The Effects of Internet-Based Teaching and Learning Systems on Learners

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Abstract

The purposes of this study were to investigate and compare the effects of Internet-based teaching and learning systems and traditional instruction on learners in the areas of quality of students' term papers, homework, reference sources, analytical ability, synthesis and summarization of information, the costs of learning through the Internet (tuition fees not included), and time used for study. The samples were 80 graduate students randomly selected from the class of 4 subjects registered from the second semester of academic year 2000 to the first semester of academic year 2002. They were divided into 4 control groups and 4 experimental groups. The control groups studied with traditional instruction. The experimental groups studied with teacher-prepared instruction programs on the Internet-based system. The instruments used in this study were two evaluation forms, an on-line test, and questions posted on the Internet-based systems. Data were analyzed by using a one-way t-test for independent samples. The results indicated that there was no negative effect on the learners. The scores of experimental groups were not significantly higher than the scores of the control groups in the area of quality of students' term papers, homework, reference sources, and analytical ability, synthesis and summarization of information. For the study costs, the experimental groups did not significantly spend more than the control group. However, the experimental groups spent significantly less time than the control groups. It suggests that the teacher's role, changed for the Internet-based instruction, did not change the learning outcome of the students.

Keywords: Computer-mediate instruction, Internet-based Teaching/learning systems.

Background

In Thailand, the use of information technology and mobile phones increased in the past two years, according to the National Statistical Office. A survey found that there are 9.6 computer units, 4.4 Internet access units, and 2.3 fax machines for every 100 households. In 2001, the number stood at 5.8 computer units, three Internet access units and 1.6 fax machines for every 100 households. Even so, the digital divide between Bangkok and other regions remains. The Office reported there were 29.4 computer units for every 100 households in Bangkok, but the figure was well below 10 in other regions. For Internet access the figure was 17 in Bangkok and less than 5 in the regions. Of 7.4 million people in Bangkok, 2.8 million used a computer and one million used Internet, compared with 2.5 million computer users and one million Internet users in the Northeast, where 19.1 million people live. The survey was carried out among 16 million households nationwide from April to June 2002.

The Survey found 11.3 million people used a computer, 6.03 million had access to the Internet and 12.9 million owned a mobile phone. Of the total, Bangkok accounted for 45.6 % of mobile phone owners. People aged 15-24 accounted for 46.2 % of computer users. People aged 6-14 were the next biggest group, making up for 18.9%. People aged 15-24 accounted for 51.9% of those with Internet access, followed by people aged 25-34, who accounted for 21.3%. Of total computer and Internet users, 28.9 % and 34.4 % had at least bachelor's degrees or studied at universities. (National Statistical Office, 2003)

The marriage of technology and learning systems appears to have a far greater range than ever previously imagined. The above findings showed that there are many Internet users and Internet assessors using telephone lines and mobile phones. The use of Internet was expanding for many purposes in Thailand. The Thai government introduced many projects pertaining to the use of the Internet such as e-government, e-procurement, e-commerce, e-citizen, and e-learning projects. The government exerted much effort to have the Internet-based teaching and learning systems in the e-learning projects put into use in educational institutes. During the last decade, there were several studies, according to Nixon (1992) and Sercy (1993), which examined telecommunication-based courses versus traditional formats. The findings indicated that there was no significant difference in GPAs of students in either format. Nowadays, there are many research findings that indicate that the use of Internet for teaching and learning confirms the learners' achievement is higher or at least, there is no difference between the use of internet-based teaching and learning systems and traditional methods of teaching, and learning in which the achievement in most studies was measured by a teacher-prepared achievement test. The systems were suitable for graduate learners rather than other lower-level learners, which were shown by the learners' learning motivation and maturity. However, there were less obvious studies indicating the effects of Internet-based teaching and learning systems on the quality of learners' term papers, numbers of references used in homework, analytical ability, synthesis, and summarization of information from the Internet, the costs of learning through the Internet (tuition fees not included), and the time used for learning. Would there be any significant difference between students taking a course in an Internet-based environment versus those who received instruction in a more traditional, in-class model? The results of this study would help the decision-makers to adopt or reject the Internet- based teaching and learning systems as an alternative method for teaching and learning.

