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Implementation of Bruner's Learning Theory to Improve Understanding of Mathematical Concepts in Lower Grade Students of SDN Cimrutu 01 Patimuan with the Aid of Concrete Objects

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ABSTRACT

This classroom action research aims to improve the understanding of mathematical concepts, especially on measurement material, in class III SDN Cimrutu 01 Patimuan through the application of Bruner's learning theory with the help of concrete objects. The background of this research is the difficulty of lower grade students in understanding mathematical concepts that tend to be abstract. The main focus of the research is the use of Bruner's approach, which emphasizes three stages of representation (enactive, iconic, and symbolic), as well as the use of concrete objects as intermediaries for understanding. The research was conducted in three cycles, each of which includes the planning, action implementation, observation, and reflection stages. The research subjects consisted of 20 class III students of SDN Cimrutu 01 Patimuan, with a composition of 10 male students and 10 female students. Data on understanding of mathematical concepts were obtained through learning outcome tests at the end of each cycle and at the pre-cycle stage. The results of the study showed a significant increase in learning completeness, from 25% in the pre-cycle to 90% in Cycle III. In Cycle I, learning completion reached 65%, then increased to 85% in Cycle II, and finally reached 90% in Cycle III, with most students meeting the Learning Target Completion Criteria (KKTP) of at least 70. The consistency of this increase shows that the application of Bruner's theory assisted by concrete objects is effective in improving understanding of mathematical concepts, especially in measurement material in lower grades. The learning strategy that begins with concrete experiences, continues with visual representations, and ends with symbolic understanding is proven to be in accordance with the stage of students' cognitive development. This study concludes that mathematics learning based on Bruner's theory through the use of concrete objects can be an effective alternative to improve students' understanding of mathematical concepts, especially in abstract material.

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1. INTRODUCTION

"Education is a fundamental element in individual development, and mathematics is one of the basic subjects that plays a vital role in the formation of students' cognitive abilities".[1] Education plays a very important role in shaping and developing individual potential as a whole. Through education, students not only gain knowledge, but also hone their ability to think, behave, and interact with the environment. In this context, mathematics is one of the basic subjects that has a major contribution in supporting children's cognitive development from an early age, especially at the elementary school level.

Mathematics is not just a matter of counting, but also a means to train logic, reasoning, and problem-solving skills. Therefore, effective mathematics learning is needed to build a strong foundation of thinking for students, especially in lower grades.

"Mathematics is one of the sciences that has a very important role in human life. Mathematics makes a very large contribution, from the simple to the complex, from the abstract to the concrete to solve problems in all fields. Mathematics is one of the subjects that has been introduced to students from elementary school (SD) to higher levels (College). Mathematics itself basically has abstract basic objects. According to Soejadi in Muhsetyo that: "the abstractness of mathematics because its basic objects are abstract, namely facts, concepts, operations and principles." Meanwhile, according to Piaget, elementary school students whose ages range from 6 or 7 years to 12 or 13 years, are in the concrete operational phase. In this phase, students are generally still bound by concrete objects or tend to think concretely, rationally and objectively in understanding a situation".[2]

"Mathematics is a science that plays an important role in various aspects of life and cannot be separated from life. Mathematics also plays an important role in the development of science and technology, both as a tool in the application of other fields of science and in the development of mathematics itself. Because of the importance of mathematics in everyday life, mathematics is made one of the compulsory subjects at every level of education in schools. Mathematics standards in schools include content or material standards (mathematical content) and process standards (mathematical processes) (Shadiq in Hidayati and Widodo 2015:131). Process standards consist of problem solving, reasoning, and communication". [3].

