

Applying Problem Based Learning to Improve Understanding of Elementary School Students' Mathematics Learning Concepts in Maguwoharjo

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1. Abstract

This research begins with observations on mathematics learning activities in the discussion of time conversion. The observation results show that the implementation of mathematics learning has not met the expected standards. This study discusses the application of the *Problem Based Learning* learning model through two stages, namely Cycle 1 and Cycle 2. Based on the results of the study it can be concluded that the percentage of students whose grades were completed was 36.9% with an average score of 65.2. Then in the second cycle there was an increase to 79% with an average value of 83.1. This means an increase of 42.1%. This increase proves the success of the Problem Based Learning model to improve understanding of the concept of learning mathematics.

Keywords: *Problem Based Learning, Basic Concepts for Learning Mathematics*

2. Introduction

Mathematics is a basic science that has an important role in everyday life. The ability of students if they want to continue to the next school is always measured by the achievement of learning outcomes in mathematics. Mathematics makes it easy to choose a solution to the problem at hand. The success of studying mathematics can be useful for students in preparing themselves to face advances in science and technology.

However, in reality, in learning, many students tend not to like this lesson. Mathematics is usually considered a difficult subject for students to work on. Therefore, it is necessary to improve mathematics learning which encourages students to create learning that is fun and effective.

The same problem also occurred with elementary school students in Maguwoharjo. Many students do not like learning mathematics. Based on the data from the daily test results, there are still many students whose grades do not meet the standard, namely out of 19 students only 6 whose grades are above the standard. To overcome this problem, researchers offer alternative learning using *problem-based learning models*.

Problems can be used to formulate problems, which can be converted as follows: (1) How to improve mathematics learning outcomes using problem based learning models? (2) How to increase learning outcomes using problem based learning? This study aims to : (1) determine the increase in student learning outcomes using the *Problem Based Learning (PBL)* model and (2) knowing the increase in student learning outcomes use *Problem Based Learning (PBL)*.

Piaget in (Heruman, 2013: 1) states that the average age range of elementary school students is 6-13 years. Students in this age range are in the concrete operational phase. The outstanding ability in this phase is that students tend to be able to think in an attempt to operate logical rules, although they still depend on objects that are concrete in nature. The process of learning mathematics has an abstract tendency, so it requires tools in the form of media and teaching aids to make it easier for the teacher to explain what the teacher will convey.

The Problem Based Learning (PBL) Learning Model is a learning activity that combines concrete problems or problems tested by the teacher as a basis for conveying the essence of the material of a subject. (Muniroh, 2015: 38). *Problem Based Learning* is seen as a model that describes a problem based on facts and has meaning for participants

students to further openly investigate and determine a solution. Panen (in Rusmono, 2012: 74) says that the process of identifying existing problems, collecting data, and using this data in the process of solving problems in the *Problem Based Learning learning model* can encourage students to play an active role in learning.

Learning using the *Problem Based Learning* (*PBL*) model has several characteristics that support student learning activities. The characteristics of the PBL model itself according to Barrow (Shoimin.A, 2014: 130) are: (1) The learning process focuses on students as students, (2) The problems presented to students are problems that are relevant to everyday life. day so that students are able to easily understand the problem, (3) This model optimizes the ability to think collaboratively in small groups by giving instructions and implementing clear objectives, and (4) The teacher positions himself as a facilitator for students in the learning process .

Problem Based Learning model according to (Shoimim, 2014) is carried out with the following systematics:

1. Learning objectives, tools and materials needed are conveyed by the teacher. Then the teacher sparks student motivation to be involved in problem-solving-based activities that have been selected.
2. Fostering student efforts to define and organize tasks related to problems.
3. Students are encouraged to collect data on the results of relevant problem solving.
4. Students share tasks with their group members to plan and prepare work according to the report with the teacher's instructions and directions.
5. The teacher helps students reflect or evaluate what they have explored through previous processes.

Problem Based Learning according to Magued Iskander (in Fathurrohman, 2015) if made in a syntax can be implemented as follows:

1. First, the learning objectives, facilities or tools and materials needed are conveyed by the teacher. Learners are motivated to engage in concrete problem-solving activities as specified;
2. Second, students define and classify learning tasks related to problems that have been done in the previous stages;
3. Third, appropriate information is relevant to the conditions of students and experiments are carried out to get a bright spot in solving problems;
4. Fourth, students to share tasks and plan appropriate work as a result of solving problems in various forms, for example reports, videos or models; And
5. Fifth, students to reflect or evaluate the process of solving that is done.

