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Blended Learning Model to Promote the Ability to Analytical Thinking and Learning Outcomes of Computer and Educational Technology Students

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Abstract

The purposes of this research were: 1) to develop a blended learning model to promote analytical thinking ability and learning outcomes of Computer and Educational technology students 2) to compare analytical scores before and after blended teaching of Computers and Educational Technology students and 3) to study the satisfaction of students about the blended learning method. The researcher conducted the instructional design theory of ADDIE MODEL used in this research. The experiment was conducted with the sample group in the study were 3rd year students 30 students in Computer and Educational technology students the academic year 2021 who study in the first semester of academic year 2021. The instruments in this research were 1) Teaching Management Plan 3 plans to 4 hours in total 12 hours 2) Analytical thinking ability test for 3rd year students of Computer and Educational Technology in Faculty of Education at Nakhon Sawan Rajabhat University and 3) The satisfaction questionnaire of students that blended learning model. The statistics used in data analysis were mean, standard deviation and t-test. The findings of this research as following:

It has resulted in the development of a teaching style that combines integration with the analytical thinking process in the course of learning management in computational science at the primary and secondary level. There are five steps in the learning process: 1) reviewing 2) thinking 3) sharing 4) constructing and 5) applying and the results of checking the appropriateness of the teaching management plan that integrates with the analytical thinking process found that the experts assessed the quality of the teaching management plan integrated with the analytical thinking process. It was very appropriate ($\bar{x} = 4.70$) when students receive integrated teaching and learning management with the analytical thinking process of the course of learning management in computational science at primary and secondary levels. The students' analytical thinking ability after study was statistically significantly higher than before at the .05 level and were satisfied towards blended learning at a high level.

Keywords: Blended Learning, Analytical Thinking

Introduction

Blended learning is a variety of teaching and learning which is a widely method in the present. It aims to provide learners with important learning goals and the development of learners' skills in the 21st century (Panich, 2012). This is an instructional management that combines classroom learning about face-to-face between learners and teachers and learning outside the classroom through activities and websites which is a flexible learning style that are likely to respond to individual differences among learners in learning styles, attention styles and the ability of each learner (Bonk & Graham, 2004) The teachers can use at least two teaching methods to organize teaching. For example, the teachers present lesson content through technology combined with face-to-face teaching. In addition, the teachers may hang the lesson content on the web and follow the teaching activities using e-learning or with LMS (Learning Management System) or computer. After that, the learners conclude the lesson by discussing with the teacher in the classroom (Anukoonvej, 2012).

Competitive economy to education management to focus on the development is important. While the education system has not been able to develop students' thinking skills as they should. It also aims to teach people to think the same of the instructor, to feeding of knowledge rather than thinking of new things and also sticking to the old teaching culture that students think contrary or inconsistent with the teacher's ideas which they will not get a good score. Although, the information technology brings the learners to a large number of resources but the problem is the learners extract information without using analytical skills, apply thinking and extending knowledge etc. As, we can be seen from the student's report which they search the information from the internet to put in the report by lack of understanding and analysis that the information is true and reliable. (Office of the Education Council Secretariat, 2007: 73) Consistent with the results of the national academic conference which organized by the Office of the Basic Education Commission (OBEC) Kenan Institute of Asia and the Institute for the Promotion of Teaching Science and Technology (NSTDA) that raise the quality of basic science education in 2012. The teachers from all over the country attend the meeting and join to analyze the results of the international test to Program for International Student Assessment (PISA) of Thai children found that the scores were low because of lack of analysis. (Bangkok Business Online, 2012) due to the wrong education system, teaching management does not make students and graduates think analysis. (Prasert Publishing, 2014). The problems show that students lack the ability to think critically. Therefore, the desirable characteristics of learners in the new era must focus on thinking, analyzing, thinking skill, learning and vocational skills in life (Chaisaeng, 2014) which is in accordance with the standard of the national education with the characteristics desire of learners to be able to critical, synthetic and creative thinking.

