Creation of Problem-based Learning Package in "Water Resoures" for High School Students in Samoeng Pitthayakhom School, Chiangmai Province, Thailand

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ABSTRACT

The objective of this research was to create a learning activity package using problem - based learning (PBL) in the topic of water resource. The study explored the effectiveness of the package for learning achievement in the Sciences class, and the satisfaction of high school students for participating in the application of the package, at Samoeng Pitthayakhom School, Chiang Mai province, Thailand. The results showed that the score of effectiveness of the learning package was 75.88/75.11, which was higher than the critical set point. The students' learning achievement was higher than the previous test at a statistical significance level of .05, and the level of students' satisfaction was in high score with an average of 3.91. This research could be applied to the learning activities of Sciences subject, scientific projects, and independent studies (IS) of the students. Moreover, this research had recently won the 3rd place in the Science Project Competition at the 64th Northern OBEC 2014.

Keywords: Achievement, Learning effectiveness, Learning activity package, Sciences

Introduction

In the world of knowledge, theories can be changed and adapted to the new discovered fact. An important tool to archive those changes is a skill of students to review related information coupled with an ability to analyse such changes. In this regard, the students can then be applied these changes to their lives indefinitely. There is such a technique that centralizes the student-based learning methodology which is called Problem-Based Learning (PBL).PBL is a event or problem-based learning system. Regarding this, the students learn how to solve, think and discover supplementary information to understand basic and advanced explanations of phenomenon or events. Students are classified into small groups with a chair person and a secretary and take turn by other members round by round. Such classification yields a cooperative working environment that supports students to plan for discovering the problem origins, making a hypothesis and testing the hypothesis. Furthermore, the students will have an ability to search for additional information and present to the group, leading to conclusions. Teachers prepare supplementary problems that meet all of learning subjects as well as learning materials and resources without giving any information or guiding students how to discover the answers. Gallagher (2001:180) defines the PBL as a

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study that students learn from problems. Students use cooperation skills to find out how to solve the problem. They also combine their knowledge and problem-solving methods altogether. The problems are daily life-related and in accordance with the students' living. PBL will develop the student's learning skills rather than the core of knowledge that leads students to be a self-supported knowledge function.

Referring to this, this research created a PBL learning activity package with the title of "Water Resources" for the Department of Sciences, at the high-school level. This research was designed to study the effectiveness of PBL-suite application, the students' learning achievement and satisfaction. After this, the authors hope this PBL-suite is to be one of the tools that can support students' ability to think critically, take actions and solve problems on their own as well as for their community. This PBL-suite should also lead students' self-support in academic susceptibility.

Methodology

The population were 401 of high school students in Samoeng Pittayakom School, Chiang Mai, Thailand in the first semester of year 2014. Thirty samples were randomly chosen for a PBL-suite test. The tools to archive the research objective are listed in the following:

1. The PBL-suite which was classified in to 4 activities:
   1.1 What contaminates the water
   1.2 Chemical contamination of agricultural process
   1.3 Determination of dissolved oxygen
   1.4 Water resource survey

The period of learning was designed to 20 hours, starting from the 1st semester of year 2014. The package was validated by individual and group tests including the field experiments

2. Thirty items multiple-choiced test papers of "Water Resources" was implemented. Each item was tested for validity by being assessed one-sampling group of 80 high school students. The assessment showed difficulty (p-score) between 0.20-0.80 and classifier (r-score) more than 0.2. The test paper had the reliability of 0.71 when calculated with the KR-20 of Kuder-Richardson.

3. A Satisfaction of the PBL package assessment form which included ten items was tested for validity. The reliability test was 0.82 as calculated by the Cronbach's alpha method.

4. A lesson plan entitled "Water resource" that consisted of 5 learning units. All learning units were tested for validity by reviewers and supervisors before its use in the research.

Experiment

The research used a quasi experimental design and one-group pretest-posttest for testing the samples. Before the use of PBL package, the students were asked for the pretest. After that, the PBL was applied to the students in accordance with the standard of the Department of Educational Standardization and Academic Development. The PBL-suite met 6 criteria that confirmed the students' learning progress.. Finally, the students were asked for the posttest and for determining their satisfaction in the learning package.

The method for analyzing the effectiveness of learning achievement and the effectiveness of output (E1/E2) were then carried out via using the percentage of pretest and posttest scores. The independent t-test and the students' satisfaction score were then used to analyze a difference in a mean average, together with standard deviation scores.

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Results and discussion

The statistical analyses were divided into 3 parts following the objectives of the research.

