

Results of Blended Learning Model Using Cognitive Tools to Developing Graduate Students' Analytical Thinking Skills

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Abstract

The present research study aims at investigating the outcomes of a blended learning model by using cognitive tools in developing graduate students' analytical thinking skills. The participants are graduate students at technological education during the first semester of 2010. Twenty-one students were recruited. Research tools include a learning content management system (LCMS) of the blending learning model using cognitive tools and questionnaires measuring students' ability in analytical thinking skills and satisfactions. Statistics for data analysis are percentage, arithmetic mean, standard deviation and dependent t-test.

The outcomes revealed that after instructing graduate students with the LCMS of blending learning model:

- 1) The students significantly score higher in analytical thinking skills at the .05 level.
- 2) The students are satisfied with the blending learning model at the high level.

Keywords: Blended Learning, Cognitive Tools, Analytical thinking skills

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1. Introduction

Education lays the cornerstone of national development in the era of Knowledge-based Economy/Society (KBE/KBS) with new knowledge (Office of the National Research Council of Thailand: NRCT, 2007). Information and Communication Technology (ICT) has been effectively developed and used as a tool to develop and support education widely. Therefore, management in education needs a shift in terms of paradigm, patterns, techniques and teaching methods to respond to human resource development and competitiveness of the country's advances in technology and adaptation to the distribution of knowledge. These needs are consistent with the National Education Act, Chapter 9 Technologies for Education, focused on information and communication technology in both direct and indirect uses. As elaborated in Section 65, individuals, both manufacturers and users of technologies for education need to be trained so that they acquire knowledge and skills in operation and use of technology with quality and efficiency. In Section 66, students are entitled to develop their ability to use technology for the purpose of study when they reach their first opportunity to do so. This purpose is to provide them with adequate knowledge and skills to use technology for education. In the pursuit of knowledge at their own pace throughout their life, higher education must prepare individuals for social and professional lives. The government should promote learning foundation structures,

development of higher education institutions and use of their potentials in information and communication technology, in turn supporting information technology and communication policy of the national e-Education. The policy is a 15-year long-term plan, No. 2, 2008-2022, stating the policy guidelines regarding learning foundation structures that the government should support both private and public tertiary institutions to use information and communication technology. The purpose is to reduce digital divide; distance learning and e-Learning from informality, formality, independence, customization to massification are in particular. The guidelines are concurrently accordance with tertiary development plan 10 (2008-2011) addressing the importance of development policy of tertiary learning foundation structures. Potential use of information and communication technology is hence essential, for it is seen to meet the strategies of e-Society, e-Industry, e-Commerce, e-Education and e-Government.

Styles of blended teaching and learning on the web and in the classroom are a form of flexible learning. This flexibility responds to individual differences in their learning model, cognitive styles, interests and abilities (Bonk & Graham, 2004), enabling them to study and practice independently at any location as needed (Bersin, 2004). In addition, blended teaching and learning on the Web and in the classroom also improve students to acquire knowledge meaningfully within two different physical settings, online and classroom (Kaye, 2003). In

terms of the management of content, instructors can arrange simple content for their students to learn by themselves from the web. The content that is more difficult to learn can be prepared and instructed in a traditional classroom. This approach offers equal opportunity in learning to students from various levels of competence and enables them to acquire knowledge successfully. Interaction of cooperative learning on the network can improve academic achievement, cooperative learning, ability to solve problems, creativity, analytical thinking and good judgment (Na Songkhla, 2007).

Use of cognitive tools for creating cognitive map is one way to help record ideas that monitor wider and clearer perspectives than a record that has not yet put into a systematic record. Cognitive map is a model that demonstrates relationship of conception in order to learn how to brainstorm, remember information, imagine and solve problems. Mind map is a mnemonic technique, which helps long-term memory. This technique ties new knowledge with schema or background knowledge along with the development of right brain by means of imagination, use of keywords, and word extension like webbing (Buzan, 2010).

Analytical thinking is a cognitive skill, which is higher than skills in learning and comprehension. It is an ability to categorize data into subclasses including components, relations and principles through mass media. The categorized data are then processed in order to understand others' thoughts or the relationship

of ideas that people would like to know the meaning clearly (Michaelis, 1992). Blooms (1976) constructed taxonomy of learning domains: cognitive, affective and psychomotor.

Developing learners' analytical thinking skills is a desirable feature of today and future society using the blended learning model through electronic media and traditional classroom, and cognitive tools to develop analytical thinking skills of learners. Therefore, it is essential to develop and examine how use of blended learning management system using cognitive tools affects graduate students' analytical thinking skills. The study outcomes will be guidelines for development of blended learning models by using cognitive tools and of analytical thinking for other tertiary institutions.

