The Development of Project-Based Learning through ICT Media to Enhance Problem Solving Ability in an E-Book Creation Course for Junior High School Students

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Abstract
This research was aimed 1) to develop and evaluate the quality of Project-Based Learning (PBL) through ICT media to enhance problem solving ability in an E-Book creation course for junior high school students, 2) to evaluate the efficiency of the PBL through ICT media, 3) to study the effectiveness after using the PBL through ICT media, 4) to evaluate the problem solving ability after learning from the developed PBL through ICT media, 5) to evaluate the projects of students who learned from the developed PBL through ICT media, and 6) to examine the students’ satisfaction towards the PBL through ICT media to enhance problem solving ability. The sampling group consisted of 40 junior high school students in the second semester of the academic year 2011 from Banchongchang School, Tambon Prupree, Bannasarn District, Surat Thani Province. There were 3 phases for research as in 1) conceptual study, 2) model development of learning process and 3) development of learning process. The research results were as follows: 1) the quality of the PBL through ICT media as assessed by experts in contents was 4.63 on average with S.D. of 0.48 or at very good level and the quality as assessed by experts in media was 4.67 with S.D. of 0.48 or at very good level; 2) the effectiveness of the PBL was 83.17/82.17, higher than the criteria of 80/80; 3) the index of efficiency was 0.72 and the average posttest score was higher than the average pretest score with index of efficiency at 64.00%; 4) the result from the project assessment was 4.53 with S.D. of 0.48 or at very good level; 5) the students’ satisfaction towards the PBL through ICT media to enhance problem solving ability was at the highest level. It could be concluded that the developed Project-Based Learning through ICT media to enhance problem solving ability in an E-Book creation course for junior high school students could be used in actual classroom.

Keywords
Project-Based Learning through ICT media, Problem solving ability, E-Book

1. Background and Significance
Information technology system has changed the learning form and the sources of knowledge as nowadays all people can learn and learning is not limited inside classroom anymore; learning can take place anywhere, even homes can be a learning place if there is a good information communication system [1].

The National Education Act B.E. 2542 (1999) (Second Amendment in B.E. 2545 (2002) Chapter 9 Section 66 focuses on the rights of learners to increase their potential to use educational technology in their learning. This will give opportunities to students to gain knowledge and skills to search for knowledge on their own all their life. Therefore, instruction through online network has become more important at the present time [2].

The results from the course in E-Book Creation of Banchongchang School in the academic year 2010 showed that the learning achievement of students was at acceptable level and lower than the requirements. This might be due to the learners, instructional style and the nature of the subject. However, one major problem was about the fact that students lacked of analytical thinking skill for synthesis, critical thinking and problem solving ability.

Project-Based Learning (PBL) to enhance problem solving ability will provide learners with direct experiences. Learners will learn to think, solve the problems, work in a systematic manner, make plans, analyze and learn by themselves. To teach students to think, do and solve problems by themselves is the heart of instruction at all levels because modern societies are intended for learning. Each day is full of information which requires thinking process and thorough analysis to make a right decision and utilize it to the maximum. Teaching students to think, therefore, is important for education because it can make learners grow in many aspects as in intellectual, social, emotional, moral and ethical dimensions so that they become good citizens in the society happily [3].
Therefore, the researchers who taught the E-Book Creation course decided to develop PBL to enhance problem solving ability in the course with the hope that it could help students reach the required learning achievement and to the benefits of students who need to realize their potentials to live in a society happily.

2. Research Objectives

1. To develop and evaluate the quality of Project-Based Learning (PBL) through ICT media to enhance problem solving ability in an E-Book creation course for junior high school students
2. To evaluate the efficiency of the developed PBL through ICT media to enhance problem solving ability in an E-Book creation course for junior high school students
3. To examine the effectiveness of learners who learned from the developed PBL through ICT media to enhance problem solving ability in an E-Book creation course for junior high school students
4. To evaluate the problem solving ability of students who learned from the developed PBL through ICT media to enhance problem solving ability in an E-Book creation course for junior high school students
5. To evaluate the projects of students who learned from the developed PBL through ICT media to enhance problem solving ability in an E-Book creation course for junior high school students
6. To examine the students’ satisfaction towards the PBL through ICT media to enhance problem solving ability in an E-Book creation course for junior high school students

3. Research Hypotheses

1. The quality of the Project-Based Learning (PBL) through ICT media to enhance problem solving ability in an E-Book creation for junior high school students would be at good or higher level.
2. The efficiency of the developed PBL through ICT media to enhance problem solving ability in an E-Book creation for junior high school students would be at the criteria of 80/80.
3. The effectiveness of learners who learn from the developed PBL through ICT media to enhance problem solving ability in an E-Book creation for junior high school students would show index of efficiency higher than the .05 level.
4. The students who learned from the developed PBL through ICT media to enhance problem solving ability in an E-Book creation for junior high school students would show higher learning achievement from the posttest than the pretest with statistical significance at the .05 level.
5. The results from the assessment of projects made by students who learned from the developed PBL through ICT media to enhance problem solving ability in an E-Book creation for junior high school students would be at good or higher level.
6. The students would express high or higher satisfaction towards the developed PBL through ICT media to enhance problem solving ability in an E-Book creation for junior high school students.