Statement of the Problem

The problem of this study was to identify effects on learners in the use of Internet-based teaching and learning systems at King Mongkut's Institute of Technology North Bangkok.

Purposes of the Study

The primary purpose of this study was to investigate the effects of Internet-based teaching and learning systems on learners. The second purpose was to compare the effects on learners when using the Internet-based system and traditional methods. A final purpose was to make suggestions for teaching and learning development.

The Objectives

1. To investigate and compare the quality of students' term papers between the use of Internet-based teaching and learning systems and the traditional ways of teaching and learning.
2. To investigate and compare the reference sources used by the students who studied with the use of Internet-based teaching and learning system and the traditional ways of teaching and learning.
3. To evaluate and compare the ability of students in analysis, synthesis, and summarization of information.
4. To identify and compare the study costs between the two methods of teaching and learning.
5. To indicate and compare the time spent by using the two methods of teaching and learning.

Research Hypotheses

1. The quality of students' term papers studied with the Internet-based teaching and learning systems was higher than that of students' term papers studied with traditional methods (H-1).
2. The reference sources of students' homework studied with the Internet-based teaching and learning systems was more than those of students' homework studied with traditional methods (H-2).
3. The analytical ability, synthesis, and summarization of information when studied with the Internet-based teaching and learning systems were higher than when they studied with traditional methods (H-3).
4. The costs of learning with the Internet-based teaching and learning systems were more than the costs of traditional learning (H-4).
5. The time spent in learning with the Internet-based teaching and learning systems was less than the time spent in traditional learning (H-5).

Delimitation of the Study

During the course of this investigation, several limiting factors were encountered. These factors include the following:

1. This study was limited to graduate students of King Mongkut's Institute of Technology North Bangkok majoring in Technical Education Technology who registered in the second semester of the academic year 2000 to the first semester of the academic year 2002.
2. The instruments used in this study were 2 evaluation forms, an on-line test, and a response form posted on the Internet developed by the researcher.
3. Data that were not pertinent to indicating the effects of the Internet-based teaching and learning systems as presented in the hypotheses were not analyzed.
4. The evaluations were limited to those given in the objectives. They were marked by the researcher based on students' outcomes.

Basic Assumptions

This study was based on the following assumptions.

1. In most of the literature, there were concerns about the lack of technological expertise on the part of teacher and student, resistance to change on the part of faculty, student passivity, hardware limitations, and learner isolation. It was assumed that those factors did not threaten the reliability and validity of this study.
2. It was assumed that the Thai language instrument used in this study posted an acceptable level of validity and that translation did not change the meanings.
3. It was assumed that the students expended their best efforts of learning used in evaluating their performance.
4. It was assumed that the sample size of this study was adequate to represent the population.
5. It was assumed that the research methodology was appropriate to find the solutions.

Methodology

This study was designed to obtain data from the performance of students when they studied with the Internet-based teaching and learning systems and traditional methods. Experimental research seems ideally suited to this study. An evaluation form and performance test was the best instruments to obtain data. The samples were 80 graduate students of the Department of Technological Education, Faculty of Technical Education, King Mongkut's Institute of Technology North Bangkok who registered in the second semester of the academic year 2000 to the first semester of the academic year 2002. They were divided into 2 major groups: experimental and control. The control groups consisted of 40 daytime students from 4 classes. There were 10 students selected from each class. The experimental groups consisted of 40 evening students from 4 classes. They were 10 students selected from each class. Members of both the experimental and control groups were primarily educators who were currently employed as classroom teachers in vocational and technical colleges. There were 4 classes with 4 subjects, one class for each subject, used in this study. They were the classes of Philosophy of Vocational/ Technical Education (A), Didactics for Technical Courses (B), Educational Innovation for Technical Education (C), and Research and Theories in Educational Technology (D). Each subject included both theoretical and practical content. Instruction was delivered during sixteen, three-hour periods, typical of graduate-level education within the graduate-degree programs at the institution. The control and experimental groups were given the same assignments as usual practices. The experimental groups attended classes equipped with Internet-accessed computers. The teacher, also the researcher, was respected as a custodian. The control groups received instruction in a traditional lecture, question-answer, and small group activity format. The experimental groups received teacher-prepared instruction programs in the Internet-based authoring system. The difference between the two groups was in-class lecture versus in-class Internet instruction. The classroom management system and testing system were used for both the experiential and controls groups. Only the students in experimental groups were allowed to use the authoring system that contained Internet-based instruction programs for each subject. Each student was given a user name and

password for logging in onto the systems. A monitoring system was installed in the Internet server for retaining the students' activities on the systems.

