
The Implementation of Problem Based Learning Model to Improve Students' Learning Outcome of Logic and Set of FKIP Mathematics Education Study Program, University of Riau

Syofni

University of Riau

syofni@lecturer.unri.ac.id

Abstract - This is a classroom action research which aims to improve students' learning outcome by improving the learning quality which is done by implementing Problem Based Learning model in logic and set subject. This model is chosen because at the beginning of the learning, the students are given problem which expected to encourage the students in learning and motivate them to identify their initial abilities. Students' learning outcomes are said to be improved if at low and very low interval the frequency of students' decreases from SD to SUTS and to SUS, or at high and very high intervals the frequency of students' increases from SD to SUTS and to SUS. There are decreases in the number of students at very low score intervals from 10 students at the basic score to 5 students at the middle exam. Meanwhile, at the very high score intervals there are improvements from 3 students at the basic score to 8 students at middle exam and to 10 students at the final exam. Therefore, it can be concluded that Problem Based Learning model is successfully improved students' learning outcome of logic and set of FKIP mathematics education study program, university of Riau.

Keyword: Problem Based Learning Model; Classroom Action Research

1. Introduction

Students' active participation plays a vital role for an effective learning activity. It means that the entire student must be involved (Slamet, 1999; 145) and they must actively engage in the teaching learning process (Bruner, XXXX). This active participation will be achieved if it is carried out by discovering (Hudoyo, 1983;17). By trying to discover there will be a satisfaction which motivate the students to face the upcoming assignments. Soedijarto (1981; 13) states that the only significant school variable which decides students' success is the level of students' active participation in the teaching learning process. Learning, according to the notion of learning in quality of higher education book, is one's effective effort which is done consciously to change his/her own behavior (Slamet, 1999, 127).

Lecturers' major responsibility toward their students is conducting the teaching learning activities which means they have to teach their students and to make the students experiencing the learning process. There are many alternatives to make the students learn, yet no particular best way to face all kind of situations. Therefore, it becomes the lecturers' responsibility to find a strategy that suit students learning needs.

1.1. Learning Based on Constructivism Views

According to constructivism theory which its word alone derived from the word "to construct", ones should be able to construct his/her own knowledge. A knowledge which cannot be merely transferred to another, but should be interpreted by him/herself (Baharudin & Nur, 2007).

Learning must be packaged into a process which constructs the knowledge that the students create in their mind as a result of an interaction between their senses with the world. Students need to get accustomed to overcoming problems, discovering something which beneficial for themselves and wallowing with ideas, since lecturer will not be able to provide all the knowledge they need. Students' active participation during the teaching learning process encourages them to create their own knowledge which leads to students-centered learning (Baharudin & Nur, 2007).

Piaget and Vigotsky (in Baharudin & Nur, 2007) emphasize that it is necessary to put a social nature of learning and they suggest to have a learning group. It means that the students must collaboratively construct the knowledge together with their friends.

The principles of constructivism according to Mudjiman (in Fajaroh & Dasna, 2008) are as follows: (1) the students' actively construct the knowledge; (2) the learning pressure relies on the students; (3) teaching is a process of assisting the students; (4) the pressure tends to the process not to the product; (5) the curriculum emphasizes on the students' participation; and (6) teacher is a facilitator.

1.2. Problem Based Learning Model (PBLM)

Rosyidi and Marjono (2008) state that learning model is a conceptual frame which envisages the systematic procedure in organizing teaching learning experience to achieve a particular learning objective which used as a teacher's guidance. The selection of a suit learning model will ease the process of achieving the objectives. In line with that, Suprijono (2009) categorized learning model into 3 parts namely direct learning model, cooperative learning model and problem based learning model.

Problem based learning (PBL) is a learning model which begins by giving a problem to the students. Usually, the given problem will be related to the real world or authentic. Collaboratively with the group, the students formulate the problem and identify their level of knowledge, search and learn the related material individually before reporting the solution of the problem (Rusman, 2015). Sani (2015) argues that PBL is a learning model which the delivery is conducted by presenting a problem, purposing questions, facilitating investigation and opening dialog. The discussed problem should be a contextual problem which students can find in their daily life.

