DEVELOPMENT OF PROBLEM-BASED BLENDED LEARNING MODEL IN DEVELOPING UNDERGRADUATE STUDENTS’ CRITICAL THINKING

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ABSTRACT

The purposes of the research study were: 1) to study conceptual framework and to study the opinions of panel experts on a Problem-Based Blended Learning (PBBL) model, 2) to develop a PBBL model which is to develop undergraduate students’ critical thinking, 3) to study the effects of using a PBBL model, 4) to study students’ opinion on the model, and 5) to propose the verified PBBL model.

The research and development (R&D) procedures were divided into four phases. The first phase was to study conceptual framework, the second phase was to develop a PBBL model, the third phase was to study the effects of using a developed PBBL model, and the fourth phase was to propose the verified PBBL model. The instruments used to assess undergraduate students’ critical thinking were Cornell Critical Thinking Test Level Z and MOODLE LMS was used to manage the blended learning system. The sample group in this study consisted of 40 undergraduate students from the Electronic Media Production for Education course at the Faculty of Education, Chulalongkorn University. Students studied via the Internet using PBBL model for eleven weeks. Data were analyzed by using frequency, percentage, arithmetic mean, standard deviation and t-test dependent.

The research results indicated that the PBBL model consisted of four components as followed: 1) principles, 2) objectives, 3) instructional process, and 4) learning evaluation. The instructional process consisted of two stages. The first stage was the preparation stage which included orientation, practice, learner grouping, and pretest on critical thinking skills. The second stage was learning stage which included the study of content, the presentation of situation, the clarification of terms and concepts, the definition of problems, the development and sequences of hypothesis, the formulation of learning objectives, the collection and validation of new information, the synthesis of information, the identification of generalization and principles, and the implementation of knowledge.

The study also found that undergraduate students’ posttest score in critical thinking were significantly higher than pretest score in critical thinking at .01 level. The students evaluated the PBBL process as a high level of appropriateness.

Keywords
Blended Learning, Problem-Based Learning, Critical Thinking.

INTRODUCTION

In an information technology era, new educational methods are being introduced to support the complex learning environment and the development of professional competencies. There are also emphasis on collaborative construction of knowledge through active learning and on the importance of higher-order skill such as critical thinking, problem solving, and self-regulation. The important factor to improve students’ critical thinking is learning and teaching method such as Problem-Based Learning.

The Problem-Based Learning (PBL) is a absolute approach to education and involves a constructivist approach to learning (Harper-Marinick, 2001). The curriculum consists of carefully designed problems that are in demand from learners in acquisition of
critical knowledge, problem-solving proficiencies, self-directed learning strategies and team participation skills. The learning processes replicate the common use of systemic approach when solving problems or challenges that are encountered in life and career (Barrows and Tamblyn, 1980).

Moreover, flexibility is increased when education is less dependent on time and place by making personalized learning routes available for individual students (Jochems, Merriënboer, and Koper, 2004). Many educational technologies are used to serve the way that curriculum changes. Particularly information and communication technology (ICT) in the sense of the Internet and its applications such as the WWW, e-mail, teleconferencing, groupware for computer supported collaborative learning (CSCL), learning management system (LMS), web-based learning (WBL) are growing rapidly among higher education in Thailand. However, all of these terms imply that the learners are of distance from the teachers, and computers are used to access learning resources, or to interact with the lessons provided, the teachers or their peers. In practice, many of these terms are used interchangeably.

The options for web-based learning ranges from the use of applications in traditional classrooms to comprehensive online courses in which there is no face to face contact. A blended course utilizes a combination of teaching methods in traditional classrooms and distance learning format via the Web. A blended approach may improve the efficiency of classroom management, especially for large classes (Papo, 2001), which would also increase the degree of student-led learning (Saunders and Klemming, 2003) and student achievement (Johnson, McHugo and Hall, 2006).

The aim of this study is to develop the blended learning model for higher educational level using problem-based learning to develop undergraduate students’ critical thinking.

