extending to the present context. By documenting this case, it is possible to identify the challenges and opportunities associated with introducing a multimedia rich and highly interactive component to an introductory course at a local university.

Further, it is important to gauge students' perceptions and their utilization of the courseware. In this study, a summative quantitative survey design was used to obtain as much information as possible from the instructor and students. This method of study would not interfere with how the classes were delivered and was an achievable and practical approach of inquiry. It is also believed that students within a learning environment are in a good position to evaluate instruction because of their experience with many other learning environments (Fraser, 1998).

Since a major limitation of a case study approach is related to the generalizability of the findings, readers of this paper are expected to determine the level of generalizability imbedded in the present results and their applicability in relation to their knowledge about their particular educational setting.

AN ANALYSIS OF THE PRESENT COURSE

The various quality issues related to the present course are described as follows.

Institutional Support

As mentioned earlier, the present course was delivered on LearningSpace 3.0. This Web-based learning tool has an advanced and broad feature set. It provides a password-protected access. Most importantly, it has facilities for both synchronous and asynchronous communication tools, e.g., e-mail, bulletin board and real-time chat rooms. Within the university, there is a supporting structure which provides resources and expertise to faculty members (e.g., instructional design, multimedia designers and Web programmers).

Student Support

Gaining access to the appropriate equipment is the first step to ensure that distance education students will have the opportunity to learn the same skills as on-campus students (Bruce & Hwang, 2001). Actually, almost every student and faculty at local tertiary institutions is well equipped with fast PCs or laptop computers through low-price PC purchases campaigns. All the local universities have also been well supported by broadband transmission facilities. The present students should encounter no great difficulties to get access to the technology or hardware.

Faculty Support

Similar to what Boettcher and Conrad (1997) had suggested, the planning and preparation for

this Web-based course required more than one year. The instructor served as the content expert who provided the core part of the course, i.e., the materials. He was supported by an instructional designer and other Web specialists. Pedagogical and technological decisions were facilitated during the development process.

Course Development

A multimedia approach was used in the development of the present course. Macromedia Flash was used to implement interactive course contents, with the use of graphics, animations, simulations and guided student activities. Since students need guidance about how to read and attend to information (Bruce & Hwang, 2001), various ways were used to highlight the importance of particular materials, e.g., bold face, larger font size, pop-up messages/questions, end of module questions and online quizzes. These questions and quizzes aimed to help stimulate active learning of students and allow them to assimilate and integrate the knowledge they just learned. Animated demonstrations were used to enable students to apply the knowledge in a correct way.

Course Structure

According to Ko and Rossen (2001), the online syllabi must include greater detail than on-campus course syllabi. Thus, apart from using a modular structure, the present course also consisted of a detailed syllabus, hyperlinks to additional readings, assignments, self-assessment exercises calendar of course events, archives of video clips and media files, grading, navigation and technical help, as well as a discussion forum. The course syllabus contained course descriptions, objectives, requirements, the instructor's and the tutors' contact information and a course schedule (outline). To provide the students with a better orientation, this course started with a face-to-face 1.5 hr lecture by the instructor to ensure that the students were adequately familiar with the new learning environment and had acquired necessary Web skills. Further, the additional resource materials such as the hyperlinks, post-module self-assessment and demonstrations would enable a more in-depth understanding of contents.

Teaching and Learning

It is considered that teaching begins in the development process and continues with the offering of the online course (Bruce & Hwang, 2001). Actually, it is still the faculty who teaches the students but not the online medium. Thus, the faculty's expertise, feedback and availability remain critical to effective instruction in Web-based classes. The present course took into account the students' need for mentoring by the instructor. They were encouraged to communicate with the instructor through e-mails so that rapid feedback could be received. Threaded discussions on the online materials or assignments were also created for students' active participation which also facilitated the development of relationships and collaborations among students. In order to more closely monitor students' progress, the instructor and the teaching assistant conducted weekly laboratory sessions to meet with students and answer their questions directly. This further maximized the contacts between learners and instructors and ensured students' understanding of course materials.