At the higher education level found the problem in teaching and learning management of higher education. There was a problem in quality that is below international standards. Issues to inferior quality include: inefficient teaching and learning management, the teaching method also emphasizes

on the transfer of knowledge from the teachers. The lack of research and building new knowledge does not encourage students to have the ability to use critical thinking analytical, synthetic and creative thinking including the problems caused by the teachers who are impaired in their duties. The lack of academic discipline does not commit to the pursuit of modern knowledge. There are deficiencies in management and lack of quality control mechanisms. (Ministry of University, 2000) Therefore, it is necessary to adjust the learning management model to be appropriate in order to solve problems urgently. The learning management model will help to solve the problems in teaching and learning which is a part that promotes success to work and see the guidelines for the development of teaching and learning. Consistent with the research results of the Office of the Education Council Secretariat (2009) found that the factor affecting learner quality development was the adjustment of teaching methods of teachers that the teachers must pay attention to study and research the learning management model to apply teaching and learning.

Therefore, the teaching and learning management in lecture may not enough. The teachers should find a variety of teaching methods that help learners to easily access the content anytime, anywhere in order to increase their knowledge and understanding by arranging various learning styles to enable learners to achieve Learning that happens in the classroom is blended with learning outside the classroom by using a variety of learning resources along with assigning both group and individual tasks to learners to study and self-directed learning, report preparation, use of networking systems, do exercises, an electronic lessons (e-learning), a computer-assisted instruction (CAI), an electronic books (e-books) which the learners are capable of analytical thinking, skills to select information evaluate the value of the data and use data wisely and also a person who can manage learning that encourages students to think critically as well.

Objectives of the Study

1. To develop the blended learning model and promote analytical thinking ability and learning outcomes of Computer and Educational Technology students.

2. To compare the analytical scores before and after blended learning of Computer and Educational Technology students.
3. To study the satisfaction of students about the blended learning method.

Research Methodology

This research has the following research steps.

Step 1 Analysis

1. To study of documents, theories and research related to the development of blended learning for the course of learning management in computational science at primary and secondary levels.
2. To study and analyze students' learning from past academic year results and interview from instructors in other subjects.
3. Before teaching and learning in the course of learning management in computational science at the primary and secondary level which the teachers were interviewed through an interview form about the problems encountered in their studies, the expectations in the course of study and the students want from their studies in this course.
4. To bring the results of interview from students which is part of the design of blended learning in the course of learning management in computational science at the primary and secondary level as well.

Step 2 Design

1. Schedule learning management takes into the teaching process and the results that will occur to the learners as well as appropriate to the level of knowledge and ability of the learners which the researcher chose a blended learning method which is an instructional process that focuses on learners. Blended learning is a teaching and learning activity that emphasizes flexibility. There is a mix of different teaching tactics that uses to teaching materials. The teaching activities and a variety of teaching styles including online teaching and face-to-face teaching respond to individual differences among learners. The aim is to enable all learners to achieve the goals

of teaching and learning blended method. It is a learning model that focuses on teaching and learning activities by creating a learning environment and atmosphere. Teacher's teaching method, learner learning style, teaching materials, communication channel and interaction patterns between learners and teachers, learners and learners, learners with content, learners with a variety of learning contexts respond to the individual differences of learners. In order for each learner to achieve the best results from teaching and learning. In this research will focus on blended learning to integrate in online, networking and traditional classroom learning by organizing a learning environment that encourages learners to exchange knowledge together in the context of online learning.