**PURPOSE OF THE STUDY**

The purposes of this study were:

1. to study the conceptual framework and opinions of panel experts for the approval of Problem-Based Blended Learning model for developing undergraduate students’ critical thinking
2. to develop a Problem-Based Blended Learning model for developing undergraduate students’ critical thinking
3. to study the effects of using Problem-Based Blended Learning model for developing undergraduate students’ critical thinking
4. to study students’ opinions on Problem-Based Blended Learning model for developing undergraduate students’ critical thinking
5. to propose the verified Problem-Based Blended Learning model for developing undergraduate students’ critical thinking

**CONCEPTUAL FRAMEWORK**

Conceptual framework of this study is shown in figure 1. Three components were used for creating PBBL model which theoretically affected blended learning, Problem-Based Learning, and critical thinking skill of learner.

![Figure 1: conceptual framework of the study.](image)

**RESEARCH METHODOLOGY**

The Research and Development (R&D) approach were used.

The research procedures were divided into four phases:

1. The first phase was to study conceptual framework.
2. In this phase, researcher analyzed and synthesized the concepts, principles, theories, and research study concerning existing Problem-Based Blended Learning (PBBL) model, and the study of opinions from panel experts for the appropriateness of PBBL model. The sample group were 21 instructors from 11 universities and 15 undergraduate students from 3 universities.
3. The second phase was to develop PBBL...
In this phase, the researcher used information obtained from the first phase to develop the PBBL model. Then, the model was certified by 15 experts through blended learning, critical thinking, and problem-based learning. Furthermore, it tried out by 40 undergraduate students from the Electronic Media Production for Education course at the Faculty of Education, Chulalongkorn University.

3. The third phase was to study the effects of using a developed PBBL model.

In this phase, the same 40 undergraduate students, who registered for the course, were used as a sample group. The group studied via web with the PBBL model for 11 weeks, followed with a critical thinking test and then asked for their opinions.

4. The fourth phase was to propose the verified PBBL model.

In this phase, the researcher proposed the verified PBBL model from five experts in blended learning, critical thinking, and problem-based learning.

Quantitative statistics used in this study were frequency, percentage, arithmetic mean, standard deviation and t-test dependent.

RESEARCH RESULTS

The results from researching a PBBL model to develop undergraduate students' critical thinking are presented as follows:

Figure 2: A Problem-Based Blended Learning model for developing undergraduate students' critical thinking

Figure 3: Components of a PBBL model for developing undergraduate students’ critical thinking.

Figure 2: a Problem-Based Blended Learning model for developing undergraduate students’ critical thinking.

Part 1 Components of a PBBL model for developing undergraduate students’ critical thinking.

Figure 3: components of a PBBL model for developing undergraduate students’ critical thinking.
A PBBL model for developing undergraduate students’ critical thinking which is consisted of four components:

1. **PBBL model principles**

PBBL model principles consist of six components:

1) **Blended learning system**

The blended learning system consist of two components which include 1.1) web-based learning based on self pace e-Learning and live e-Learning and 1.2) traditional classroom (F2F classroom).

2) **Problem-based learning and teaching**

The problem-based learning and teaching consist of ten stages which include 2.1) the study of content, 2.2) the presentation of situation, 2.3) the clarification of terms and concepts, 2.4) the definition of problem, 2.5) the development and sequence of hypothesis, 2.6) the formulation of learning objectives, 2.7) the collection and validation of new information, 2.8) the synthesis of information, 2.9) the identification of generalization and principles, and 2.10) the implementation of knowledge.

3) **Activities to develop critical thinking**

An activities to develop critical thinking consist of six stages which include 3.1) identification and clarification of the problem, 3.2) collection of information, 3.3) analysis and evaluation of the evidence, 3.4) consideration alternatives and implications, 3.5) selection and implementation of the best alternative, 3.6) Conclusion.

4) **Interaction on web**

The Interaction on web consist of four components which include 4.1) Learner -Content, 4.2) Learner- Learner, 4.3) Learner -Instructor, 4.4) Learner-Interface.