Part 1. Effectiveness of PBL Learning Package

The package which was implemented for the students had the effectiveness (E1/E2) of 75.88/75.11, and that was higher than the specified standard (75/75). This PBL suite was mostly instructed to the process rather than knowledge. Then, the specified criteria was met at 75/75 by Chaiyong's (1977) calculation [Chaiyong:1977,139]. This PBL suite had E1/E2 difference less than 5%, which indicated that the package was designed and developed in valid, congruent and good quality. Furthermore, the PBL activities showed the balance of pretest and posttest that indicated similar difficulties. The results also complied with Ramphueng (2014), in which the author created and studied an activity series in "Scientific Skill and Process" for grade 10 students of Chiang Mai Rajabhat University Demonstration School. The research also complied with Pichabhob (2013) who created and studied an activity series entitled "Force and motion" for grade 9 students, Waree school, Chiang Mai, Thailand. The problem-based learning in the topic of "Water Resources" yielded the students for them having their own ability to develop and search for their own information to solve problems and apply their knowledge to live in daily life. This also complied with Pacharin (2010) who studied and developed the Biology problem-based activities and applied to grade 10 students in Pra Prathom Wittayalai, Nakorn Prathom, Thailand in the topic of "Basic Chemistry in Living Organisms"

Table 2: Effectiveness(E1/E2) of PBL Learning Package

PBL title	Formative-summative Assessment (E_1/E_2)	Criteria (E_1/E_2)
"Water resource" PBL , Sameong Pittayakom School, Chiang Mai, Thailand	75.88/75.11	75 /75

Part 2: PBL Learning Achievement

The pretest and posttest scores before and after the PBL package was applied resulted in a mean average of 13.87 and 22.53, respectively. When comparing the pretest and posttest scores in a t-test, it was found to have a statistical difference with the significance level of .5 (Table 3). The calculated t score (14.69) was higher than the critical t score (1.699) at .05 level of significance. Thus, the test for hypothesis was accepted. This complied with Wannapa (2010), who studied the relationship between PBL and the students' scores of Sciences tests and solving ability for grade 7 students in Thung Pho Wittaya, Uthai Tani, Thailand.

From the experiment, it was found that the posttest score was higher than the pretest one. The result indicated that the students could achieve their objectives as noted in a learning plan. It was also found that the clear objective and course design indicated three

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behavior of the students, including cognitive, phychomotor, and affective domains. The PBL package also let the students to have activities that they could pay more attention and cooperation in sharing, solving, critically thinking and taking actions. Then, their knowledge was grounded and congruent. The PBL suite also complied with the course design that led the students to work together in groups and turn the members of their group into a chair person. This also made the students pay more attention in their role and responsibilities as a leader and a follower. The activities were designed to suit for their age, knowledge and abilities.

Table 3: Learning Achievement before and after PBL Learning Package Application

Test		S.D.	t
Pre	13.87	3.52	14.69*
Post	22.53	2.10	

* Confidential level .05 $*t_{0.05\ df=29} = 1.6991$

Part 3. Students' Satisfaction in PBL Learning Package

Satisfaction of the students after applying the PBL package into the course was found to be high. The calculation of an average mean score was 3.91 with 0.36 S.D. When classified in items, the item with highest satisfaction was "Students have fun in activities and learn how to work in group" with the score of 4.77. The second was "Promote students to learn from real phenomenon in community" with the score of 4.67. While the least score was "Students have independent studies with a chance to exchanging and sharing their information" with the score of 3.40. High scores of satisfaction might be from the activities letting the students taking actions and doing experiments. These led the students to get their idea easily without feeling bored. Jiraporn (2002) concluded that when applying such activities to the students, they would be more satisfied. Teachers should also provide supplementary facilities, including learning atmosphere, events, lecture techniques and cooperation between teachers and students. The course design should also have an open scheme that let students make a lesson plan along with the teacher, as well as also make an opportunity to the students to share and interact with each other, including sharing honor and rewards. The students were then be honored for their achievement. Aree (2002) noted in her research that the students paid more attention and actively took participation in the activities delightfully, due to the course design leading the students to take actions in real experiments with the provided materials and equipments. Instead of feeling bored in the Sciences class, the students had fun in such activities and felt proud to present their new discovered conclusions or their own answers. These reinforced the students' ability in learning Sciences and discovering advanced knowledge.

The designed PBL package met the students' satisfaction. These achievements were due to the suitable design of the learning package that suited their age, knowledge and their abilities. The package was designed to meet their everyday life. When applying this to the students, they were honored and felt proud.

Conclusion

An effectiveness of the PBL package entitled "Water Resources" for the high school students had an effectiveness of 75.88/75.11, and yielded a higher value than that of the

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specified criteria 75/75. The learning achievement score of the posttest was higher than the pretest at the 0.05 level of significance. The students were satisfied with the package with an average mean score of 3.91, and 0.36 standard deviation. The designed PBL package suited the students age, knowledge and abilities and was also related to their everyday life.

Suggestion

1. This PBL package may be applied to students in other levels and also may be announced for the use in local school courses.
2. The PBL package can be applied to other learning topics such as soil, air, or other topics related to students surroundings and interests.
3. The PBL may involve with communities. People in the community may have a chance to share and help to sustain the learning.

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