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Applying Computer-based Technology to Instruction for the Effectiveness of Teaching and Learning

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ABSTRACT

This study collaborated computer-related facilities into the classroom practice of teaching and collected assessment data from the university's official records and students' formative and summative evaluation scores to verify the purposes of the research. From the empirical progress, the computer-based teaching model provided a mechanism that was plausible operation and valuable for improving students' test scores. Therefore, the implementation of the computerized system could yield dramatic benefits to university-wide learning needs and prove to be a sustainable technological tool for promoting effectiveness of teaching and learning.

Keywords: *Computer-based instruction, technology-mediated learning, computer-assisted instruction*

1. INTRODUCTION

As the computer technology advances profoundly in the 21st century, the teaching tools have been empowered by combining the internet, projection equipment, PowerPoint software, and web resources into the instructional scenarios. Thus, the contents of teaching become vivid with delightful visual icons, graphs, or appealing explanations, which may generate very different teaching phenomenon in contrast to the traditional teaching method. This study utilized a class of 34 students as the research subjects in the fall semester of 2009, and employed computer-based media to deliver the course of "Thematic Project Design." The purposes of the research were to explore: (1) the model of delivering the course in the university via support of computer-based technology, and (2) the effectiveness of the computer-assisted teaching in terms of students' evaluation of the course and their learning outcomes. On the basis of such research purposes, the study collaborated computer-related facilities into the classroom practice of teaching and collected assessment data from the university's official records to serve as formative and summative evaluation data of the class. Overall, this research attempted to set up an appropriate model of accommodating computer technology into the teaching routines, and verified the intended achievement by the proof of the empirical assessment data.

2. ASPECTS OF TECHNOLOGY-ORIENTED LEARNING

A wide variety of electronic materials has appeared in the development of the computer technology. There have been familiar terms in the academic society such as information systems (IS), technology-mediated learning (TML), competency-based web learning (CBWL), etc. Regarding CBWL, Chang (2007) [1] claimed that it enhanced students' fondness for learning in comparison to the environment of traditional learning. Likewise, students were reported to prefer digital web-based learning rather than pencil and paper. The empirical research of CALM (computer-assisted learning method) at Indiana University asserted the overwhelmingly positive feedback from students for such online functions of the computer (deSouza, McLean, & Berger, 2008) [2]. As a matter of fact, technology-mediated learning (TML) was invested profoundly in academic institutions. Gupta and Bostrom (2009) [3] advised that TML could increase the effectiveness of learning programs and integrate information systems into educational theories for knowledge acquisition.

Knowledge of human beings might cross various disciplines. However, the computer infrastructures could facilitate useful templates for inter-disciplinary transition. In exploring students' perceptions of science, Tan, Yeo, and Lim (2005) [4] adopted computer-supported collaborative learning (CSCL) to study science, and found significant improvement from pretest to posttest regarding students' scientific thinking and inquiry skills. As various instructional media available to educators, Rodgers and Withrow-Thorton (2005) [5] compared three formats of teaching- lecture, video, and interactive computer-based instruction. They designated that computer-based instruction generated a higher degree of motivation than the other two methods. Taken as a whole, the findings broadly displayed that technology infrastructures really contributed an essential framework for teaching profession. Further, Hartnell-Young (2006) [6] recognized the support of computer technology and funding from the administration for advancing the knowledge of instructional technology.

3. COMPUTER-BASED WEB FACILITY

As the university in which the authors serve earned the grant of the nation-wide teaching excellence program, it implemented intranet teaching system for faculty. The website of the intranet teaching system is linked on the homepage of the university. After the faculty applied for their accounts, they can get access to their teaching courses of every semester. Further, the Teaching Excellence Center (TEC) of the university generates an intranet website for their individual course of teaching (see Figure 1). Thus, the unique website becomes a digital platform that the faculty can manage to promote students' learning with the online service of the Teaching Excellence Center. For the researched course, the e-syllabus, test dates, reading materials, and handouts were posted in the folders of the website. Besides, some impromptu data for the ongoing projects were posted so that students could retrieve the information for reviewing taught contents, preparing for tests, obtaining latest information for updating class schedules, or coordinating report topics with students of other groups.