Evaluation and Assessment

Online courses must be subject to the same scrutiny as on-campus programs. In the present case, the students were of the first cohort of users of this course. They were only offered the online learning option if they enrolled in this course. It was necessary to know what they thought about the course. A summative survey on students was conducted to evaluate the effectiveness of the instruction. The objectives were to understand their online learning experiences and behaviors in using this specially designed courseware in particular, and to gauge their attitudes towards online learning in general. The details of this survey will be reported in the following sections.

SURVEY METHOD

Two Internet surveys were conducted to track changes in students' experiences in and attitude towards online learning. The first survey was performed after the mid-term exam and the second one after the final exam.

The target respondents for the first survey were a randomly selected group of 80 students. They were sent an email invitation to take part in this survey. Around half of them responded (48.8%). All respondents were offered a gift coupon as incentive.

The second survey was conducted during term break. It was more difficult to collect data from students. Thus, the email invitation was sent to all 180 students. Finally, 64 students responded (35.6%). They were offered book coupons as incentive.

The questionnaire of the first survey (Mid-term survey) contained 13 close-ended questions. Students were asked about their experience in engaging in various learning activities associated with the course and their attitudes towards online learning or self-directed learning. The second survey (Final survey) basically replicated the previous one. The additional questions were concerned with students' learning methods as well as their mid-term examination results.

RESULTS OF THE SURVEY AND DISCUSSIONS

There was an even breakdown of male and female respondents in both surveys (51.3% vs. 48.7% respectively for the Mid-term survey; and 48.4% vs. 51.6% respectively for the Final survey).

Table 1 shows the mid-term examination results of the respondents which are obtained from the Final Survey. The majority obtained above average results (62.5%). The largest amount of students got somewhat higher than average results (45.3%).

Table 1. Mid-term examination results of the respondents

Examination Results	%
Much higher than average	17.2
Somewhat higher than average	45.3
Average	18.8
Somewhat lower than average	17.2
Much lower than average	1.6
n:	64

It was found that 21 students had taken both surveys. This group is composed of more female than male students (61.9% vs. 38.1%). The distribution of their mid-term examination results is as follows:

Table 2. Mid-term examination results of the respondents who took part in both surveys

Examination Results	%
Much higher than average	14.3
Somewhat higher than average	23.8
Average	33.3
Somewhat lower than average	23.8
Much lower than average	4.8
n:	21

By conducting independent group t-tests, significant differences were observed between the first and the second sample in various aspects.

Online usage

Towards the end of the semester, the overall online usage of the courseware increased. The past three week usage before the mid-term and final examination were 9.7 hours vs. 15.7 hours, respectively ($p < .05$).

The online self-assessment exercises were used more frequently towards the end of the semester (5.56 vs. 9.56 times). The average time for completing a self-assessment decreased from 14.5 minutes before the mid-term examination to 11.8 minutes before the final examination. That means students could do the exercises more efficiently.

Preference of the learning medium

Before mid-term, students favoured print-based materials more than online materials. The average weekly usage was 4.26 hours and 3.43 hours, respectively. Towards the end of the semester, students' use of the online medium surged to over 5 hours on average, outweighing the use of print materials (3.7 hours).

Perceived usefulness of various online components

There were slight improvements in the perception of the usefulness of the various online learning components towards the end of the semester (e.g., ScreenCam demonstrations, self-assessments) although no significant between-group differences were observed.

Table 3. Perceived usefulness of various components on a 4-point Likert scale

Statement	Mid-term Survey	Final Survey
ScreenCam demonstrations in the skill modules	2.75	2.96
Self-assessment tasks	2.74	2.96
Interface design of the concept modules	2.71	2.90
Animations in the concept modules	2.74	2.77
Video clips in the concept modules	2.49	2.60

n varies from 35-38 for Mid-term survey and 52-60 for final survey (1=not useful at all, 4=very useful)

Students' learning strategies

Regarding students' learning strategies, around half of the respondents in both surveys used to follow the instructor's study schedule closely. They usually went from one module to another and studied the materials that were more interesting or not familiar. However, towards the end of the semester, some students became more familiar with the course materials and its format, so they tried to study the course materials in the way they considered to be more effective without following any specific order.