Fathurohman (2016) proposes that PBL model uses a real world problem as a trigger for the students' learning process before knowing the formal concept. The students critically identify the relevant information and strategy along with conduct an investigation to solve the problem. In this matter, Suyadi (2013) states that PBL involves the students in an active and collaborative learning process, and students-centered learning oriented so the students are able to develop the ability to solve the problem individually. PBL also can be started by conducting a group activity, such as individual investigation and discovery also solve a problem under the facilitator supervision.

As stated by Sakur, et al (2006) PBL can activate the students in learning process this model prioritize the students activity in discovering a problem, analyzing, and reporting the information from various obtained sources. PBL also encourages the students to improve their motivation in group work in solving a contextual problem. This model helps the students to develop students' active thinking in finding a problem's solution through data investigation which leads to a rational and authentic solution for the problem.

According to aforementioned elaboration, it can be concluded that PBL is a learning model which started by giving a problem where the problem itself can be found in the students daily life and the students are forced to actively participate or the so called students-centered learning. Moreover, PBL is stressed to the process of solving the problem.

Trianto (2010) states the objective of PBL is to help students in developing their thinking and problem solving skill, learning adult authentic role and becoming an independent learner. To add, Rusman (2015) also declares the objectives of PBL are to master learning materials from heuristics discipline and develop problem solving skill. PBL also relates to life wide learning, skill to use information, collaborative team learning, reflective and evaluative thinking skill. So, the objectives of PBL are to help the students develop their thinking and problem solving skill which leads to the development of collaborative learning.

The main characteristic that distinguishes one learning model from another is the special characteristics of the learning model. Rusman (2015) states the characteristics of the PBL model are as follows: (1) problem is the learning starting point; (2) problem is raised according to real world unstructured problem; (3) problem needs multiple perspectives; (4) problem challenges students' current knowledge, attitude and competence which need identification of learning needs; (5) learning self-direction becomes the main thing; (6) the use of diverse sources of knowledge, their use, and evaluation of information sources is an essential process in problem based learning; (7) learning is collaborative, communication, and cooperative; (8) the development of inquiry and problem solving skills is as important as mastering the contents of knowledge to find solutions to a problem; (9) synthesis and integration of a learning process; and (10) problem based learning involves evaluating and reviewing student experiences and learning processes.

The problem solving process is carried out through some stages of students and teacher activity. PBL has five stages which started with problem identification by the teacher and ended with presentation and data analysis by the students. These five stages are based on PBL syntax arranged by Rusman (2015) that is modified to PBL stages.

1. The stage of student orientation to the problem. At this stage, teacher explains the logistics needed and proposes a phenomenon or demonstration or story to solve the problem.
2. The stage of organizing the students to learn. At this stage, teacher helps the students to define and organize learning assignments which related to the problem.
3. The stage of guiding individual and group investigations. At this stage, teacher encourages students to gather appropriate information, carry out experiments to get explanations and problem solving.
4. The stage of developing and presenting the result. At this stage, teacher helps the students in planning and preparing a proper creation as the result of the learning assignment such as report, video, model also help them to share equal assignment with friends.
5. The stage of analyzing and evaluating the problem solving process. At this stage, teacher helps students to reflect or evaluate their investigation and the processes they use.

The Directorate General of Primary and Secondary Education Ministry of Education and Culture (2017) states that the steps of the PBL model are as follows:

1. Orienting students to problems. This stage is to focus students on observing the problem that is the object of learning.
 2. Organizing learning activities; Organizing learning is one of the activities in which students raise questions (or ask questions) on the problem being examined.
 3. Guiding independent and group investigations. At this stage students gather information / conduct experiments to obtain data in order to answer or solve the problem under study.
 4. Develop and present the work. Students' associate data found from experiments with various other data from various sources.
 5. Analysis and evaluation of the problem solving process. After students get answers to existing problems, then they are analyzed and evaluated.
-

In this study, researchers combined the opinions of Rusman and the Directorate General of Primary and Secondary Education of the Ministry of Education and Culture to compile learning steps with PBL. The learning phases that the author designed so that students can follow the PBL Model in Logic and Set lectures are as follows;

Phase 1. Student Orientation to Problems.

