

Understanding Mathematical Concepts Using Manipulative Media Based Problem Based Learning Models in Elementary Schools

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1. Abstract

This research was conducted to find out the implementation of the application of learning using the problem-based learning (PBL) model based on manipulative media on students' conceptual understanding. This study uses a class action research method with data analysis techniques using comparative descriptive. The sample is fourth-grade students at SD Kota Yogyakarta, totaling 25 people. The results of this study indicate that learning is going well, it can be seen from the students' response to understanding the concept of presenting data using manipulative media through the problem-based learning model which is positive. Increased understanding of students' cognitive aspects of concepts is at 80% completeness in cycle II. This is by the classical completeness criteria of 75%. So it can be said that the solution so that students can understand the concept of learning mathematics data presentation material with a problem-based learning model based on manipulative media is appropriate.

Keywords: *Understanding of mathematical concepts, manipulative media, Problem Based Learning*

2. Introduction

Education is a process to influence students to be able to adapt as well as possible to their environment (Nata, 2001). According to RI Law No. 20 of 2003 concerning National Education System says that: Education is a conscious and planned effort to create a learning atmosphere and learning process so that students actively develop their potential

to have religious spiritual strength, self-control, personality, intelligence, noble character, and skills needed by himself and society. The success of the learning process in schools is determined, among other things, by the accuracy of the teacher's teaching on student development. The development of elementary school students includes physical, intelligence, emotional, social, and personality aspects. Therefore the importance of a learning method that is chosen by the teacher is to be adapted to students so that learning is more meaningful and understood more deeply. In addition to learning methods, subjects also include things that need to be considered by the teacher. Subjects that are still difficult for most students are mathematics.

Learning mathematics is the formation of a mindset in understanding an understanding and in reasoning a relationship. In the process of learning mathematics, understanding mathematical concepts is a very important part. This is because understanding the concept is an important basis for solving mathematical problems and problems in everyday life. According to Indiana, Rohaeti, & Sumarmo (2021), indicators of understanding mathematical concepts include a) restating the concepts that have been learned; b) classifying objects based on whether the requirements that form the concept are met or not; c) identifying the characteristics of the operation or concept; d) apply concepts logically; e) provide examples or counter-examples (against examples) of the concepts being studied; f) present concepts in various forms of mathematical representation (tables, graphs, diagrams, sketches, mathematical models, or other means); g) linking various concepts in mathematics and outside mathematics; h) develop necessary and/or sufficient requirements for a concept. According to Piaget's theory in children's cognitive development, children aged 7-11 years are in the concrete operational stage. In this phase, students can think to operate logical rules, but still with concrete

objects. Therefore, students need tools such as media to facilitate the delivery of material delivered by the teacher so that students can understand data presentation well.

The act of using manipulative media which are all objects that can be seen, touched, heard, felt, and manipulated so that students can experience learning directly. Another function of manipulative media is to simplify difficult or difficult concepts, present material that is relatively abstract to be more real, and explain understanding or concepts more concretely. Another effort made so that students can understand the concept of learning mathematics is to design appropriate learning. Kelana & Wardani (2021) explained that the problem-based learning model presents students with an authentic and meaningful problem and provides an opportunity to carry out investigations. When students are faced with situations where concepts are applied, learning will be more meaningful and widespread. This learning model can increase students' self-confidence and independence. By using a combination of learning models with learning media, namely problem-based learning models assisted by manipulative media, it is hoped that students will more easily understand mathematical concepts. This study aims to describe the efforts made by teachers in understanding mathematical concepts using the problem-based learning model assisted by manipulative media in elementary school students.

3. Methods

The type of research method used is Classroom Action Research (CAR). The subjects in this study were the teacher as a researcher and 25 grade IV students consisting of 15 male students and 10 female students at SD Kota Yogyakarta. Data collection techniques using tests. Data analysis techniques can be obtained from qualitative data and quantitative data that can be analyzed descriptively. The data analysis used in this study is descriptive comparative, namely data analysis techniques by comparing the results

between cycles, the learning outcomes of the first cycle are compared with the learning outcomes of the second cycle. Qualitative data were obtained from the results of student observations in participating in learning, while teacher observations were made when the teacher carried out learning using the Problem-Based Learning model based on manipulative media. Quantitative data were obtained from the results of written tests given to students at the end of each cycle I and II. Criteria for the success of the learning process of teacher and student activities based on mastery learning can be measured if a student can achieve 65% absorption individually and 75% classically with an adequate and accountable level of competency achievement as a prerequisite for further competency mastery (Ministry of National Education, book 3, 2004; 16).

Action research consists of pre-action, action planning, action implementation, observation, evaluation, and regular reflection from one action to the next. This stage begins with the planner solving existing problems, then proceeds to carry out the stages of problem-solving efforts by implementing and observing the learning process. After that, a reflection is held to see whether the cycle results have achieved success indicators or not. In the first cycle, prospective researchers collect information to determine the factors that reduce student learning outcomes and then develop a learning plan that suits the needs of students to find out the causes of a decrease in learning outcomes and can measure the extent to which students' ability to understand learning material. If the implementation of the first cycle has not been successful, then the research is continued to - cycle II and so on by repeating the same stages so that success indicators are achieved and the research is stopped.