Table 1: The Control and Experimental Groups were Administered to the Subjects during Semesters for Data Collection.

Subjects	Semester 2/2000		Semester 1/2001		Semester 2/2001		Semester 1/2002	
	Control Group	Experimental Group	Control Group	Experimental Group	Control Group	Experimental Group	Control Group	Experimental Group
Philosophy of Vocational/Technical Education (A)	C n=10	D n=10			E n=10	F n=10		
Didactics for Technical Courses (B)			C n=10	D n=10			E n=10	F n=10
Educational Innovation for Technical Education (C)			E n=10	F n=10			G n=10	H n=10
Research and Theories in Educational Technology (D)	A n=10	B n=10			C n=10	D n=10		

Table 1 showed that there were 4 control groups, Group A, C, E, and G and 4 experimental groups, Group B, D, F, and H. There were 10 samples in each group randomly selected from all students who enrolled in each subject. The sample groups were administered the 4 subjects as follows.

Semester 2/2000:

Group A was a control group consisting of 10 daytime second year students enrolled in the Research and Theories in Educational Technology class.

Group B was an experimental group consisted of 10 evening second year students enrolled in the Research and Theories in Educational Technology class.

Group C was a control group consisting of 10 first-year daytime students enrolled in the Philosophy of Vocational/ Technical Education class.

Group D was an experimental group consisted of 10 first year evening students enrolled in the Philosophy of Vocational/ Technical Education class.

Semester 1/2001:

Group C was a control group consisting of 10 daytime second-year students enrolled in the Didactics for Technical Courses class.

Group D was an experimental group consisting of 10 evening second-year students enrolled in the class of Didactics for Technical Courses.

Group E was a control group consisting of 10 first-year daytime students enrolled in the Educational Innovation for Technical Education class.

Group F was an experimental group consisted of 10 first year evening students enrolled in the Educational Innovation for Technical Education class.

Semester 2/2001:

Group C was a control group consisting of 10 daytime second-year students enrolled in the class of Research and Theories in Educational Technology.

Group D was an experimental group consisting of 10 evening second-year students enrolled in the Research and Theories in Educational Technology class.

Group E was a control group consisting of 10 first-year daytime students enrolled in the Philosophy of Vocational/ Technical Education class.

Group F was an experimental group consisting of 10 first year evening students enrolled in the Philosophy of Vocational/ Technical Education class.

Semester 1/2002:

Group E was a control group consisting of 10 daytime second-year students enrolled in the Didactics for Technical Courses class.

Group F was an experimental group consisting of 10 evening second-year students enrolled in the Didactics for Technical Courses class.

Group G was a control group consisting of 10 first-year daytime students enrolled in the Innovation for Technical Education class.

Group H was an experimental group consisting of 10 first-year evening students enrolled in the Innovation for Technical Education class.

There were 3 Internet-based systems used in this study. They were the classroom management, authoring, and testing systems. The 3 systems covered usual teaching and learning activities. Details of each system are as follows.

1. **The classroom management system** was developed in a client-server on Linux platform. A MySQL database management system was used along with Apache web server, Perl language as server software tools, and Netscape or Internet Explorer as client software tools. This system was designed for student enrolment, information recording, classroom management, subject bookings, recording and verification of class schedules, grading, grade checking, and graduate verification. It was equipped with on-line help for users learning how to use the system on their own.

2. **The authoring system** was an on-line courseware authoring system via the Internet. It was developed on a Linux platform. The users were able to create courseware effectively without using HTML programming skills. It was designed to cover all features of the computer-assisted instruction (CAI) such as courseware development, testing, students' attendance, test attendance, score measurement, and attending-time measurement.