Table 4. Ways of using the modules

Statement	Mid-term Survey	Final Survey
I tried to follow the suggested study schedule closely.	56.4%	50.0%
I went from module to module and study the materials that I was interested or not familiar.	38.5%	28.1%
I just studied the materials that I was interested or not familiar without any specific order.	5.1%	15.6%
I rarely (i.e. a few times only) studied the materials.	0.0%	1.6%
I studied the modules according to the order of test	0.0%	1.6%
Others	0.0%	3.1%
n:	39	64

It was found that these students basically adopt higher-order learning skills to study the course materials than just memorizing notes. The most commonly used method was "trying to understand what the contents mean" which was supplemented by "relating the contents to prior knowledge". However, students were less dependent on "memorizing the contents" or "working on problem sets". Students may find these methods less effective in processing conceptual knowledge.

Table 5. Study methods used by the students

Statement	Most Often	Sometimes	Never	Rarely	Average Frequency
I tried my best to understand what the contents meant.	57.8%	40.6%	0.0%	1.6%	3.56
I tried to relate them to similar things I already learned.	40.6%	46.9%	0.0%	12.5%	3.28
I tried to memorize the contents as much as possible.	28.1%	54.7%	1.6%	15.6%	3.09
I tried to work through a lot of the problems in that subject.	9.4%	54.7%	4.7%	31.3%	2.69

n: 64 (all respondents in the second survey)

Engagement in collaboration

The present students had a fair amount of participation in collaborative activities throughout the semester. Since it was an introductory course focusing on practical skills and applications, students more likely interacted with each other on the clarifications of course contents, assessments, and other course administrative issues, e.g., dates of examinations, grades and assignment submission deadlines.

Table 6. Participation in collaboration activities

Statement	Mid-term survey	Final Survey
I discussed the ideas and concepts taught in this course with other students	2.77	3.09
I assisted other students who encountered problems in understanding the course contents or in homework assignment	3.00	2.72
I studied with other students for quizzes or worked with other students on an assignment for this course	2.85	2.89
<i>n</i> :	39	64

(1=never, 5=very often)

Differences in terms of academic performance

Students were categorized into three groups in terms of their mid-term results (below average, average, above average). One-way ANOVA analyses were used to determine how the mid-term performance affected students' use of the course, study habits and attitudes towards online learning. It is noted that better-performed students were more positive about this learning method and were better able to appreciate the course design and benefit from it.

Table 7. Comparing findings among students of different mid-term results

	Students' Mid-term Examination Results		
	Below Average	Average	Above Average
<u>Course structure</u>			
Overall, the course site provides me with clear links to different sections/parts of the course.	3.25	3.25	3.98
<u>Study method</u>			
I try my best to understand what the contents mean.	3.25	3.42	3.7
<u>Course contents</u>			
When I studied the module contents, I was able to understand the concepts and ideas most of the time.	2.92	3.17	3.83
<u>Attitudes toward online learning</u>			
I enjoy learning online a lot.	2.83	3.08	3.65

* the above figures represent average ratings where 5 represents the best score

Twenty-one students had completed both surveys. The possible changes in their attitudes towards online learning, usage of the courseware, and studying methods were the key focuses of the analysis.

Significant increase in the use of self-assessments

The students' use of self-assessments soared remarkably from 3.81 time (past three week usage before mid-term) to 7.88 times (past three week usage before final examination).