2. The overall design of blended learning consists of learning activities for each topic, presenting lessons in blended learning and supporting for blended learning to design activities for each topic including definitions of outcomes from learners' actions, the objective activities, the grouping of all activities, the assessment in each unit, the design and development of learning materials consists of material selection, a development of case study, an electronic lessons (e-learning), a computer-assisted instruction (CAI) and an electronic books (e-books), presentation of design results and the development of results from the second step, detailing the lesson design in each design section and develop teaching and learning evaluation by considering the learners' analytical ability. The process of learning management developed by the researcher to integrate the concepts from the study of basic theories and concepts were constructivist theory, principles of brain-based learning management and active learning which develop learners to the ability to critical thinking including the principles of learning management model, objectives of the learning management model, teaching process of learning management model and measuring and evaluating learning management model. The teaching and learning process consisted of 5 steps: 1) the previous knowledge review stage 2) the co-thinking stage 3) the learning exchange stage 4) the knowledge creation stage and 5) the application stage.

3. Arrangement a blended learning management model into 3 types to development learner skills as follows:

Blended learning management develop a skill-driven learning that is a combination of self-paced learning and teaching by teachers as facilitators and supporters in learning to improve knowledge and learning skills.

Blended teaching management develop an attitude driven learning by using a combination of different media for each event which used as a media for the transmission of knowledge to develop specific behaviors of learners.

Blended learning management develop a competency-driven learning that is a combination of tools which used to support the creation of knowledge management by the teachers give advice on the development of learners' ability that create a blended teaching method with an emphasis on development in skill-driven learning, the development of attitude-driven learning and the development of competency-driven learning based on Valiathan (2002, cited in Wanpirun, 2008)

The table shows the integrated teaching and learning process with the analytical thinking process 5 steps

Learning Activities	Learning Materials
<p>Reviewing</p> <ul style="list-style-type: none"> Teacher informs the purpose of learning to clarify the subject of the lesson and relationship with knowledge and the old experience The teacher greets the learners and ask questions about the learner-center learning management model that learners know and ask the question. "What does a student-centered learning management model mean? How is it important? and What are the elements?" 	<ul style="list-style-type: none"> Online Sticky notes weblog E-Tutoring, E-Coaching, E-Mentoring <p>The development analytical thinking</p>
<p>Thinking</p> <ul style="list-style-type: none"> Divide students into 6 groups; brainstorming and analyzing, find answers together, get group answers. The topic of the learner-center learning management model by comparing similarities and discrepancies along with reasoning and detailed analysis of responses from group members. The students study from the exam papers or research from the internet by using Online Sticky Notes (imagine that it is a familiar sticky note pad called Post it on PC looks like a small window and like a note on the screen for creating reminders). 	<ul style="list-style-type: none"> Matching, categorizing Error Analysis Summary of general principles Application
<p>Sharing</p> <ul style="list-style-type: none"> Learners analyze and create knowledge by sharing the results of the questions assigned by the teacher along with exchanging presentations with classmates by the teacher to guide and facilitate. Learners write a note in a weblog, digital storytelling. 	
<p>Constructing</p> <ul style="list-style-type: none"> The teacher describes the conclusion and learners to ask questions about the issues of interest and exchanging experiences among students (by E-Tutoring, E-Coaching or E-Mentoring) Learners summarize the knowledge and exchange the knowledge by applying various techniques from each group and summarize the knowledge and discuss the results together. The teacher uses questions to create a thinking process and support the information to apply in daily life, education and career. 	

<p>Applying</p> <ul style="list-style-type: none"> • The teacher assigns to divide the working groups into each group and divide the work duties to aptitudes and abilities which are divided into 14 topics on learning management methods: 1. Cooperative Learning 2. Graphic Organizer 3. Learning Center 4. Inquiry Method 5. Ask and Question Model 6. Project Method 7. Learning Cell 8. The use of Community activities 9. Committee Work Method • 10. 4 MAT Learning Activity Design 11. Discussion Method • 12. Talents Unlimited 13. Unit Teaching Method 14. Role Playing) • The students have been assigned tasks in each group to learn about a case study on the real context of learning management at school and exchanging experiences by uploading data, pictures or video clips that saved to the cloud (Cloud: Google, share, Flickr, Timetoast) of each person and presented in front of the class along with the students who listen to the presentations to write digitally recorded weblog and digital storytelling. • The teacher gives the opportunity to show their abilities and presenting techniques, methods, practices and activities. 	
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Creating a Teaching Management Plan