5) **Learner’s roles**

For the theoretical class, students studied through web-based instruction using self place e-Learning and live e-Learning in group learning. For the practical class, participation in traditional classroom (F2F), students shall be eager to find out the answers and present solutions to resolve the problem assigned by the instructor using their own knowledge, learning interchangeably side-by-side, brainstorm for hypothesis, make discussions and investigations for appropriate resources to resolve the problem.

6) **Teacher’s roles**

The teacher have a role to manage the class, assess understanding and process, give feedback on learning log, monitor and give advice to students in the web board, encourage students to assess their own learning, and give formative and summative evaluation.

7) **Supportive resources on the web**

The supportive resources on the web consist of three components which include 7.1) presentation of situations to problem tool 7.2) communication tools 7.4) online resources

2. **PBBL model objectives**

The objectives of PBBL model to develop undergraduate students’ critical thinking consist of seven components:

2.1) Deductive
2.2) Semantics
2.3) Inductive
2.4) Credibility
2.5) Induction planning experiments
2.6) Definition
2.7) Assumption identification

3. **Instructional process of PBBL model**

The Instructional process of PBBL model consist of two stages:

3.1) **The Preparation stage**

1) Orientation
2) Practice
3) Learner grouping
4) Pre-test on critical thinking skills

3.2) **The Learning stage**

1) Study of content
2) Present the situation
3) Clarify the terms and concepts
4) Define the problem
5) Develop and sequencing the hypothesis
6) Formulate learning objective
7) Collect and validate new information
8) Synthesize information
9) Identify generalization and principles derived from studying this problem
10) Implementation of knowledge

4. **Learning evaluation**

Evaluation of undergraduate students’ critical thinking consist of seven components:

4.1) Deductive
Part 2 instructional process of PBBL model for developing undergraduate students’ critical thinking

Figure 3 instructional process of PBBL model for developing undergraduate students’ critical thinking.

<table>
<thead>
<tr>
<th>PBBL Stage</th>
<th>Method / Tools</th>
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<tbody>
<tr>
<td>Preparation stage</td>
<td></td>
</tr>
<tr>
<td>1. Orientation</td>
<td>- Method</td>
</tr>
<tr>
<td>- Teaching Assistant</td>
<td>- F2F Classroom: Lecture</td>
</tr>
<tr>
<td>- Student</td>
<td>- Tools</td>
</tr>
<tr>
<td>- Teaching handbook</td>
<td>- Learning handbook</td>
</tr>
<tr>
<td>2. Practice</td>
<td>- Method</td>
</tr>
<tr>
<td>- F2F Classroom: Demonstration, Drill and practice</td>
<td>- Tools</td>
</tr>
<tr>
<td>- LMS</td>
<td>- Computer Lab</td>
</tr>
<tr>
<td>- Teaching handbook</td>
<td>- Learning handbook</td>
</tr>
<tr>
<td>3. Learner grouping</td>
<td>- Method</td>
</tr>
<tr>
<td>- F2F Classroom</td>
<td>- Tools</td>
</tr>
<tr>
<td>- LMS: Web board</td>
<td>- Online Learning: Online testing</td>
</tr>
<tr>
<td>4. Pre-test on critical thinking skills</td>
<td>- Tools</td>
</tr>
<tr>
<td>- LMS: Pretest in critical thinking (Cornell Critical Thinking test, Level Z)</td>
<td></td>
</tr>
<tr>
<td>Learning stage</td>
<td></td>
</tr>
<tr>
<td>1. Study of the content</td>
<td>- Method</td>
</tr>
<tr>
<td>- Theoretical content</td>
<td>- Online Learning: Self pace e-Learning</td>
</tr>
<tr>
<td>- Practical content</td>
<td>- Tools</td>
</tr>
<tr>
<td>- LMS: Online content</td>
<td>- F2F Classroom</td>
</tr>
<tr>
<td>- Method</td>
<td>- Tools</td>
</tr>
<tr>
<td>- Computer Lab</td>
<td>- LMS: Problem situation webpage</td>
</tr>
<tr>
<td>2. Present the situation</td>
<td>- LMS: Web board</td>
</tr>
<tr>
<td>- Computer Lab</td>
<td>- LMS: small group chat room</td>
</tr>
<tr>
<td>3. Clarify the terms and concepts</td>
<td>- Method</td>
</tr>
<tr>
<td>- Online Learning: Live e-Learning, e-Brainstorming</td>
<td>- Tools</td>
</tr>
<tr>
<td>- LMS: Web board</td>
<td></td>
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### PBBL Stage Method / Tools

