Development of an Instructional Model in Mathematics with the Use of Interactive Webcast for Sukhothai Thammathirat Open University Students

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ABSTRACT

The purposes of this research project were: 1) to develop an instructional model in mathematics with the use of interactive webcast for Sukhothai Thammathirat Open University students; 2) to study learning achievements of students learning via the instructional model in mathematics with the use of interactive webcast; and 3) to study opinions of students towards the instructional model in mathematics with the use of interactive webcast. There were four steps in the development of the instructional model in mathematics with the use of interactive webcast for Sukhothai Thammathirat Open University students. The four steps of development were: (1) content analysis of the lesson; (2) lesson design; (3) lesson production; and (4) lesson evaluation. The research sample comprised 30 purposively selected students who registered for the Course 30205: Mathematics and Statistics in the first semester of the 2009 academic year and three experts for evaluation of the contents and educational technology. Evaluation data were analysed using the mean, standard deviation and t-test. Research findings revealed that the developed instructional model in mathematics with the use of interactive webcast consisted of five components: analysis, design, production and development, implementation and evaluation. Evaluation results of the developed model indicated that the model was appropriate and relevant at the high level. Students' learning achievement was significantly increased after receiving instruction with the use of interactive webcast. Opinions of students towards the instructional model with the use of interactive webcast were at a high level.

INTRODUCTION

Sukhothai Thammathirat University (STOU) is an open university in Thailand using the distance learning system; it does not have regular classroom instruction on campus. STOU students have to study by themselves from the distance instructional media provided by the university. They can also attend tutorial classes provided by the university at various off-campus learning centres throughout the country. Tutorial classes, however, are offered as supplementary to self-study and the university does not require every student to attend every tutorial class. At present, distance tutorial with the use of interactive webcast is a model of distance instruction that enables students to learn from the same instructor via the Internet system. Therefore, distance tutorial can be available at the same time to all students so that they can interact with the instructor as well as with other students during the tutoring session.

The use of webcast as instructional media enables the instructor to present his/her well-prepared instruction systematically. The computer network efficiently helps the instructors to present the contents of their instruction in the form of multimedia that can present documents, audio and visual broadcasts to learners. It also enables the learners and instructors to have interaction immediately that will help to increase the efficiency of the learning process and enable the instructors to receive immediate feedback from the learners. Interaction is very important in the distance learning process as it enables the instructor and learners to have direct personal contacts and involvement in instructional activities via the interactive instructional media. Martin and others (1996) studied a two-way distance instructional programme. They found that a good two-way distance instructional programme has a good interaction method. This finding was in agreement with a study conducted by Surachai Sikkhabandit (1998) which concluded that a good distance instruction system must have five-fold types of interaction: (1) interaction between the instructor and learners, (2) interaction between learners and learners, (3) interaction between two or more persons, (4) interaction between the learner and instructional media, and (5) interaction between the instructor and instructional media.

In this research, creating interaction in the instruction via the computer network can be done in every process of instruction from the beginning until the end of the process. For example, interaction between learners and the instructor, and between learners themselves can be done with the use of e-mail, chatting, and asking and answering questions (FAQ); while interaction between learners/instructor and technology can be done in activities such as browsing through various websites, searching for information via the use of search engines, transferring of files, etc. In addition, the instructor can determine the teaching methods to train learners on learning skills such as having them listen to the instructor's lectures, having them take notes, having them process their knowledge, and testing them. Learning skills are skills that learners can use to learn by practicing and experimenting in order to acquire more knowledge and skills. Equipping learners with learning skills can result in reducing the failing and drop-out rates.

The Mathematics and Statistics Course is the course that aims to present foundation concepts and principles in mathematics and statistics. Based on the statistics of students who enrolled in this course, as obtained from the university's Office of Registration, Records and Evaluation, more than 50 percent of those who enrolled in

the course could not get the passing grade (Office of Registration, Records and Evaluation, 2007).

When details of students' learning achievement scores were analysed, it was found that the most problematic competency for students was the skill for solving word problems in mathematics (Kowit Prawalpruek, 1990). The cause of this problem might be that learners did not know how to start solving the word problems, and after reading the problems did not know the direction to proceed in order to solve them (Pattaya Saihu, 1993: 34; Shoenfeld and Hermann, 1982: 484 – 494).