Students are asked to do the exercises at the end of each section, to create challenges for the material to be studied, increase curiosity, know the initial abilities of students

Phase 2. Organizing Students for Learning.

Students learn / construct independently the material / principles of the corresponding chapter, while finding answers to exercises or questions in Phase 1, which are carried out individually and in groups.

Phase 3. Guide Individual and Group Investigations.

In this phase students are asked to go back to doing exercises or questions in order to know the improvement in their ability to complete the exercise and will be able to motivate students to learn, because they can solve problems better. Students make important notes to be questioned in class discussions.

Phase 4. Develop and Present the Work.

Students and lecturers conduct class discussions to discuss the notes of the students' questions which have not been completed in phase 2. This phase will provide a lot of experience to students, which is able to increase the understanding of the principles learned.

Phase 5. Analyze and Evaluate the Problem Solving Process.

The final stage of this PBL, students complete the problems encountered starting from phase 1.

The aforementioned stages, will give the students a better learning experience, since the students face the problem repeatedly, so the constructivism learning process can be more meaningful.

1.3. Problem Based Learning Model Design with Constructivism Approach

An action is planned to implement the constructivism learning approach in problem based learning model. The action is divided into two cycles namely cycle 1 and cycle 2. The first cycle is carried out at the first half of the semester and the second cycle is carried out at the second half of the semester. Each of cycle is ended with a test which is midterm for the first cycle and final exam for the second cycle.

2. Research Methodology

This classroom action research is planned to have two cycles namely cycle 1 and cycle 2. Since this is an improvement of the learning practice research that has been done, it is expected to contribute toward the learning quality and improvement of learning outcomes at Set and Logic subject at the second semester academic year 2018/2019 in mathematics study program, majoring PMIPA FKIP university of Riau with 69 subjects.

2.1. Research Procedure

According to Kemmis and Mc. Taggart cited from Leo (2006) the cycle model in classroom action researcher has four components, namely:

1. Plans: "what" class action plans to do to improve, enhance or change thinking and as a solution. Plans include preparing learning scenario, student worksheets, learning outcomes tests and observation sheets.
2. Actions: what is done by lecturers or researchers who are looking for the desired improvement, improvement or change. Actions include motivating students in learning by implementing PBL. During learning students are grouped according to learning with PBL implementation.
3. Observation: replace the results or reactions of actions taken or imposed on students. observation is carried out simultaneously with the implementation of the action. The observation was carried out by all students who took the lecture. This is done because students are adults who do the learning and most know the needs of the learning they do.
4. Reflection: the researcher examines, sees and considers the results or considers various assessments. Reflection includes reviewing, seeing and considering the results of student observations in the form of student records of the learning process that pleases the weaknesses and weaknesses of action. Weaknesses and deficiencies of the action are corrected in the next cycle.

2.2. Data Analysis

For the purpose of answering questions in the formulation of the problem, there are two types of data analysis carried out, namely quantitative data analysis and qualitative data analysis.

Quantitative data analysis intended to answer the first problem formulation and see the success of the action. Data analysis was performed with **Descriptive Analysis of Basic Statistics (Average, Maximum Score, and Change of Score)**.

Average parameters, maximum scores, minimum scores and changes in scores from student learning outcomes obtained by basic scores (conventional learning), midterm scores (end of cycle 1) semester exam scores (end of cycle 2) are provided as a basis for stating improved learning outcomes. If there is an increase in the average, the maximum score of the minimum score and the number of students who have increased scores more than those who have decreased or remained, then it can be concluded an increase in student learning outcomes by applying the PBL Model.

3. Finding and Discussion

For the purpose of answering the formulation of the problem, there are two types of analysis carried out, namely quantitative data analysis and qualitative data analysis. Analysis of Learning Outcomes on the Basic Score (SD), UTS Score (SUTS) and US Score (SUS) To see an increase in student learning outcomes from before action to after action, by comparing the number of students who have increased scores with those who have decreased. If the number of students increases more than those that remain and decreases, it is concluded an increase in student learning outcomes. Following is a table about the number of students experiencing an increase, a constant and a decrease in elementary, SUTS and SUS.