<table>
<thead>
<tr>
<th>PBBL Stage</th>
<th>Method / Tools</th>
</tr>
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</table>
| 4. Define the problem | • Method  
  - Online Learning: Live  
  e-Learning, e-Brainstorming  
• Tools  
  - LMS: Small group chat room  
  - LMS: Web board  
  - LMS: Online question assignment 1 define the problem |
| 5. Develop and sequencing the hypothesis | • Method  
  - Online Learning: Live  
  e-Learning, e-Brainstorming  
• Tools  
  - LMS: Small group chat room  
  - LMS: Web board  
  - LMS: Online question assignment 2 develop and sequencing the hypothesis |
| 6. Formulate learning objective | • Method  
  - Online Learning: Live  
  e-Learning, e-Brainstorming  
• Tools  
  - LMS: Small group chat room  
  - LMS: Web board  
  - LMS: Online question assignment 3 formulate learning objective |
| 7. Collect and validate new information | • Method  
  - Online Learning: Live  
  e-Learning, e-Brainstorming  
• Tools  
  - LMS: Small group chat room  
  - LMS: Web board  
  - LMS: Online question assignment 4 collect and validate new information |
| 8. Synthesize information | • Method  
  - Online Learning: Live  
  e-Learning, e-Brainstorming  
• Tools  
  - LMS: Small group chat room  
  - LMS: Web board  
  - LMS: Online question assignment 5 synthesize information |
| 9. Identify generalization and principles | • Method  
  - Online Learning: Live  
  e-Learning, e-Brainstorming  
• Tools  
  - LMS: Small group chat room  
  - LMS: Web board  
  - LMS: Online question assignment 6 identify generalization and principles |
| 10. Implementing of knowledge | • Method  
  - F2F Classroom: Classroom discussion, Oral presentation  
• Tools  
  - LMS: Small group chat room  
  - LMS: Web board  
  - Computer Lab |

**Evaluation stage**  
[after 11 weeks]  
Post-test on critical thinking skills

### Part 3 the result of implement a PBBL model for developing undergraduate students’ critical thinking

The results of using a PBBL model with 40 undergraduate students from the Electronic Media Production for Education course at the Faculty of Education, Chulalongkorn University studied via web with PBBL model for 11 weeks are as follows:

1. Undergraduate students’ posttest score in critical thinking ($\bar{x} = 41.00$, $S.D. = 6.70$) were significantly higher than pretest score in critical thinking ($\bar{x} = 30.03$, $S.D. = 8.85$) at .01 level. The instruments used to assess undergraduate students critical thinking was Cornell Critical Thinking Test Level Z.

2. Undergraduate students had the opinion that the PBBL process was appropriate in the high level and that the PBBL process would help undergraduate students to develop knowledge, critical thinking skill, problem solving skill and skill in information technology and communication.

### CONCLUSION

A PBBL model to develop undergraduate students’ critical thinking consisted of principle, objective, instructional process and evaluation. The instructional process of the PBBL model is divided into two main stages: the preparation stage and the learning stage. The findings from this study appear to provide strong support for
the premise that a problem-based learning and teaching approach delivered using blended learning involving web based instruction and face to face instruction could provide strong supports for develop undergraduate students’ critical thinking skills and PBBL processes would help undergraduate student to develop knowledge and skills in information and communication technology.

REFERENCES


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