Therefore, it is the duty of the instructor to organise the instructional model and activities to provide learners with opportunities to practise their mathematics problem solving skills, that is, the skill to analyse mathematics problems; the mathematics calculation skill; and the skill to recognise the relationships among components of the problem STOU, 1983: 427). The learners must also be able to take notes from the contents of the lectures according to their understanding, to do the assigned exercises, to draw pictures and illustrations in order to enhance their understanding, and to plan for solving problems (Musser and Burger, 1994: 10). The learners should leave the traces in their problem solving procedure that will enable the instructor to use as clues for finding ways to remedy the learners' learning deficiency and for use as evidence in the assessment of their attitudes towards mathematics learning.

Based on the statistics concerning the large number of students failing the course and the above discussed principles, the researchers would like to develop an instructional model in mathematics with the use of interactive webcast for STOU students in order to enable students to gain direct learning experience from the instructor via listening to the lectures, note taking, processing of knowledge, and doing exercises. These activities will enable students to practise their mathematics skills up to their full potential, to follow their own learning progress, to have good attitudes towards learning mathematics, and to acquire mathematics process skills.

RESEARCH OBJECTIVES

1. To develop an instructional model in mathematics with the use of interactive webcast for STOU students.
2. To study students' learning achievements before and after learning from the instructional model with the use of interactive webcast.
3. To study students' opinions towards the instructional model in mathematics with the use of interactive webcast.

SCOPE OF RESEARCH

1. Scope of Research Content

The content of the 30205 Course: Mathematics and Statistics was used for development of the instructional model in mathematics with the use of interactive webcast. The course content being used is Unit 6: Analytical Geometry with the

following specific topics: (1) The Coordinate Axis System; (2) Straight Lines; and (3) Circles and Parabolas.

2. Scope of Research Target Group

2.1 Research Population. The research population comprised STOU students who enrolled in the 30205 Course: Mathematics and Statistics in the first semester of the 2009 academic year.

2.2 Research Sample. The research sample consisted of 30 purposively selected STOU students in the Faculty of Management Science, who enrolled in the 30205 Course: Mathematics and Statistics in the first semester of the 2009 academic year and had never studied in this course.

RESEARCH INSTRUMENTS

1. The developed instructional model in mathematics with the use of interactive webcast
2. A mathematics learning achievement test
3. A questionnaire to assess students' opinions

RESEARCH METHODOLOGY

This research study followed the research and development methodology with the operational steps as follows:

Step 1: Searching for the Instructional Model in Mathematics with the Use of Interactive Webcast

In order to search for the instructional model, the researchers studied, analysed and synthesised information from documents, articles and related research studies to acquire the principles, and concepts of the instructional model with the use of interactive webcast. Also, two data-collecting instruments were developed, namely, a questionnaire on opinions of experts regarding the components of the instructional model, and an evaluation form for experts to assess the developed instructional model.

Step 2: Development of the Instructional Model in Mathematics with the Use of Interactive Webcast

In this step, the instructional model in mathematics with the use of interactive webcast was developed based on information acquired in Step 1 and opinions of experts regarding the desired instructional model. The procedure and details for development of the instructional model is shown in Figure 1.

From Figure 1, the procedure for development of the instructional model in mathematics with the use of interactive webcast comprises the following steps: analysis, design, build up/development, implementation, and evaluation. The details of each step are described as follows:

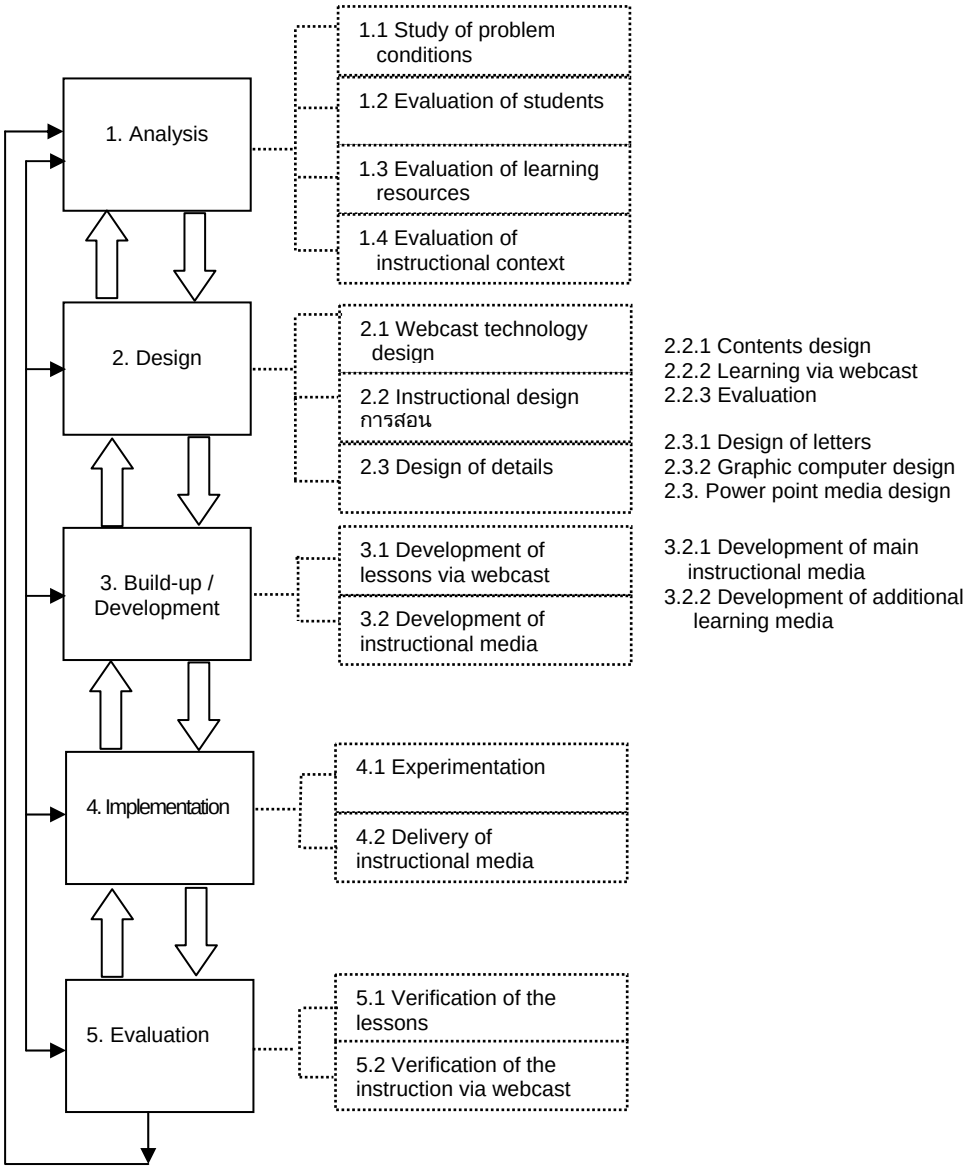

Figure 1: Flow chart showing procedure and details for development of the instructional model

1. Analysis. There are four activities in the analysis step as follows:

1.1 Study of the conditions of problems. Problem conditions being studied include the conditions of instructional problems, the use of information technology and students' needs on the learning methods in order to acquire word problem solving skills in mathematics.

1.2 Evaluation of students. Students being evaluated are STOU students who enrolled for the 30205 Course: Mathematics and Statistics.

1.3 Evaluation of learning resources. Learning resources being evaluated are instructional materials in Unit 6: Introduction to Analytic Geometry of the 30205

Course: Mathematics and Statistics, other learning resources for students, and the employed instructional technology.

1.4 Analysis of the current instructional context. The current instructional context being analysed includes the university's policy, goals and objectives in provision of distance instruction.

2. Design. There are three activities in the design step as follows:

2.1 Designing interactive webcast to fit the instruction. In this activity, the researchers must design how, when, and in which contents to use interactive webcast in the instructional process.

2.2 Designing the details of instruction. The details of instructional design are the following: (1) designing the objectives and contents of instruction including determination of learning objectives, sequencing of contents and dividing learning contents into small learning units; (2) designing the methods of learning and learning activities including the introduction to the lesson, presentation of contents, having students participate in learning activities in various methods of learning, doing exercises and concluding of what has been learned; and (3) designing the evaluation of learning outcomes including determination of evaluation instruments and determination of the evaluation system for the lesson.