Mathematics is one of the basic subjects that plays an important role in developing students' logical, analytical, and systematic thinking skills. However, in reality, many students at the elementary school level, especially the lower grades, have difficulty understanding abstract mathematical concepts. This is caused by a learning approach that is less appropriate to the child's cognitive development stage, so that the material presented cannot be optimally understood by students. To overcome this problem, the application of Bruner's learning theory is one alternative that can be used in the mathematics learning process. This theory emphasizes three stages of representation in the learning process, namely enactive (direct experience), iconic (visual representation), and symbolic (abstraction). By applying these three stages, students can understand mathematical concepts gradually, starting from concrete experience to achieving abstract understanding. [4]

The use of concrete objects in mathematics learning is in accordance with the enactive stage in Bruner's theory. Through manipulating concrete objects, students can directly experience the concepts being studied, making it easier for them to understand the material. This approach can also increase students' learning motivation, because they are actively involved in a fun and meaningful learning process. [5]

In the lower grades of elementary school, children are still in the early stages of cognitive development, so they find it easier to understand mathematical concepts through a concrete approach. Teachers or parents can use real objects such as buttons, small stones, popsicle sticks, or other objects and toys to help children understand basic arithmetic concepts.

The use of concrete objects helps students connect abstract concepts with their real experiences. When children count directly with the help of objects, they not only memorize numbers, but also develop logical thinking skills and understand the calculation process as a whole. This approach also makes learning more interesting and fun, thus motivating children to continue learning and practicing counting.

This research was conducted at SDN Cimrutu 01 Patimuan, Cilacap Regency, with 20 third grade students as subjects. "The purpose of this study was to implement Bruner's learning theory in mathematics learning with

[1] Dyah Aini Purbarani, 'PENERAPAN MEDIA KONKRET UNTUK MENINGKATKAN HASIL BELAJAR SISWA PADA MATA PELAJARAN MATEMATIKA SISWA KELAS 1 SDN BALUASE', 2024.
[2] Almira Amir, 'Pembelajaran Matematika Sd Dengan Menggunakan Media Manipulatif', *Forum Paedagogik*, VI.1 (2014), p. 78.
[3] Aminah Ekawati, Winda Agustina, and Fahriza Noor, 'Analisis Kemampuan Pemecahan Masalah Matematika Siswa Dalam Membuat Diagram', *Lentera: Jurnal Pendidikan*, 14.2 (2019), pp. 1–7, doi:10.33654/jpl.v14i2.881.
[4] Rahmawati, Andi Syukriani, and Rosmah, '7198-22366-1-Pb', *Sigma (Suara Intelektual Gaya Matematika)*, 3 (2011), pp. 1–10.
[5] Sundari Sundari and Endang Fauziati, 'Implikasi Teori Belajar Bruner Dalam Model Pembelajaran Kurikulum 2013', *Jurnal Papeda: Jurnal Publikasi Pendidikan Dasar*, 3.2 (2021), pp. 128–36, doi:10.36232/jurnalpendidikandasar.v3i2.1206.

the help of concrete objects, and to evaluate the extent to which this approach can improve students' understanding of mathematical concepts".[6]

The results of this study are expected to contribute to the development of a more contextual and enjoyable mathematics learning model for elementary school students, especially in the lower grades. In addition, the findings of this study can also be a reference for teachers in designing more effective learning that is in accordance with the needs and characteristics of students.[7] This study aims to identify appropriate and effective learning strategies, in line with the characteristics of students in lower grades.

2. RESEARCH METHOD

This study adopts the classroom action research (CAR) method based on four main components, namely planning, action implementation, observation, and reflection. This study was conducted in three cycles, with a benchmark for success if more than 75% of students achieve the established criteria. achieve the Learning Objectives Achievement Criteria (KKTP) of 70 in mathematics.

Classroom action research is a form of research activity that focuses on a particular group of subjects, with the intention of improving the learning situation in the classroom in order to support the improvement of the quality of learning. The subjects of the study were all students of class III SDN Cimrutu 01, Patimuan District, Cilacap Regency in the 2024/2025 academic year. There were 10 male students and 10 female students, so the total number of students in the class was 20 people. The material taught was Measurement. The instrument used to collect data was a Mathematics learning outcome test with the criteria for Mathematics learning achievement set at 70.

The research was conducted in April 2025. Each cycle consists of planning, action, observation and then reflection. The implementation activities were Cycle I on April 15-16, 2021 and Cycle II was held on April 21-22, 2022.

3. RESEARCH RESULT AND DISCUSSION

a. Cycle 1

The evaluation results in cycle 1 showed that out of 20 students, only 13 managed to achieve a score above the Learning Objective Achievement Criteria (KKTP), or equivalent to 65% learning completion. Meanwhile, as many as 7 students have not met the KKTP standard. This means that there are still students who have not achieved completion in the measurement material in cycle 1.