The function of the intranet website could be further explained as follows. The course required students to orally report topics, and they needed to check the intended topic with students of other groups so that there would be no similar report contents. To ensure different individual report topics, the course posted a discussion panel for students, and they needed to register their topics in the panel. According to the sequence of the posting, students might easily find out whether their intended topics have been taken by other students. Henceforth, the overlapping topics could be avoided. To ensure that students utilized such a system, they were required to apply an account in the website of the researched course, and the instructor checked their entry records irregularly to make certain that all students participated in this system.

There were efficient functions for the intranet website. In the past traditional class delivery method, the instructor might need to print out copies when students were required to prepare oral reports, group members' self-evaluation form, or guidelines for class presentations. However, with the computer-assisted class management, students might just retrieve the website and accomplish their coursework accordingly. There was no time pressure for the teacher to remind students important dates and required assignments, neither waste of printing abundant papers.

4. METHODOLOGY OF RESEARCH

The research was conducted in the undergraduate class of the university where the authors taught during past decades. A total of 35 students participated in the research, and were divided into 6 groups for study arrangement. Under such grouping scheme, students took the coursework which was designed with thematic topics, and they were required to learn the subject knowledge through teacher's lectures and cooperative learning with their group members. As the intended topic was fulfilled in teaching, students were required to take a quiz, a total of 8 quizzes were employed in the semester. Also they took the final test which was implemented at the end of the semester. Then, the results of the quizzes and final test were used as the data for evaluation of the student's learning. In addition to the scores of the quizzes and test, interviews to the students and university academic documents were adopted for supplementary data collection. The comments and feedback of students were qualitatively analyzed with summarized results, while the official release of the university's academic records were tallied for justifying the effectiveness of the instruction.

5. ASSESSMENT OF THE COURSE

In the process of curriculum design and teaching, there are essential steps to assure the effectiveness of teaching and students' learning. Among them, assessment is the procedure that must be employed to justify the results of teaching, and it can be categorized as the formative and summative evaluation in terms of its examining features (Dick, Carey, & Carey, 2005) [7]. In the similar study of systematic teaching, formative evaluation has been implemented to the researched subjects and acquired proof of the intended research purpose (Lu & Cheng, 2008; Zhang & Lu, 2007) [8] [9].

For this research, the formative evaluation was adopted in the mid-term evaluation on students' achievement quizzes while summative evaluation in the final tests of students' achievement tests. As the matter of fact, the quiz items and contents of the reports in the class were posted in the intranet website before students took the final test. Therefore, the feature of convenient access and online review function of the computer-supported teaching was fully utilized for motivating students' learning. Consequently, six groups earned remarkable improvement of average scores between their quiz and test with score gains from 50.6 to 78.8 (group 1), 49.4 to 81.33 (group 2), 68.8 to 93.8 (group 3), 84.4 to 95.29 (group 4), 72.5 to 92.5 (group 5), and 63.1 to 93.5 (group 6). This showed a meaningful achievement of students' learning via the assistance of computer facility (see Table 1).

Table 1: Comparison of Quiz and Final Test Scores
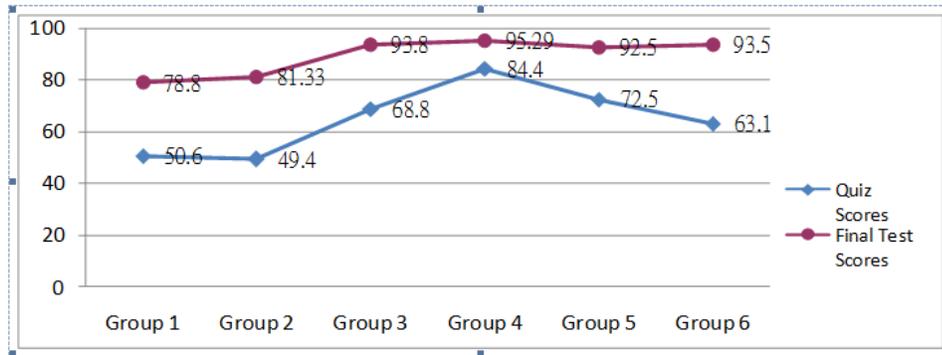
In the middle of the semester, the Teaching Excellence Center employed a students' survey on the researched course, and average scores from the mid-term evaluation was 4.38, while the scores increased to be 4.52 in the end-of-semester survey which evaluated the overall teaching circumstances. In comparison to the departmental average scores of total evaluated courses 4.31 and university-wide total courses evaluated average scores of 4.31, the researched course based on technology-supported teaching really acquired higher degree of credit in terms of its instructional performance (see Table 2).