2.3 Designing the details of the interactive webcast. In this activity, the researchers designed the details of the interactive webcast including the components of the picture screen, shapes and sizes of letters, the use of colors, and the use of graphic computer illustration.

3. Build up/Development. There are two activities in the build up/development step as follows:

3.1 Development of lessons via interactive webcast. In this activity, the researchers developed the lessons via interactive webcast based on information acquired in activities 2.1 to 2.3. The developed lessons are within the framework of instructional methods and instructional activities.

3.2 Development of instructional media. In this activity, the researchers developed instructional media to be used in the lessons. The developed instructional media comprise (1) main instructional media including learning manual and learning texts; and (2) additional learning media including power point presentation and graphic computer illustration.

4. Implementation. There are two activities in the implementation step as follows:

4.1 Experimentation with the instruction via interactive webcast. The experiment took place in the first semester of the 2009 academic year. The experiment covered six hours including five hours for instruction and learning activities, 30 minutes for pre-testing, and 30 minutes for post-testing. The activities of the experiment were the following:

(1)	Explanation on learning with the use of interactive webcast	10 minutes
(2)	Pre-testing	30 minutes
(3)	Organising instructional activities:	
	- On the topic of Coordinate Axis System	2 hours
	- On the topic of Straight Lines	1.30 hours
	- On the topic of Circles and Parabolas	1.30 hours
(4)	Post-testing	30 minutes

4.2 Delivery of the learning documents on the topic of Introduction to Analytical Geometry including the learning manual to students via the ordinary mail and e-mail in order for them to review their learned lessons.

5. Evaluation. In this step, three experts were asked to evaluate the developed instructional model in two aspects: (1) the verification of the lessons; and (2) the verification of the components of instructional model in mathematics with the use of interactive webcast.

Step 3: Experimentation with the Developed Instructional Model in mathematics with the Use of Interactive Webcast

After the instructional model had been developed, the researchers conducted an experiment to test its effectiveness with a research sample consisting of 30 purposively selected STOU students who enrolled in the 30205 Course and attended its tutorial sessions. The experimental design was of the One Group Pretest-Posttest Design. Details of the experiment are described in 4.1 above. As two dependent variables were involved, namely, mathematics learning achievement and students' attitudes towards the developed instructional model, the employed data collecting instruments were a mathematics achievement test and a questionnaire to assess student's opinions towards the developed instructional model. Data were statistically analysed using the mean and standard deviation.

Research Findings

Conclusions from research findings are as follows:

1. Results of the experts' evaluation of the developed instructional model in mathematics with the use of interactive webcast shows that the components of the model are in accord with each other and appropriate at the high level.
2. Results of the experiment with the developed model shows that students' post-experiment learning achievement scores in both the theoretical and practical components are significantly higher than their pre-experiment counterparts, as shown by their post-experiment mean score of 4.50 in comparison with their pre-experiment mean score of 2.43. This finding indicates that the developed instructional model is effective as it enables students to achieve higher learning achievement mean score after the experiment, with the mean score difference of 2.07.
3. As for opinions of students towards the developed instructional model, the rating mean of their opinions towards the developed instructional model is 4.16, which is at the high level.

The above research findings lead to the conclusions that the developed instructional model in mathematics with the use of webcast is appropriate as verified by experts, and that the developed model is effective as it enables students to have higher post-experiment learning achievement than their pre-experiment counterpart and students have opinions that the model is highly appropriate.

Recommendations for Further Research

The following recommendations for further research are proposed:

1. The developed instructional model in mathematics with the use of webcast should be extended to cover the whole 30205 Course and put to experiment for the whole semester in order to determine its effectiveness and efficiency in instruction of the whole course.
2. Other instructional models with the use of interactive webcast should be developed for use in other mathematics courses to enhance learning achievement of STOU students on a wider range.
3. Instructional models with the use of interactive webcast should be developed and used in courses in other disciplines that are quite different from mathematics such as language courses in order to determine their effectiveness in courses of different nature.

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