4. Research Scope

The scope of this study on the PBL through ICT media to enhance problem solving ability in an E-Book creation course for junior high school students was as follows.

4.1 Population

The population in this study consisted of 40 junior high school students in the second semester of the academic year 2011 from Banthongchang School, Tambon Prupree, Bannasarn District, Surat Thani Province [5].

4.2 Tools used in this study

The tools used in this study consisted of 1) the PBL through ICT media to enhance problem solving ability in an E-Book creation course for junior high school students, 2) the quality assessment form for the PBL through ICT media, 3) the efficiency assessment form for the PBL through ICT media, 4) the pre-test and post-test to find out the index of efficiency, 5) the problem solving ability assessment form, and 6) the questionnaire on learners’ satisfaction towards the PBL through ICT media.

5. Research Design

The research design for the PBL through ICT media to enhance problem solving ability in an E-Book creation course for junior high school students followed 3 phases.
1. Conceptual study for the PBL through ICT media to enhance problem solving ability in an E-Book creation course for junior high school students
2. Model development of learning process for the PBL through ICT media to enhance problem solving ability in an E-Book creation course for junior high school students
3. Development of learning process for the PBL through ICT media to enhance problem solving ability in an E-Book creation course for junior high school students

According to such phases, the PBL through ICT media to enhance problem solving ability in an E-Book creation course for junior high school students could be shown in the Figure below.

6. Research Results

The research results about the PBL through ICT media to enhance problem solving ability in an E-Book creation course for junior high school students could be described in terms of the development, the quality, the effectiveness, the index of efficiency, the problem solving ability and the population’s satisfaction.

6.1 The development of the case-based online instruction

The PBL through ICT media to enhance problem solving ability in an E-Book creation course for junior high school students was developed and there were several components which were pretest, lesson contents, learning resources, activities for revision, project activities, problem solving ability and posttest. These were shown in Figure below.

Table 1 Mean score of the quality in terms of contents and media presentation for the PBL through ICT media
6.2 Results from the quality assessment

The quality assessment from the experts in contents and the experts in media presentation for the PBL through ICT media to enhance problem solving ability in an E-Book creation course for junior high school students could be described according to the Table below.

<table>
<thead>
<tr>
<th>Item</th>
<th>X</th>
<th>S.D.</th>
<th>Meaning</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Contents</td>
<td>4.63</td>
<td>0.48</td>
<td>Very Good</td>
</tr>
<tr>
<td>2. Media presentation</td>
<td>4.67</td>
<td>0.48</td>
<td>Very Good</td>
</tr>
</tbody>
</table>

According to Table 2, the effectiveness of the PBL through ICT media to enhance problem solving ability in an E-Book creation course for junior high school students yielded the E1/E2 value of 83.17/82.17, higher than the criteria of 80/80.

6.4 Results about the index of effectiveness

The index of efficiency for the PBL through ICT media to enhance problem solving ability in an E-Book creation course for junior high school students was measured using the pre-test score and the post-test score and it was shown below.

<table>
<thead>
<tr>
<th>Score</th>
<th>Pre-test</th>
<th>Post-test</th>
<th>E.I.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Percentage</td>
<td>44.58</td>
<td>79.92</td>
<td>0.64</td>
</tr>
</tbody>
</table>

According to Table 3, the learning results from the PBL through ICT media to enhance problem solving ability in an E-Book creation course for junior high school students yielded the index of efficiency of 0.64. This means that the learners increased their knowledge by 64%.

6.5 Results about the problem solving ability

The results about the problem solving ability of students after using the case-based online instruction on social network to enhance problem solving ability in robot control were shown in Table 4.

According to Table 4, the average pre-test score was 13.38 and the average post-test score was 23.98. It could be said that the post-test score was higher than the pre-test score with statistical significance at the .05 level.

6.6 Results about the assessment of projects done by students

The results about the assessment of projects done by students could be grouped into 5 categories as in 1) observation of working behaviors of students as a group, 2) assessment of their report and proposal, 3) project operation, 4) project report and 5) project presentation. The data were shown in Table 5.

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Table 2 Results from the effectiveness measurement

Table 4 Average scores of the population in terms of their problem solving ability
verification and reflection. This means the learners could

In 4 steps of
Principles of Department of Curriculum and Instruction Development which are 1) problem analysis, 2) problem solution operation, and 4) project presentation. This means the learners could

The learners could increase their problem solving ability by 72%. This is because the researchers followed 4 steps of problem solving ability in an E-Book creation course for junior high school students showed that it was 0.72 or the learners increased their problem solving ability by 72%. This is because the researchers followed 4 steps of

mean score of 4.53 with S.D. of 0.65. In other words, their work was at the highest level. This is because the PBL through ICT media was developed in accordance with the systematic plan as in 1) instructors would create problem situations in the context; 2) instructors and students plan their work; 3) creative ways are proposed to solve problems; 4) projects are presented and 5) projects are assessed. To do so with ICT media requires the coverage for various domains which are intellectual, affective and skill so that learners become those with ability and those who can work in a team to help one another. This is similar to the research by Amphai Orsuwan [7] in that students with Project-Based Learning environment with statistical significance at the .01 level.