2. Objectives

2.1 To develop a blended learning model using cognitive tools.

2.2 To investigate the effect of blended learning model using cognitive tools in developing graduate students' analytical thinking skills.

2.3 To examine graduate students' satisfaction with the blended learning model using cognitive tools.

3. Hypotheses

Graduate students who study through the blended learning model using cognitive tools significantly earn higher scores of analytical thinking skills.

4. Scope of the Study

4.1 Study Variables

- Independent variable: the blended learning model using cognitive tools.

- Dependent variable : analytical thinking scores and satisfaction .

4.2 Populations and Samples

- The population in this study is graduate students of King Mongkut's University of Technology North Bangkok, enrolled in the first semester of the academic year 2010.

- The sample used in the research study is 21 graduate students majoring in Educational Technology, Faculty of Technical Education, King Mongkut's University of Technology North Bangkok, semester 1 of the academic year 2010.

4.3 The duration of the study was 10 weeks.

5. Research methodology

Research methodology is divided into two stages.

Stage 1: Develop a blended learning model using cognitive tools.

The develop a blended learning model using cognitive tools for graduate students is developed according to ADDIE Model, consisting of five steps as follows:

1. Analysis: First, analyze problems and needs for blended learning content management system (LCMS) using cognitive tools for graduate students. Then analyze contents that are appropriate for a blended learning management

tools using cognitive tools. After that, analyze characteristics of graduate students and contexts that are related to the blended LCMS using cognitive tools.

2. Design: Design a blended LCMS using cognitive tools for graduate students, learning objectives and strategies of authentic assessment.

3. Development: Develop the blended learning model using cognitive tools for graduate students, learning management plans, and surveys of behavioral observation, achievement testing and satisfaction.

4. Implementation: First, test the blended learning model using cognitive tools with three individual graduate students, followed by small group testing of six graduate students. Observation and interviews are research approaches for testing. Data garnered are then revised for improvement. After that, start a field trial with a group of fifteen graduate students using the revised blended learning model using cognitive tools. Then collect qualitative data through observations and interviews with the students who participate in the field trial to find out problems and suggestions concerning the blended learning model using cognitive tools. Efficiency of the achievement testing survey is reliable at 0.77 and difficult at 0.42-0.74, while the analytical thinking skill survey is reliable at 0.82 and difficult at 0.35-0.80.

5. Evaluation: Assess the quality of the blended learning model using cognitive tools and plan using cognitive tools. Five experts evaluate

the quality of content and five others evaluate the quality of the blended learning model using cognitive tools.

Stage 2: Study the effect of blended learning model using cognitive tools in developing graduate students' analytical thinking skills.

This stage involves One Group Pretest - Posttest Design (William and Stephen, 2009)



The procedure in this stage is as follows:

1) Before the experiment

1.1 Give students an orientation of the blended learning model using cognitive tools, testing, evaluation and how to use the blended learning system.

1.2 Pretest the students' analytical thinking skills, evaluate it and inform the outcomes to them.

2) During the experiment

2.1 The students study information and communication technology according to

the blended learning model using cognitive tools for ten weeks.

2.2 Posttest the students' analytical thinking skills, evaluate it and inform the outcomes to them.

2.3 Have the students complete the survey of satisfaction with the blended learning management system using cognitive tools for ten weeks.

Statistics used for data analysis include percentage, arithmetic mean, standard deviation and t-test dependent.

6. Research Results

6.1 The outcomes of development of the blended learning model using cognitive tools.

6.1.1 The blended learning model using cognitive tools consisted of five components: 1) LCMS, content styles, homework submission, contacts and scaffolding.

6.1.2 The outcomes of development of the blended learning content management system using cognitive tools are shown in Table.

Table 1: The outcomes of development of the blended learning content management system using cognitive tools

Item	\bar{X}	S.D.	Level
1. Content	4.60	0.55	highest
2. Instructional Design	5.00	0.00	highest
3. Screen Design	4.80	0.45	highest
4. Techniques	4.80	0.45	highest
Overall	4.80	0.41	Highes

According to Table 1, the overall level of the outcome of the blended learning content management system using cognitive tools is the highest ($\bar{X} = 4.80$, S.D. = 0.41). When considering each item, the level of the instructional design is the highest ($\bar{X} = 5.00$, S.D. = 0.00), followed by the screen design and the techniques ($\bar{X} = 4.80$, S.D. = 0.45).

6.2 The outcomes of the analytical thinking skills before and after using the blended learning content management system are illustrated in Tables 2 and 3.