3. **The testing system** was developed in a client-server on Linux platform. A MySQL database management system was used along with Apache web server, Perl language as server software tools, and Netscape or Internet Explorer as client software tools. This system was designed to make test items in four types of tests: multiple choice, matching, true-false, and cloze tests. It was designed for testing management via the Internet, keeping test items as a test bank, analyzing a test to verify the difficulty level, and reliability of a test. The test results were sent by e-mail. These systems were developed from Master's-degree projects by Mr. Suwat Banlue, Mrs Kotchakorn Bunlue, and Mr. Kittipong Suwannaraj under the researcher's

supervision. They were operated on a Linux operating system at the Computer-Based Instructional Center (CBIC), Department of Technological Education Faculty of Technical Education. The URL was http://testing.met.kmitnb.ac.ch.

Instruments and Data Collection

The instruments used in this study were developed in the Thai language. They were 2 evaluation forms used for marking the quality of students' term papers and students' homework. A test was used to measure the ability in analysis, synthesis, and summarization of information. The test items were selected from the test bank that posted an acceptable reliability and validity. The test consisted of 40 items measured in analytical ability, synthesis, and summarization of information. A response form containing questions asked on the cost of learning and time spending was posted on the classroom management system. A panel of 15 experts was used to validate the validity of the instruments.

Two papers were assigned for each class. The quality of papers was marked by the teacher according to the points listed in the evaluation form. The total scores were 100, 50 scores for each paper. The teacher entered the scores for the student reports in the classroom management system.

Homework was the exercises at the end of chapters. The students were assigned to present their homework to the teacher and peers in the following class. An evaluation form was used by the teacher and peers to evaluate the presentations according to the listed items that focused on the reference sources, locations, and activities used in the presentations. The mean scores from the teacher and peers were used for hypothesis testing. The total scores were 100. The classroom management system was used to manage these scores.

The experimental and control groups were given an on-line test in classroom environment with a proctor to measure the analytical ability, synthesis, and summarization of information. The total scores were 40. The scores were sent to the students via e-mail and recorded on the testing system.

The students responded to the answers pertaining to the study cost in Thai currency and the numbers of hours used for study in the course. The questions were posted on the classroom management system in which it was used for data collection.

Findings

There were 8 experiments in 4 consecutive semesters for this study. There were 2 subjects in each semester. Data were analyzed by using a one-tail t-test for independent samples. For 18 degrees of freedom at a t-value equal to 1.734 is required for significance at the level of .05 (Ferguson, 1981, p. 521).

Table 2 shows data for both groups in the semester 2/2000.

Hypothesis	Subject	Group	N	Mean	Std. Dev.	t-Value
H-1	A	C, Control	10	83.80	6.34	-1.225
	A	D, Experiment	10	87.30	6.13	
H-2	A	C, Control	10	86.70	7.54	-1.629
	A	D, Experiment	10	91.71	6.11	
H-3	A	C, Control	10	29.40	4.12	-.975
	A	D, Experiment	10	31.30	4.74	
H-4	A	C, Control	10	1251.00	204.80	.153
	A	D, Experiment	10	1238.00	173.94	
H-5	A	C, Control	10	101.90	13.06	5.533*
	A	D, Experiment	10	74.50	8.64	
H-1	D	A, Control	10	82.80	6.34	-1.168
	D	B, Experiment	10	86.20	6.68	
H-2	D	A, Control	10	85.90	6.66	-1.451
	D	B, Experiment	10	89.80	5.29	
H-3	D	A, Control	10	30.60	3.81	.068
	D	B, Experiment	10	30.50	2.68	
H-4	D	A, Control	10	1273.60	165.66	.487
	D	B, Experiment	10	1239.10	150.72	
H-5	D	A, Control	10	103.50	7.81	8.154*
	D	B, Experiment	10	77.00	6.68	

* p< .05

Table 3 shows data for both groups in the semester 1/2001.