7.2 The assessment of projects done by students

The results from the assessment of projects done by students showed that the projects done by students were assessed with mean score of 4.53 with S.D. of 0.65. In other words, their work was at the highest level. This is because the PBL through ICT media was developed in accordance with the systematic plan as in 1) instructors would create problem situations in the context; 2) instructors and students plan their work; 3) creative ways are proposed to solve problems; 4) projects are presented and 5) projects are assessed. To do so with ICT media requires the coverage for various domains which are intellectual, affective and skill so that learners become those with ability and those who can work in a team to help one another. This is similar to the research by Amphai Orsuwan [7] in that students with Project-Based Learning environment with statistical significance at the .01 level.

8. Suggestions

8.1 Suggestions for application in classroom instruction

1. Project-Based Learning or PBL allows learners to search for knowledge and seek meaning from the problems in order to find the answers on their own. In this way, learners will change the way they perceive the world and they can see the relationship between facts and learning through group works. This leads to the discovery of the way to learn things by themselves. Students are also encouraged to express themselves, show virtues and be patience as well as forgive others' mistake. Instructors can then use PBL in other subjects such as sciences.

2. According to the results about the problem solving ability, students could solve the problems according to 5 problem situations and as such learners could increase their learning ability through systematic problem solving skill. Therefore, instructors could use this approach in assessing their problem solving ability in the future.

3. ICT media is suitable for collaborative learning and self-study because it can make learning faster. Therefore, ICT media should be more encouraged to be used in

<table>
<thead>
<tr>
<th>Table 5</th>
<th>The learners’ satisfaction towards the PBL through ICT media</th>
</tr>
</thead>
<tbody>
<tr>
<td>Item</td>
<td>μ</td>
</tr>
<tr>
<td>1. Observation of working behaviours of students as a group</td>
<td>4.60</td>
</tr>
<tr>
<td>2. Assessment of their report and proposal</td>
<td>4.48</td>
</tr>
<tr>
<td>3. Project operation</td>
<td>4.50</td>
</tr>
<tr>
<td>4. Project report</td>
<td>4.20</td>
</tr>
<tr>
<td>5. Project presentation</td>
<td>4.87</td>
</tr>
<tr>
<td>Total Average</td>
<td>4.53</td>
</tr>
</tbody>
</table>

According to Table 5, the results from the assessment of projects done by students were the highest. In other words, the interpretation of the score shows that their work was at the highest level.

6. Results about the learners' satisfaction

The learners’ satisfaction towards the PBL through ICT media was measured and shown in the following table.

<table>
<thead>
<tr>
<th>Table 6</th>
<th>The learners’ satisfaction towards the PBL through ICT media</th>
</tr>
</thead>
<tbody>
<tr>
<td>Item</td>
<td>μ</td>
</tr>
<tr>
<td>Learners’ satisfaction</td>
<td>4.58</td>
</tr>
</tbody>
</table>

According to Table 5, the learners’ satisfaction towards the PBL through ICT media was the highest. In other words, the interpretation of the score shows that their satisfaction was at the highest level.

7. Discussions

The PBL through ICT media to enhance problem solving ability in an E-Book creation course for junior high school students could be discussed as follows.

7.1 The problem solving ability of learners

The results about the index of efficiency of learners who used the PBL through ICT media to enhance problem solving ability in an E-Book creation course for junior high school students showed that it was 0.72 or the learners increased their problem solving ability by 72%. This is because the researchers followed 4 steps of

<table>
<thead>
<tr>
<th>Mean</th>
<th>Mean</th>
</tr>
</thead>
<tbody>
<tr>
<td>Difference</td>
<td>Difference</td>
</tr>
<tr>
<td>10.60</td>
<td>4.454</td>
</tr>
<tr>
<td>15.053*</td>
<td>39</td>
</tr>
<tr>
<td>0.000</td>
<td></td>
</tr>
</tbody>
</table>

* statistically significant at the .05 level

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3. ICT media is suitable for collaborative learning and self-study because it can make learning faster. Therefore, ICT media should be more encouraged to be used in
educational institutions so that they meet the demands of learners and as a way for those who would like to do self-study to meet the individual differences.

8.2 Suggestions for further studies

1. There should be a comparative study between traditional learning and ICT media learning in the subject area of problem solving ability from this study on the PBL through ICT media to enhance problem solving ability in an E-Book creation course for junior high school students.

2. There should be a comparative study of problem solving ability between ICT media, Project-Based Learning, problem solving approach by Department of Curriculum and Instruction Development for other subjects such as sciences, mathematics, Thai and occupations.

3. There should be a study of learners in other aspects such the impact of ICT media on critical thinking, creative thinking and originality.

9. References


[7] Orsuwan, A. 2011. A Comparative Study of Learning Achievement between English Language and Management Skill of Grade 8 Students through Project-Based Learning and Traditional Instruction, a Master’s dissertation in Instructional Principles, Rajabhat University Ayuthaya.