Table 2: Comparison of Course Evaluation Scores
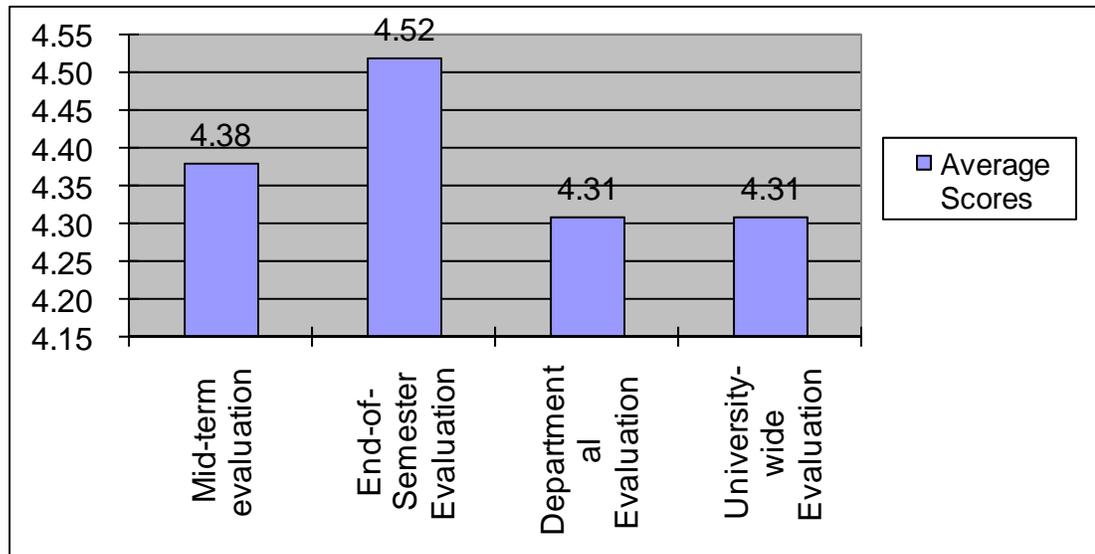
Besides, students were required to write reflective journals on this course and handed them in at the end of the semester; also, there is a section of open-ended questions in the mid-term's student survey. As the feedbacks of students' survey and the reflective journals were reviewed, some highlights of the comments were denoted at below.

* In the class, I like to use the PowerPoint slides to make my reports. It is a challenge to create animation in the slides, and I got a sense of achievement when I successfully make the effect on the slides via exchanging ideas with my group members.
* With the video from internet, classmates are more attentive to the class, especially the audio equipment in the classroom makes the video pleasant for hearing.
* I am attracted by the classmates' presentations. It is amazing that they can find so many interesting electronic materials to share with us. If the assignments of all courses are all like this, it will be not boring to come to class.
* I don't think the teaching website means too much to me. It is just like my routine jobs of uploading and downloading files….
* Some students are doing excellent job in operating computer. They show the video efficiently as they report their contents. But, a few students have troubles in connecting the right websites in their presentations. They should find some ways to improve their skill of using the facility.
* Using computer in the class is a trend, and I like to retrieve data in our intranet website; I don't need to worry about important dates of the course. I can always get access to the website, and review the materials online to prepare my test.
* I feel great and like to learn something in the class!
* I think that computer work is better than paperwork. With computer and internet, we don't need to listen to the teacher's lecture all the time.