The teaching management plan was in the course of learning management in computational science at the primary and secondary level for 3rd year students and the researcher has done the following;

- To study and analyze the learning objectives of the course of learning management in computational science at the primary and secondary level.
- To study the documents and textbooks of the course of learning management in computational science at the primary and secondary level.
- To create an analysis table and allocate content about learning objectives.
- To study the blended learning management from various documents and study the teaching process model created by the researcher.
- To make a teaching management plan integrated with the analytical thinking process 3 plans to 4 hours in total 12 hours and then bring it to experts to check the appropriateness of the teaching management plan.

Determine the Characteristics of the Student’s Test

Analytical thinking ability test for 3rd year Computer and Educational Technology students in Faculty of Education at Nakhon Sawan Rajabhat University. It is a multiple-choice test with 4 choices. The test was created from the analysis of the level of assessment of behavioral outcomes, psychology and

learning objectives. Therefore, it was a criteria-based test (Phatthiyathanee, 2003) 60 numbers.

Step 3 Development

The tools obtained from the design process such as blended learning management, teaching management plan, analytical thinking ability test and questionnaire of student’s satisfaction in learning management. The quality of the tools was examined by experts to determine the quality of the teaching management plan that had integrated teaching and learning management integrated with the analytical thinking process.

The researcher brought the research tools to experts to check the blended instruction as follows:

- To bring the teaching management plan to examine by 3 experts as follows:
- Assistant Professor Aphakorn Phodong, Ph.D. Lecturer of Curriculum and Instruction in Faculty of Education at Nakhon Sawan Rajabhat University.
- Assistant Professor Phiraya Phothipitak Lecturer in Curriculum and Instruction in Faculty of Education at Nakhon Sawan Rajabhat University.
- Assistant Professor Wuttichai Philuek, Ph.D. Lecturer of Computer and Educational Technology Department in Faculty of Education at Nakhon Sawan Rajabhat University.

To determine the validity of learning objectives, content, language and appropriateness of teaching

and learning activities in each teaching management plan by using the assessment form created by the researcher which is a rating scale with the following criteria for consideration (Thaweerat, 1993)

- 5 means most suitable
- 4 means very suitable
- 3 means moderately suitable
- 2 means less suitable
- 1 means least suitable

and the end is open-ended format for experts to give suggestions for use as information to improve teaching management plans.

- 1.2 To take the expert opinion score to get the mean and the standard deviation. The researcher was conducted the analytical criteria (Thaweerat, 1993).
- 4.51 - 5.00 means the most appropriate
- 3.50 - 4.49 means very suitable
- 2.50 - 3.49 means moderately appropriate
- 1.50 - 2.49 means less suitable
- .00 - 1.49 means least appropriate

In each aspect, if the mean of expert opinions were 3.50 or more and the standard deviation was not more than 1.00 concluded that the components of the teaching management plan were consistent and applicable (Ketsing, 1995 cited in Nakvisut, 2005) and have been revised to the advice of experts until a suitable teaching management plan.

Checking the Quality of the Test for Content Validity

Researchers bring research tools to experts to conduct quality checks of 21st Century Skills tests to determine content validity.

- To check content validity to consistency index between the exam and the index item-objective congruence: IOC by specifying the scoring criteria from the consideration as follows. (Saraithip, 1996)
- Score +1 when you are sure that the test is measured for its intended purpose.
- Score 0 when you aren't sure that the test is measured for its intended purpose or not.
- Score -1 when you are certain that the test isn't measured its intended purpose.
- Criteria for determining the conformity index
- Questions with a consistency index value from 0.50-1.00 have a validity value.