Learning by applying models PBL Shoimin according to (2014: 132) has several advantages , as follows:

1. Encourage students' ability to solve problems with a concrete situation;
2. Encouraging students to build their knowledge independently through learning activities;
3. Students do not need to study material that is not related to the problem being discussed in order to reduce the burden on students by memorizing or remembering information;
4. Scientific activity is created through group collaboration;
5. Use of various sources of knowledge, both from libraries, the internet, interviews, and observations;
6. Growing the ability of students to assess their own learning progress;

3. Method

3.1. Research subject

The subjects of this study were 19 elementary school students in Maguwoharjo. This research was conducted in Maguwoharjo, Depok, Sleman. The learning improvement schedule is as follows:

**Table 3.1 Schedule for Implementation of Improvements
Mathematics Learning Time Unit Concept Material**

No	Cycle	Date and time	Time
1.	I	Friday, 19 May 2023	09.00 – 11.30
		Saturday, 20 May 2023	09.00 – 11.30
2.	II	Thursday, 26 May 2023	07.00 – 09.30
		Friday, 27 May 2023	09.00 – 11.30

3.2. Research Instruments

The data collection instrument used in this study was to use problem solving questions related to the concept of a unit of time. The questions consist of multiple choice questions and descriptions.

3.3. Data Collection and Analysis

There are 2 types of data analysis used in this study. The data contains the learning outcomes of students in the form of scores which are analyzed quantitatively. Meanwhile, the results of observations or observations of teacher performance and learning atmosphere in the classroom were analyzed qualitatively and also documentation. The data analysis technique used in this study uses the following steps:

1. Data Presentation

In this study, data presentation can be done in the form of pictures or tables. An example of data in the form of an image is a picture of class action research procedures. While the presentation of data is in tabular form, for example, student learning outcomes tables. There is also data presented with diagrams, namely for comparative data on student learning outcomes starting from the initial study, cycle 1 to cycle 2.

2. Qualitative Descriptive Analysis

This analysis was carried out for data from observers in the form of comments, criticisms and suggestions. The data is described using sentences that are easily understood by the reader. In addition, the observation data on the observation sheet provided can also be described to strengthen the data obtained from the research results.

3. Quantitative Analysis

Quantitative analysis itself is used to analyze data in the form of numbers such as scores of students' learning outcomes starting from the initial study, cycle 1, to cycle 2. The data is processed so that it can be known how to increase learning outcomes in mathematics using problem based learning. If cycle 1 has been carried out but the results are not as expected, then reflection and improvement will be carried out in cycle 2. Even so, data analysis in the form of numbers is still carried out by means of

4. Documentation

Documents as a source of information are very useful for a research. The document can be written text, *artefacts*, an image, or photographic documentation. In this case, the researcher uses written text in observation sheets/observation notes as well as pictures and photos. In this study, the teacher documented through pictures and videos the learning process during cycle 1 and cycle 2.

5. Evaluation

To assess formative tests or tests, researchers add up the scores obtained by students, which are then divided by the number of students in the class so that the average formative test can be formulated:

$$\bar{X} = \frac{\sum X}{\sum N}$$

With : $\bar{X}$ = Average value

$\sum X$ = Sum of all student scores

$\sum N$ = Number of students

6. Mastery learning

There are two categories of learning completeness, namely individual categories and classical categories. Students have completed learning when they have achieved a score of 70% or a value of 70 and the class is called complete learning if in that class there are 85% who have achieved absorption of more than or equal to 70%. To calculate the percentage of learning completeness, the formula is used:

$$P = \frac{\sum Y}{\sum N} \times 100 \%$$

With :

P = percentage of learning completeness class

$\sum Y$ = Number of students who have completed the study

$\sum N$ = Number of students

4. Results and Discussion

4.1. Results

Steps to improve mathematics learning outcomes for the unit time concept material are carried out by means of the teacher carrying out teaching activities that are adjusted to the Learning Implementation Plan . The design used in cycles 1 and 2 has also been adapted to the purpose of this study, namely to improve student learning outcomes in mathematics. This is evidenced by an increase in student learning outcomes after improving the learning process in mathematics subject matter of the unit of time concept . In cycle 1 , the results of students who completed were only 6 5.2 %, while in cycle 2 it increased significantly to 8 3.1 %.

Efforts made by the teacher in improving student learning outcomes from cycle 1 to cycle 2 in including the following: 1) Improving learning procedures that emphasize students' understanding of the basic concepts of addition and subtraction in understanding story problems solving problems according to the syntax in the *Problem Based Learning learning model*), 2) Improving the editorial writing of story questions that will be given to students with adapted to the material that has been studied by students ; and 3) Use of calculating aids that make it easier for students.