From the above students' comments in the survey and reflective journals, it revealed the fact that they were really willing to engage themselves in this technology-supported class. It appeared that the facility of computer provided a dynamic learning environment which offered various media stimulus and increased students' learning motivation and interest. Thus, computer could be actually embedded into the resources of teaching, and promote students' ability in exploring electronic database and acquiring the essential knowledge.

6. CONCLUSION

As the technology-mediated learning (TML) becomes the trend of the teaching profession, how to integrate available technology for building up the efficiency of the learning brings tremendous concern in the academic research. From this empirical study, the computer-based teaching model provided a mechanism that was plausible operation and valuable for enhancing individual learners.

The establishment of the intranet learning system was worthy for promoting university-wide teaching excellence. In effect, the architecture of the system was based on computer technology, and the effectiveness of learning as shown in this study was empirically verified. Furthermore, such results could be proposed to other departments of the university. Thus, the rule of thumb was agreeably set; the implementation of the computerized system could yield dramatic benefits to university-wide learning needs.

There have been increasing efforts for exploring the efficiency of competency-based web learning (CBWL). In the past research, CBWL has been proved to help students get better scores in learning. For this study, the results of quizzes and the final test provided the same evidence that learning through the intranet website did enhance students' competency in knowledge acquisition. Consequently, the implication from this study could be denoted as the future development of web learning materials was strongly recommended, so that teaching could be geared toward the use of technology for constructing satisfactory learning results.

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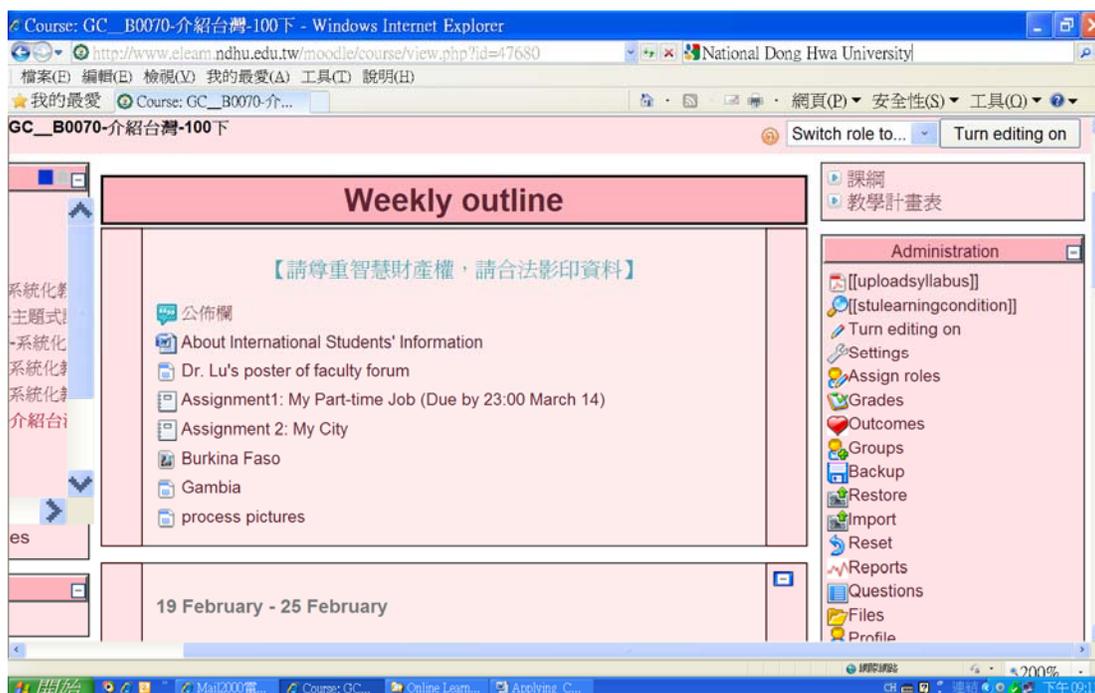
Fig 1: Intranet website of the Teaching Excellence Center (TEC)