Table 2: The outcome of the analytical thinking skills before and after using the blended learning content management system

Analytical Thinking Skills Scores	n	Total Score	\bar{X}	S.D.	t	p
Pretest	23	45	16.83	1.44	6.54	.000
Posttest	23	45	37.67	3.10		

$p > 0.5$

From Table 2, the students who were instructed through the blended learning content management system using cognitive tools significantly earn higher scores of analytical thinking skill at .05.

Table 3: The outcome of the analytical thinking skills before and after using the blended learning management system: consideration of each item

Analytical thinking Skills Scores	n	Total Score	\bar{X}	S.D.	t	p
1. Content Analysis						
Pretest	23	15	6.13	1.10	4.87	.000
Posttest	23	15	12.52	1.50		
2. Relations Analysis						
Pretest	23	15	6.261	1.01	3.69	.001
Posttest	23	15	12.48	1.50		
3. Principle Analysis						
Pretest	23	15	4.44	0.73	4.50	.000
Posttest	23	15	12.70	1.55		

$p > 0.5$

According to Table 3, the students who were instructed through the blended learning content management system using cognitive tools significantly earn higher scores of content analysis, relations analysis and principle analysis at .05.

6.3 The outcomes of the students' satisfaction with the blended learning content management system are shown in Table 4.

Table 4: The outcome of the students' satisfaction with the blended learning content management system

Instructional Activities	\bar{X}	S.D.	Level of Satisfaction
1. Preparation before instructions			
1.1 State the objectives of learning.	4.33	0.69	High
1.2 Stimulate and examine students' schema.	4.39	0.66	High
2. Study of Content			
2.1 Theory Content (Online)			
2.1.1 The blended learning content management system using cognitive tools	4.30	0.81	High
2.1.2 Presentation of (new) input	4.24	0.71	High
2.1.3 Presentation of interesting situations or issues	4.33	0.65	High
2.2 Study of Practicum Content (Face to Face)			
2.2.1 Present (new) input.	4.45	0.62	High
2.2.2 Stimulate students to respond and show their abilities.	4.45	0.62	High
2.2.3 Offer learning guidelines or data systemizations meaningfully.	4.30	0.59	High
2.2.4 Give feedbacks and positive reinforcements useful to students	4.36	0.74	High
3. Making Cognitive Map Using Cognitive Tools			
3.1 Brainstorming	4.24	0.75	High
3.2 Structuring	4.30	0.59	High
3.3 Linking	4.39	0.61	High
3.4 Summarizing	4.18	0.85	High
3.5 Application	4.45	0.62	High
4. Testing and Evaluation			
4.1 Testing and evaluating the achievement test	4.45	0.62	High
4.2 Testing and evaluating the analytical thinking skills	4.39	0.61	High
4.3 Applying knowledge through presentations	4.33	0.65	High
Overall	4.34	0.67	High

According to Table 4, indicates that the students who were instructed through the blended learning content management system using the cognitive tools were satisfied with the system at high level ($\bar{X} = 4.34$, $S.D. = 0.67$).

7. Discussion

7.1 The students who were instructed through the blended learning content management system using the cognitive tools significantly earned higher scores of analytical thinking skills at .05. This outcome is in line with Thangkabutra's (2009) study in a manner that use of cognitive map as a part of classroom instruction can develop students' thinking process.

7.2 The students who were instructed through the blended learning content management system using the cognitive tools highly felt satisfied with the system. This outcome agrees with Driscoll (2002), contending that blended learning activities can develop students' learning that challenges their potentials and respond to their learning differences. The integration also develops individual learning because it promotes independent and active learning, similar to Bonk's and Graham's (2004) suggestions in their research. Active learners therefore can cut down their classroom attendance. In addition, blended learning encourages interactions between students themselves as well as the teacher and students on a one-to-one basis. The interaction is seen to assist students to learn better (Kaye, 2003),

participate in learning community more and boost their positive attitudes towards learning (Rovai & Jordan, 2004).

8. Limitations of the Study

Several limitations should be considered in this study. Sampling would be the first limitation encountered, in this research study not random selected control group. Second, the lack of variation in the various satisfaction scores, the students were not discriminating in their assessments of the various aspects of the 10 week.

9. Implications and Recommendations

9.1 Implications are in the following:

9.1.1 Any institutions that apply the blended learning content management system using cognitive tools should have tools and foundation system essential for integration. Additionally, they should train their students at the level they can operate the system before beginning the class.

9.1.2 Any institutions that apply the blended learning content management system using cognitive tools should formally provide lecturers with teaching instructions. In order to promote positive attitudes towards this teaching and learning mode, the institutions should point out the benefits of its use to lecturers, students and all involved parties. The reason is that the blended learning system will be effective and efficient when cooperation takes place.

9.2 Recommendation for future research
Investigating the outcome of use of the blended learning content management system in other areas is recommended, such as learning achievement, judgment, logics and synthesis.

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