SIKLUS PENELITIAN TINDAKAN

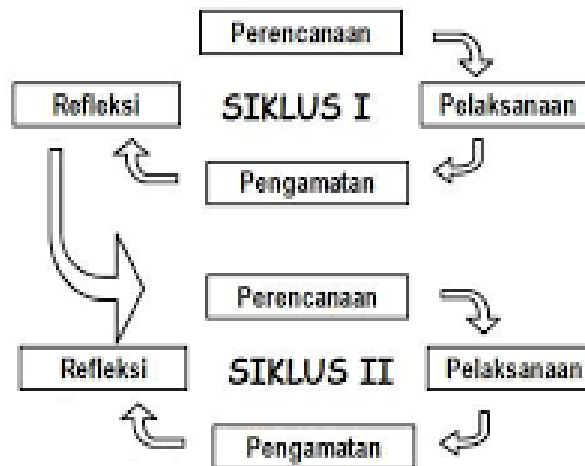


Figure 1. Schematic of Research Design

4. Results and Discussion

The results of observations on students' understanding of the attitude aspect in class IV SD in the City of Yogyakarta on the pre-cycle results of the test scores of class IV students showed that as many as 8 students by 32% were complete and 17 students by 68% were incomplete so that they could be categorized in very low success predicate criteria.

The research was carried out in 2 cycles consisting of 2 meetings. Implementation of cycle I meetings 1 and 2 will be held on May 15 2023 and May 16, 2023. Implementation of cycle II meetings 1 and 2 will be held on May 26 2023 and May 29, 2023.

The results of observing the understanding of the concept of cognitive aspects in class IV from pre-cycle scores, cycle I and cycle II experienced a significant increase and were

by the level of success that the researchers made. The results of increasing students' understanding of concepts in the cognitive aspect can be seen in Table.

Table 1. Improving Students' Understanding of Cognitive Aspects of Concepts

Information	Pre Cycle Value	Cycle value I	Cycle value II
amount	1508	1823	1958
average score	60,32	72,92	78,32
the highest score	90	100	100
lowest value	33	50	50
percentage of students complete	32%	56%	80%
percentage of students did not complete	68%	44%	20%

Based on the data above, it is known that the understanding of the concept of cognitive aspects has increased from pre-cycle with a classical completeness percentage of 32% then in cycle I it has increased again in classical completeness, namely by 56%. Cycle II increased again with a classical completeness percentage of 80%. cycle II the understanding of the concept of cognitive aspects has fulfilled the classical completeness of 75%.

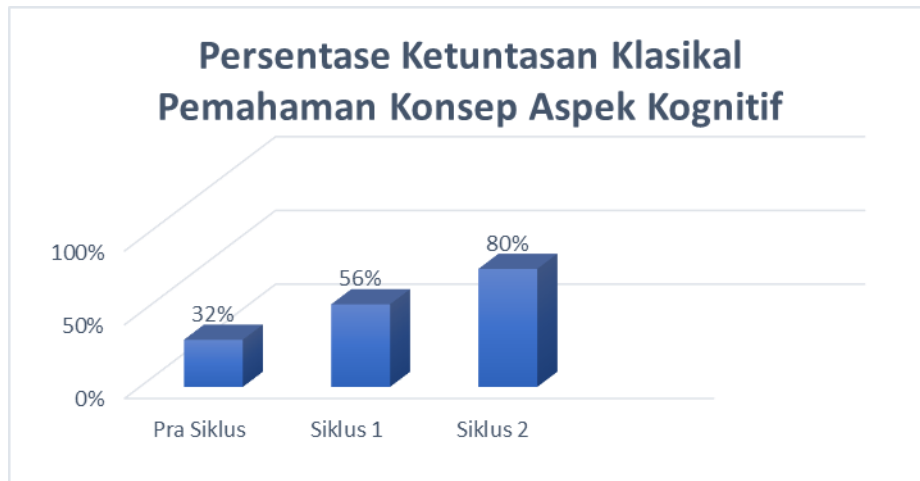


Figure 2. Percentage diagram of understanding the concept of cognitive aspects

The results of the research that has been carried out show that there is an increase in student's conceptual understanding abilities. This is evidenced by the existence of successful learning. Increased understanding of concepts in learning cognitive aspects has achieved the expected indicators of success with the application of the Problem Based Learning (PBL) learning model based on manipulative media in class IV SD Yogyakarta City.

The increase in students' understanding of concepts can be seen from the evaluation results of an average pre-cycle score of 60.32 with a completeness percentage of 32%. Cycle I average score of 72.92 with a completeness percentage of 56%. Cycle II experienced an increase again, namely an average score of 78.32 with a completeness percentage of 80%.

The results of research conducted in line with the research of Setiawan, et al (2013) found an increase in students' understanding of concepts in pre-cycle with a percentage of 53.33% then increased again in cycle I with a percentage of 73.33% in cycle III with a percentage of 93.33%.

Prihantono research, et al (2014) showed that there was an increase in students' understanding of concepts with a percentage of 28% then increased again in cycle I with a percentage of 62.96%. Cycle II increased again with a percentage of 85.18% then in cycle III it increased again with a percentage of 92.59%.

Riset Lestari dan Surajhuddin (2014) menunjukkan terdapat adanya peningkatan hasil belajar siswa siklus I memperoleh persentase sebesar 65%. Siklus II meningkat kembali memperoleh persentase sebesar 72% kemudian siklus III meningkat dengan persentase sebesar 83%.

5. Conclusion

Based on the results of research and discussion of classroom action research, it can be concluded that the Problem Based Learning model based on manipulative media can improve students' conceptual understanding of grade IV at SD Kota Yogyakarta. There was an increase in student's conceptual understanding after applying the problem-based learning model based on manipulative media. The results of the evaluation of the average score of the second cycle were 78.32 with a completeness percentage of 80%.

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