Table 1. Frequency of Students Who Have Changes in Score

	D₁	D₂
Increased	48	50
Stagnant	5	6
Decreased	16	13

Following are the basic statistics of the learning outcomes of Algebraic Structure based on table 1 above, obtained in table 2.

Table 2. Basic Statistics Basic Scores (X1) and SUTS (X2) and SUS (X3)

No.	Statistic	X ₁	X ₂	X ₃
1.	Highest score	100	100	100
2.	Lowest Score	29	35	45
3.	Mean	59,33	65,3	73,01

From Table 2, it can be seen that the improved changes from SD to SUTS and to SUS, namely with the increase in the lowest score and the average score. The highest score for the three scores has reached the maximum score.

If the data in table 2 is presented in the form of a frequency distribution, Table 3 will be obtained as follows.

Table 3. Frequency Distribution of SD, SUS and SUS

No.	Score Interval	fX ₁	fX ₂	fX ₃	Category
1.	29 --- 40	10	5	0	Very Low
2.	41 --- 52	14	13	8	Low
3.	53 --- 64	20	15	9	Medium Min
4.	65 --- 76	18	22	28	Medium Plus
5.	77 --- 88	4	2	14	High
6.	89 --- 100	3	8	10	Very high
Total		69	69	69	

From Table 3. it can be seen that the reduction (decrease) in the number of students who scored at low and very low intervals, from 24 students to 18 students at the end of cycle 1 and decreased to 8 students at the end of cycle 2, with no one having a very low score . This shows that there are 6 students with low scores and very low scores who have moved to have a moderate minimum score. On the other hand, the number of students with high and very high scores increases at the end of cycle 1 and increases again at the end of cycle 2, from 7 to 10 students and to 24 at the end of cycle 2. Based on the description above it can be concluded that, an increase in learning outcomes students, after the PBL model implementation is carried out in the learning of Logic and Set subject.

3.1. Analysis of Learning Reflection Results by Students

Reflection on learning by students is done at the end of cycle 1. The results of student reflection on learning can be described as follows. From 69 students, only 65 students collected the observation sheets. Forty (60) of them said they agreed, strongly agreed and the learning was very good, only five (9) students said they disagreed. Almost all students said that learning in the second cycle was better than learning in the first cycle. There were 10 students who expressed satisfaction with the learning carried out and still hoped that the demonstration of solving problems directly by the lecturer would be reproduced.

The reasons given by students' indicate that they are very aware of the involvement and constructivist in learning is very important to do. The reasons given include; (1) increase learning readiness and responsibility; (2) learning that is done can train students to be more independent; (3) study seriously and sincerely, be diligent and active. Increase the interaction of students and lecturer students; (4) train

to be brave to perform, which will be very useful for being a teacher and participating in the PPL which will soon be held in the following semester; and (5) reducing dependency with lecturers.

4. Conclusion

The following are conclusions based on student learning reflections.

1. The positive things obtained by students are that students are better prepared to face college (in need) by having been confronted with problems first, and require competence to solve them.
2. As for the constraints felt by students during the action process, students feel burdened with the task of solving problems first before lecturing, even though they are well aware and have agreed on the lecture process in the lecture contract, that this PBL Model is appropriate to be applied in learning.

References

- Hudoyo, H, 1998, Pengembangan Kurikulum Matematika dan Pelaksanaannya di depan kelas, Usaha Nasional, Surabaya
- Sakur, Nahor M, dan Kartini 2016. Pengaruh Pembelajaran Berbasis Masalah Terhadap Kemampuan Menyelesaikan Masalah Matematis Siswa Kelas X SMA Babussalam Pekanbaru
- Fathurrohman, M. 2016. Model-Model Pembelajaran Inovatif. Ar-ruzz Media Jogjakarta
- BSNP, 2006, Panduan Penyusunan Kurikulum Tingkat Satuan Pendidikan Jenjang Pendidikan Dasar dan Menengah, Pusat Kurikulum, Balitbang Depdiknas, Jakarta
- Depdiknas, 2013. Permendikbud Nomor 65 Tahun 2013: Standar Proses Pendidikan Dasar dan Menengah. BSNP. Jakarta.