Hypothesis	Subject	Group	N	Mean	Std. Dev.	t-Value
H-1	B	C, Control	10	82.90	7.39	.146
	B	D, Experiment	10	82.50	4.55	
H-2	B	C, Control	10	83.40	7.12	-.103
	B	D, Experiment	10	83.70	5.89	
H-3	B	C, Control	10	31.10	4.51	-.92
	B	D, Experiment	10	31.50	4.79	
H-4	B	C, Control	10	1301.10	146.09	.164
	B	D, Experiment	10	1291.10	125.28	
H-5	B	C, Control	10	104.60	10.99	3.659*
	B	D, Experiment	10	85.90	11.86	
H-1	C	E, Control	10	84.90	6.40	1.411
	C	F, Experiment	10	80.70	6.90	
H-2	C	E, Control	10	80.90	9.90	-.072
	C	F, Experiment	10	81.20	8.68	
H-3	C	E, Control	10	31.80	5.79	.715
	C	F, Experiment	10	30.10	4.79	
H-4	C	E, Control	10	1236.30	133.45	-.547
	C	F, Experiment	10	1174.90	178.77	
H-5	C	E, Control	10	102.00	12.20	3.543*
	C	F, Experiment	10	81.40	13.75	

*p< .05

Table 4 shows data for both groups in the semester 2/2001.

Hypothesis	Subject	Group	N	Mean	Std. Dev.	t-Value
H-1	A	E, Control	10	86.60	9.13	.588
	A	F, Experiment	10	84.50	6.65	
H-2	A	E, Control	10	80.20	10.44	.200
	A	F, Experiment	10	79.40	7.12	
H-3	A	E, Control	10	30.40	4.35	.749
	A	F, Experiment	10	28.40	6.67	
H-4	A	E, Control	10	1242.90	128.73	-.260
	A	F, Experiment	10	1259.00	147.74	
H-5	A	E, Control	10	106.40	8.67	3.655*
	A	F, Experiment	10	89.70	11.56	
H-1	D	C, Control	10	82.60	8.80	.212
	D	D, Experiment	10	81.80	8.04	
H-2	D	C, Control	10	84.30	10.23	.472
	D	D, Experiment	10	82.10	10.61	
H-3	D	C, Control	10	30.50	4.93	-.532
	D	D, Experiment	10	31.70	5.17	
H-4	D	C, Control	10	1176.10	127.85	-1.620
	D	D, Experiment	10	1226.50	89.74	
H-5	D	C, Control	10	104.40	9.48	4.580*
	D	D, Experiment	10	83.70	10.70	

*p< .05

Table 5 shows data for both groups in the semester 1/2002.

Hypothesis	Subject	Group	N	Mean	Std. Dev.	t-Value
H-1	B	E, Control	10	84.70	9.30	.664
	B	F, Experiment	10	82.00	8.87	
H-2	B	E, Control	10	85.80	9.34	.185
	B	F, Experiment	10	85.00	10.03	
H-3	B	E, Control	10	30.40	6.40	.483
	B	F, Experiment	10	28.90	7.45	
H-4	B	E, Control	10	1319.50	130.78	.112
	B	F, Experiment	10	1312.60	145.25	
H-5	B	E, Control	10	109.80	9.92	4.051*
	B	F, Experiment	10	89.20	17.66	
H-1	C	G, Control	10	84.60	10.64	.606
	C	H, Experiment	10	81.60	11.48	
H-2	C	G, Control	10	81.10	7.16	.748
	C	H, Experiment	10	78.50	8.34	
H-3	C	G, Control	10	30.80	5.37	-.076
	C	H, Experiment	10	31.00	6.39	
H-4	C	G, Control	10	1280.20	183.31	-.329
	C	H, Experiment	10	1305.80	169.21	
H-5	C	G, Control	10	102.10	13.12	3.568*
	C	H, Experiment	10	83.00	10.70	

*p< .05

The results repeated the same findings as follows.

1. The quality of students' term papers studied with the Internet-based teaching and learning systems was not significantly higher than the quality of students' term papers studied with traditional methods at the level of .05 (H-1).

2. The reference sources of students' homework studied with the Internet-based teaching and learning systems was not significantly more than the reference sources of students' homework studied with traditional methods at the level of .05 (H-2).
3. The students' analytical ability, synthesis, and summarization of information when studying with the Internet-based teaching and learning systems were not significantly higher than when they studied with traditional methods at the level of .05 (H-3).
4. The costs of learning with the internet-based teaching and learning systems were not significantly more than the costs of traditional learning at the level of .05 (H-4).
5. The time spent in learning with the Internet-based teaching and learning systems was significantly less than the time spent in traditional learning at the level of .05 (H-5).