- Questions with a consistency index value lower than 0.50 need to revise and not applicable.
- To bring in opinion points from experts to find the consistency index between the exam and the index item-objective congruence found that all the questions had the consistency index between the exam and index item-objective congruence at 0.67–1.00 which is greater than 0.5 indicating that the exams were consistent in content. (Saraithip, 1996) publishing a revised test of 60 items.
- To take quizzes that verified for content validity by experts and have been revised that went to test with 4th year students in Computer Studies and not a sample by checking the grading of each test item which 1 point was given for the item that the student was correctly and 0 points for the item that the student was not correct.

Step 4 Implementation

The sample in the study was 30 students in Computer Studies in the third year of the academic year 2021 who were studying in the first semester of the academic year 2021 by using the selective method.

In this experiment, the researcher did the following:

1. To take the pretest with the experimental group was 3rd year students who were studying in the first semester of the academic year 2021 with 70 questions of analytical thinking ability test at 60 minutes and check the test to the results of the exam that is a pretest score for data analysis.
2. To conduct an experiment was conducted to teach the students in the experimental group by using a blended learning process and taught the control group by using the normal teaching process at 12 hours by themselves.
3. After the teaching experiment, a posttest was performed with the students in the experimental group with a test to measure the learning satisfaction of the learning management in computational science. The same issue as the pretest and then check the test, record the results of the exam as a score after the class for data analysis.
4. The scores obtained from the pretest and posttest in the learning management in computational

science which the test was analyzed by using statistical methods to test the hypothesis and draw conclusions from the research.

Step 5 Evaluation

Data Analysis

In this evaluation, the researcher sets the statistical significance level was at .05 that find the data to answer the questions into the objectives of the research. The researcher conducted an analysis of the data collected from the implementation of the experiments at the adoption stage which conducted an analysis of pretest of the experimental group who received blended learning and compare the scores posttest in the learning management in computational science the students in the experimental group who received mixed teaching. The researcher performed the following steps:

- To take the scores from the pretest and posttest of the experimental group who received the blended learning that find the average of the academic performance scores in the learning management in computational science. Both pretest and posttest of the students tested the difference in academic performance scores pretest and posttest with statistical t-test samples that are not independent of each other.
- To bring the scores of the posttest results of the experimental group who received the blended learning who received normal learning to find the mean score of analytical thinking ability that are not independent of each other.

Results

- The results of the suitability assessment of the teaching management plan integrated with the analytical thinking process by an expert found that the experts were the same opinion that the teaching management plan created by the researcher was very appropriate.
- Third-year students in the Computer and Educational Technology who received a blended learning method integrated with the analytical thinking process in the course of learning management in computational science at the primary and secondary level. The analytical thinking ability posttest was significantly higher than pretest at the .05 level.

- The students who receive integrated learning with the analytical thinking process in the course of learning management in computational science at primary and secondary levels. There were students' satisfaction in all 3 aspects; atmosphere, teaching and learning activities and benefits. The average is at a higher level.

Discussion

The students who receive blended learning able to critical thinking the posttest was statistically significantly higher than the pretest at the .05 level because the blended web-based instruction could develop a deeper understanding of the body of knowledge more than just online learning and traditional classroom learning. As, the blended web-based teaching combines the best of traditional classroom methods and e-learning systems which the students can practice in the laboratory and practice reviewing the knowledge in the content to solve problems in learning according to the needs of the learners independently by online learning. It is also consistent with (Driscoll, 2002) the blended learning can develop learners' learning challenges in response to individual differences and their learning potential that the learners to develop their own learning abilities better (Johnson, McHugo, Hall, 2006) and can develop students to higher learning achievements because the blended learning encourages learners to play more roles in learning to enabling students to learn meaningfully and learners have the higher analytical thinking abilities posttest than pretest. From such results, it was shown that the blended learning integrated with analytical thinking process that can be used in teaching and learning to develop learners to have academic achievements and the ability to critical thinking because the teaching focuses on the students to gain direct experience, analyze data by comparing the similarities, differences and specifying the reasons to create a body of knowledge based on the concept of constructivist theory that describes learning is a process that takes place within a person. A person is a knowledge creator from the relationship between that he sees and his former cognition to form an intellectual structure (Khamanee, et al., 2001) consistent with the research of Yiemsang (1999) found that the teaching to the