Some changes in strategy of using self-assessment

The findings suggested that after the mid-term examination, a considerable amount of students changed the way they used the self-assessment. Significantly more students (71.4% for final survey vs. 47.6% for mid-term survey) did self-assessment after studying relevant module contents, whereas none (vs. 14.3% for mid-term survey) tried to do the tasks after studying only part of the related contents. Students might find this strategy more effective because they were better able to complete the relevant self-assessment. This helped provide a more valid measure of how well one has learned. However, it is likely that the modules taught later in the course were more difficult and that more efforts were required for completing the relevant self-assessments.

Slight improvements in comprehension of course materials

Students tended to be more adaptable to the online learning environment towards the end of the semester. They showed slight signs of improvements in the comprehension of module contents. A relatively larger amount of students in the final survey (33.3%) reported that they were able to understand the module contents most of the time when studying on their own

than they were in the mid-term survey (23.8%), in spite of the fact that later modules may be more difficult.

Table 8. Experience of online learning

Statement	Mid-term Survey			Final Survey		
	Agree	Neither nor	Disagree	Agree	Neither nor	Disagree
When I viewed through the module contents, I was able to understand the concepts and ideas most of the time.	23.8%	47.6%	28.6%	33.3%	38.1%	28.6%

n: 21

More confident in learning on their own

The number of students who were not confident in their ability to learn independently dropped noticeably towards the end of the semester (14.3%, vs. 42.9% in mid-term survey). This may imply that students' perception of their own ability changed with their experience. Actually, it took some time to empower students to take greater responsibility of their learning.

Table 9. Evaluation of online learning

Statement	Mid-Term Survey			Final Survey		
	Agree	Neither nor	Disagree	Agree	Neither nor	Disagree
I felt more confident learning on my own.	19.0%	38.1%	42.9%	19.0%	66.7%	14.3%
I preferred this to learning in a traditional way.	42.9%	38.1%	19.0%	42.9%	33.3%	23.8%
I enjoyed it a lot.	38.1%	33.3%	28.6%	38.1%	28.6%	33.3%

n: 21

CONCLUSIONS

The above discussion may indicate that the good practices and principles based on the literature are also valid benchmarks incorporated by local institutions when they develop Web-based distance courses. Further, a typical way to examine the effectiveness of online courses is through surveying students' perceptions (Bruce & Hwang, 2001). The results of evaluations can be used as an important basis for improving courses and learning outcomes.

The present tracking studies helped the instructor understand how students made adjustments during the course of the study. It is noted that these students became more experienced online learners towards the end of the semester. They tended to devote increasingly more time on all modules and learning activities but still, they would allocate different amount of time on different types of activities and particularly on those they found to be more useful in helping

them study effectively, e.g., self-assessments and modules on computing skills. It may imply that students adopted the strategy of “learning by doing”. As they became more familiar with the course format, the rest was to cope with the requirements of this course. It was found that a larger number of students tried to complete the self-assessment after studying the whole module content rather than finishing only part of it. That was why students spent increasingly more time studying the materials. Consequently, delivering the course online did not impair student learning by reducing their study time but on the contrary, encourage them to learn actively and in a more self-directed way. In fact, as indicated in the final survey, significantly fewer students felt uncertain about learning on their own.

Another important issue about quality of online courses is interaction (Peters, 1999). To encourage students to interact more online, the Web must be the sole, authoritative source of information about the course. Actually, students in Hong Kong feel more comfortable communicating online because they are usually rather quiet in the classroom (Milton, 2001). Online discussions allow all students to participate and give them ample time for reflection so that their responses can be more thoughtful than those in a classroom (Mims, 2000). Thus, the present course can be improved by giving more opportunities for students to engage in online discussions. Problem sets and questions which are carefully developed can be posted to support critical thinking. Students can chat about them either real-time or asynchronously. In this way, the instructor can more easily monitor students’ progress and understand what they did not understand or confused about.

After all, when making judgment about the engagement in online instruction, both the faculty members and the students need to be prepared to contribute considerable amount of time and effort during the whole learning process (it is also a learning process for the faculty) in order to ensure the quality of a Web-based distance course.

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