Discussions

The findings repeating the same results in 8 experiments showed that the systems could be used for teaching and learning effectively when compared to the traditional methods on the issues of quality of students' term papers, reference sources used in students' homework, and analytical ability, synthesis, and summarization of information. The Internet-based teaching and learning systems used learning-oriented teaching conceptions. The traditional methods used content-oriented teaching conceptions. The two learning environment (Internet-based and traditional methods) were well designed according to the learning theories and the principles of courseware development which were focused on the students' outcomes. However, the Internet-based systems may be fashionable this year and obsolete next year, which depends on the advancement of technologies used for courseware development. Noss and Pachler (1999, p. 195) pointed out "as each technological innovation has come and gone, it has left education feeling that something has happened but that nothing fundamental has changed." That should explain the reason why the outcomes showed the same results on different learning environments. The results also implied that the different learning environments could reproduce the same outcomes. The effects on learners really are the same. For the study costs (tuition fees not included), Peter Drucker in Lenzner and Johnson (1997, p. 127) stated that "thirty years from now the big university campuses will be relics…Already we are beginning to deliver more lectures and classes off campus via satellite or two-way radio at a fraction of the cost." That means that the cost of learning via the Internet will be decreased in the future as well. Now, students pay much the same in the different learning environment. However, the interesting finding was that the time used for studying with the Internet-based systems was less than the time used for studying with the traditional method at the significant level of .05. This indicated that the well-designed programs used in this study could reduce instruction time but not reduce the quality of learning outcomes or other aspects of teaching and learning.

Suggestions for Teaching and Learning Development

Excellence in all areas of teaching and learning by using Internet-based system is an unattainable goal unless the institute is able to develop skills and attitudes of teachers toward the use of Internet-based systems. The results of this study showed positive effects of the systems on learners. However, these results could be used for

developing teaching and learning and curricula as well. Suggestions for development are as follows.

1. The teachers must adapt to a learning-oriented teaching environment and change from their traditional role as a teacher to become more of a facilitator, guide, consultant, resource provider, learning-team member, and caretaker of knowledge. They should allow students have responsibility for setting own learning goals. Web sites are used for finding related literatures. Teachers are respected as custodians.

2. The students must be proficient with the computer equipment, and have reliable network access and connections. If required, computer training must be provided to minimize the occurrence of operator errors. They should emphasize recall of concepts and provide opportunity to view subject matter from different perspectives. Locations, resources, and activities should be introduced to the students. The students should be taught how to use search engines. The students should be induced to think or act governed by rules of logic and inference. Legitimization of expression of feeling and emotions are concerned.

3. Administrative support is an essential component of a successful Internet-based teaching and learning system. This function is performed by the support staff at the Web site and at the computing center, including: registration, processing, data tracking, reporting, scheduling, etc.

4. A reduced instruction time project should be introduced on campuses by using the Internet-based systems. The Internet or on-line curriculum should be accredited

Conclusions

There were 4 subjects, 8 groups of students, 8 experiments, and 4 consecutive semesters used in this study. Despite the small sample size and heavy reliance on subjective data, the study yielded two interesting conclusions. First, there was no significant difference between the two groups on the quality of term papers, homework, analytical ability synthesis, and summarization of information, and the study costs despite the experimental groups not receiving in-class lecture instruction. It suggests that the role of teacher changed for the Internet-based instruction did not change the learning outcomes of students. The effects on learners were much the same for both groups.

Another conclusion was the time spent for study of the experimental groups was less than that of the control groups. It poses a real challenge to traditional instruction, or at least traditional curriculum, but if the Internet-based teaching and learning systems are to be successful, it is a paradigm shift that must be made. Teachers respond to and accommodate learners as a caretaker of knowledge to develop their own courseware rather than giving only lecture to them. On-line programs should be introduced and accredited for part-time students. The use of Internet-based systems does not guarantee academic success, but the findings from this study suggest that it does not have significantly negative effects.

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