concept of creative theory that students have direct experiences and they combine existing knowledge with new knowledge to gain from learning, use it to interpret data, act on information and memorize it in long-term memory. Thus, when students build their own knowledge, it contributes to the development of student achievement and analytical thinking abilities. This is consistent with the concept of brain-based learning management that the brain manages meaningful experiences here, explaining How things are applied? Expanding was learned to help the brain to analyze, examine and learn more deeply. (Jensen, 2000) It is the new knowledge and lifelong learning.

The students who are taught with blended learning management in the course of learning management in computational science at the primary and secondary level. The satisfaction of the students was in all 3 aspects; the atmosphere, the teaching and learning activities and benefits. The average is at a higher level because the teaching style uses online resources such as course content, assignments, cooperative learning, tools online teaching assessment combined with traditional classroom lectures that emphasize traditional classroom learning instead of face-to-face learning that online content should cover traditional classroom content instead of face-to-face learning by designing the system which the learning environment must be considered similar to a traditional classroom by asking questions, assignment, consulting which all makes the students satisfied with the blended learning management that can discuss in teaching and learning to prepare in the part of teaching documents that the course content is clear, continuous and easy to understand. It has an orientation before class, inform the learning objectives to the students. Old knowledge is linked to new knowledge by asking questions to get answers from the diverse experiences of students and providing necessary experiences for students to understand and stimulate thinking. Educational results are presented, research joint discussion and applying knowledge in the learning atmosphere that students feel that the learning atmosphere is friendly that the students can ask for questions and comments and constant stimulation and reinforcement of students. There was an exchange of knowledge with each other while working in groups and presenting in front of the class and encourage students to express themselves. It is consistent with Wongyai (1999) said that the students will learn from friends and people

around them. When there is support, generosity, cooperation and joy in learning when there is a stress-free, exciting learning environment. expectation and overcoming and in accordance with Kaenthong (2002) said that the students do group activities together to build knowledge and share responsibility by defining situations or worksheets that practice thinking processes and together summarize as knowledge to rules that the students will make to be happy in learning. In addition, the students are involved in learning and showing the importance of learning that the students have taken action to study and search for knowledge, summarize and build your own the knowledge thus creating meaningful learning for oneself and a durable knowledge. The a fore mentioned concept of the learning management model is consistent with the learning management that focuses on the student. This is a very important principle in learning management that focuses on process rather than content with the heart of learning that must take into account both the student and the student development process (Pathomworachat, 2003).

Suggestions

Suggestions for Implementing the Teaching and Learning Management Model

1. The teacher wants to develop a learning management model in accordance with the standard framework National Higher Education Qualifications and apply the development learning management model because it is a model of learning management that emphasizes the students to create or summarize the body of knowledge by themselves that study, research and self-concluding to consistent with the development of knowledge and intellectual skills.
2. Teachers at the higher education level can use this developed learning management model as an alternative way to develop learners to the ability to critical thinking.
3. Implementation of teaching and learning management model should be studied the composition of the pattern teaching through 5 steps in order to see an overview and know the teaching process and should have a clear understanding of analytical thinking in order to apply such a model to manage learning to develop analytical thinking of learners effectively.

Suggestions for the Next Research

- To should be a study of teaching methods that uses other teaching techniques such as collaborative learning, cooperative learning, project-based learning and brain-based learning by using the blended learning to teaching and learning model.
- To should be a study of teaching and learning achievement or measure skills in other to consistent with teaching and learning at the higher education level such as learning standards at the higher education level.
- To should be a study on the effect of using blended learning to develop learners' abilities in other areas such as problem solving, creativity, creative problem solving, critical thinking, reflective thinking and the ability of information and communication technology etc.

Conclusion

Development of Blended Learning Model to Promote Analytical Thinking and Learning Outcomes of Computer and Educational Technology Preservice Teacher Students

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