There are several improvements to the learning procedure , making students more enthusiastic, active and not experiencing boredom in learning . So that the material delivered by the teacher becomes easier for students to understand and of course it also makes it easier for the teacher to convey the subject matter. Improving the learning procedure is carried out by the teacher providing material that emphasizes understanding the basic concepts of addition and subtraction in determining the unit of time to be given questions.

Student activity during learning with the learning model *Problem Based Learning* in cycle 1 and cycle 2 shows an increase. In cycle 1 65,2 % while experiencing a significant increase in cycle 2 83.1 %. In cycle 1 there were still students who were less active in participating in the learning process. This is because students do not fully understand story problems related to the operation of solving the concept of time units.

Then in cycle 2 the activity and enthusiasm of students began to increase or increase even though there were still some students who had not finished. In cycle 2 , students are also getting used to how to learn by discussing in groups. Thus it can be concluded that in an effort to improve student learning outcomes, teachers use the *Problem Based Learning* learning model on material denominations of money implemented properly and in accordance with the expected criteria.

4.2. Discussion

A. Discussion of Each Cycle

a. Cycle 1 Discussion

Activities to improve mathematics learning at Maguwoharjo Elementary School using *the Problem Based Learning* (*PBL*) learning model were carried

out on Friday and Saturday, 19-20 May 2023 with the learning methods used namely lectures, discussions and assignments. The teacher uses problems with the type of problem solving regarding the concept of a unit of time in the learning process with the aim of increasing students' understanding of the concept . Because , elementary school - aged children are still in the stage of concrete thinking . Where at this stage of thinking there must be an object or something that can be explained directly .

Consideration of the teacher choosing this learning model in including because it encourages students to build concepts on the material students learn. According to Shoimin (2014) learning by using models PBL has several advantages, one of which is that students have the ability to build their own knowledge through learning activities and the creation of scientific activities in students through group work.

In Cycle 1, the results of learning mathematics in the concept of the largest time unit were 7 students (63.7%) who achieved the minimum standard of assessment (75). From the data above it can be analyzed that students' understanding of the concept of the unit of time concept still relatively low , even though at this stage of cycle 1 the teacher has started using *the Problem Based Learning (PBL)* syntax . however , After the teacher makes observations and then reflects, the greatest possibility is that students do not fully understand when the learning process is carried out. Apart from that, the writing of questions is also considered too difficult to understand, so there needs to be simplification so that students understand what needs to be done.

The problems above require the teacher to think about what kind of problem solving can be applied during the learning process, while still using the *Problem Based Learning* (*PBL*) procedure . Then after receiving input from assessor 2 and also the results of his reflection on learning cycle 1, the teacher made changes to the lesson plan and compiled questions that were redacted because the questions could be understood more easily by students in cycle 2 later.

b. Cycle 2 Discussion

In cycle 2 , there was an improvement in the editorial process of making questions that were adjusted to the level of understanding of students. Then there are additional calculation tools, as well as questions that are equipped with calendar images. So that students will be more optimal in understanding problem-solving questions regarding the concept of a unit of time. The learning atmosphere at this stage was also more conducive than during cycle 1. In Cycle 2 , *ice breaking* was also included to spark students' learning motivation. Then the lesson is continued with triggering questions that will be used as material for group discussion.

By implementing optimal learning models and appropriate learning methods, the learning outcomes achieved by students also increase. This is in accordance with the increased attention and activeness of students in cycle 2 . It can be proven by the number of students who reach the minimum standard reach 79%. The observation results also show an increase in the activity of students and teachers in cycles 1 and 2 in each aspect.

The problems of the learning process in cycle 1 included students' lack of understanding of the basic concepts of solving mathematical problems . Students become less serious in working on evaluation questions. The problems in cycle 1 can be corrected in the implementation of cycle 2 by using media calculation aids which are carried out in groups. So that students are not scrambling in trying to find the basic concept of addition through the media. The results of observing the activities of students in cycle 2 showed an increase, namely in the core activities and working on evaluation questions so that the results of their achievements also increased.

c. Comparison of Cycle 1 and Cycle 2

Comparison of learning outcomes and increasing the average value of Cycle 1 and Cycle 2 can be described as follows:

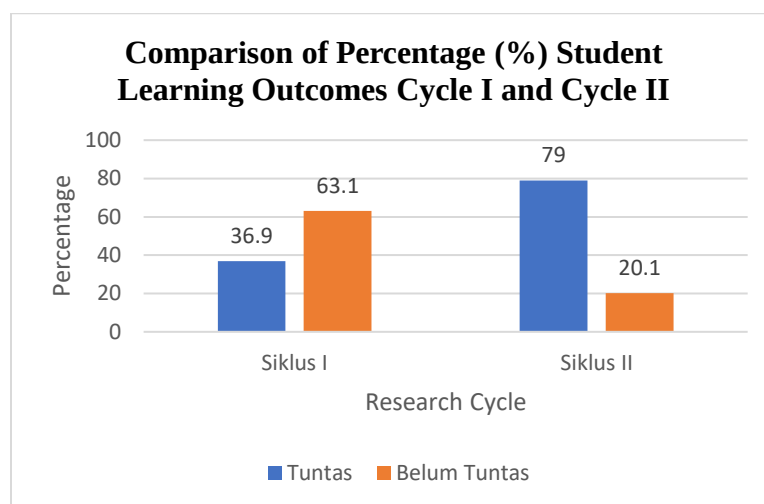
Table 4. 7
Comparison of Learning Outcomes and Improved Average Scores
Cycle 1 and Cycle 2

No	Completeness	Cycle 1		Cycle 2	
		Amount	%	Amount	%
1	Complete	7	36,9	15	79 %
2	Not Completed	12	63,1	4	21 %
Average value		65,2		83.1 %	

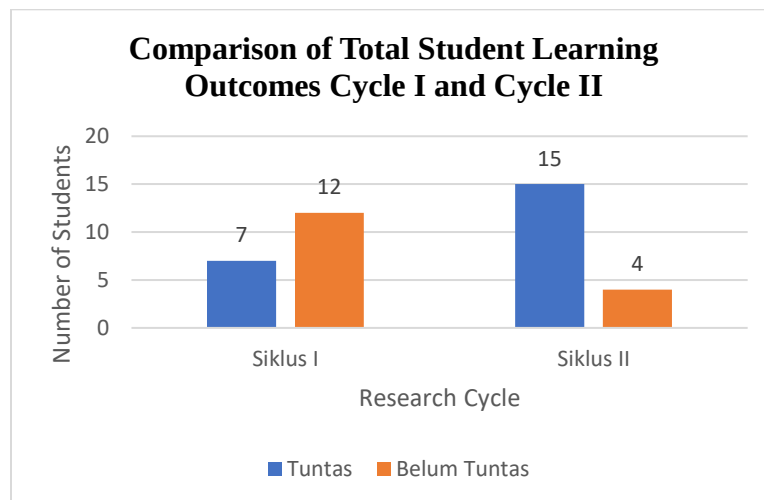
Based on the table above, we can see that in Cycle 1, students who were

able to achieve learning mastery only achieved 36.9% and in Cycle 2 it increased significantly to as much as 79%. This shows that there is a significant increase if we use the right learning methods and media so that students can learn with full motivation and can achieve the expected achievements.

Figure 4.1
Percentage Comparison Chart (%)
Student Learning Outcomes Cycle 1 and Cycle 2



**Figure 4.2 Comparison of Learning Outcomes Graph
Cycle 1 and Cycle 2 Students**



5. Conclusion

Based on the results and discussion that the researchers have described, the conclusions obtained are as follows:

- The Problem Based Learning model can increase students' understanding of the basic concepts of learning mathematics in unit time conversion material.
- Problem Based Learning* learning model for Mathematics subjects on the unit time concept material can improve student learning outcomes. In Cycle I, there were 7 students who achieved completeness or about 36.9% of the 19 students. In cycle II students who have reached the minimum standard increased significantly to 15 students or around 79%. This means there is an increase of 42.1%.

- c. The results achieved met the set targets, namely learning completeness equal to or more than the success indicator of $\geq 75\%$. The increase in the percentage of learning completeness proves the success of learning mathematics in the concept of a unit of time through the *Problem Based Learning* learning model .

6. Acknowledgments

Based on the results of the research, the following suggestions can be given:

- a. Teachers should continue to strive in choosing and using appropriate and more varied learning methods so that learning messages are conveyed and students are enthusiastic about learning.
- b. Students should always concentrate in participating in learning. Students must also be active in learning and ask questions if there is anything they don't understand.
- c. mathematics learning activities the teacher should use the *Problem Based Learning method* in planning mathematics learning. It aims to increase students' enthusiasm for learning and make learning Mathematics more fun for students, as well as encourage students' mathematical problem solving abilities.
- d. For school principals, always encourage teachers to always increase innovation and motivation in the learning process in an effort to improve learning outcomes for students in class.
- e. For schools, research with Classroom Action Research can help improve the quality of learning in schools.

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