The comparison between the results of the Pre-Cycle and Cycle 1 can be seen in the image below:

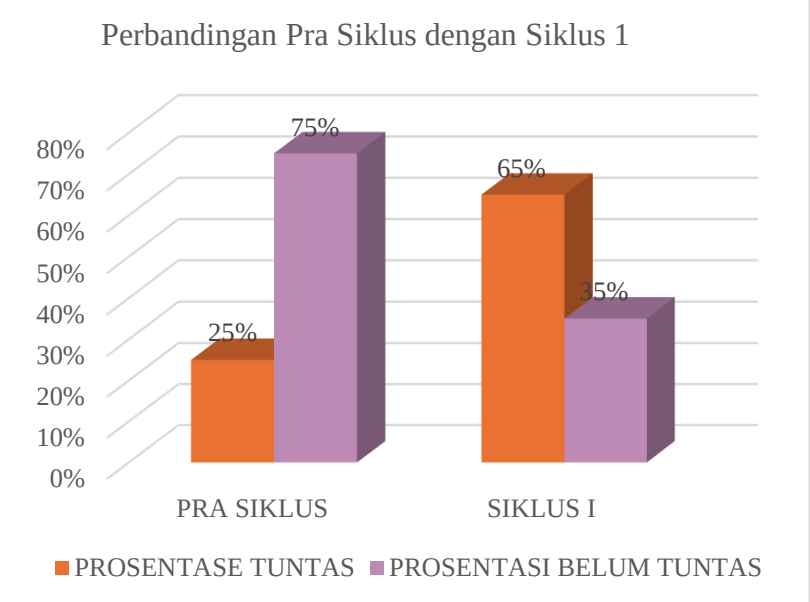

Image 1. Mathematics Learning Outcomes Pre-Cycle and Cycle 1

[6] Wahyusi Eci and Bornok Sinaga, 'Penerapan Teori Bruner Untuk Meningkatkan Pemahaman Konsep Matematika Siswa Kelas VII-Alrusyd Di SMP Swasta Islam Terpadu Khairul Imam Medan', *Jurnal Fibonaci: Jurnal Pendidikan Matematika*, 2.1 (2021), p. 20, doi:10.24114/jfi.v2i1.28663.

[7] Ahmad Hatip and Windi Setiawan, 'Teori Kognitif Bruner Dalam Pembelajaran Matematika', *PHI: Jurnal Pendidikan Matematika*, 5.2 (2021), p. 87, doi:10.33087/phi.v5i2.141.

The graph shows an increase in student learning outcomes after the implementation of mathematics learning using Bruner's learning theory assisted by concrete objects. In the pre-cycle, the learning completion rate only reached 25%, while 75% of students had not achieved completion. After the implementation of cycle 1, the completion rate increased to 65%, and the number of students who had not completed decreased to 35%.

In this context, the increase in completion occurred because students were given the opportunity to understand the concept of measurement gradually, starting from the manipulation of concrete objects (enactive), visualization (iconic), to the use of mathematical symbols (symbolic). Learning that starts from real experiences is in accordance with the cognitive development stage of lower grade students, thus helping them build a more meaningful understanding of concepts.

Thus, the implementation of Bruner's theory has proven effective in improving students' understanding of mathematical concepts, as shown by the comparison of the graphs between the pre-cycle and cycle 1.

b. Cycle II

Based on the test results in cycle II, it can be seen that out of 20 students, 17 have obtained scores above the Learning Objective Achievement Criteria (KKTP). As many as 85% of students completed cycle II. For other students, as many as 3 students did not meet the Achievement Criteria (KKTP). This is due to several factors. First, not all students can follow Bruner's learning stages optimally, especially the enactive and iconic stages which require active involvement and full concentration. Some students still have difficulty connecting concrete experiences with visual and symbolic representations, so that understanding the concept of measurement has not been fully formed. Second, differences in abilities and learning styles between students are also obstacles. There are students who need more time to understand concepts through concrete objects, while learning takes place in a limited time. In addition, some students are less focused during the activity, so they are not optimal in following the learning process.

A comparison between the results of Pre-Cycle, Cycle I and Cycle II can be seen in the image below:

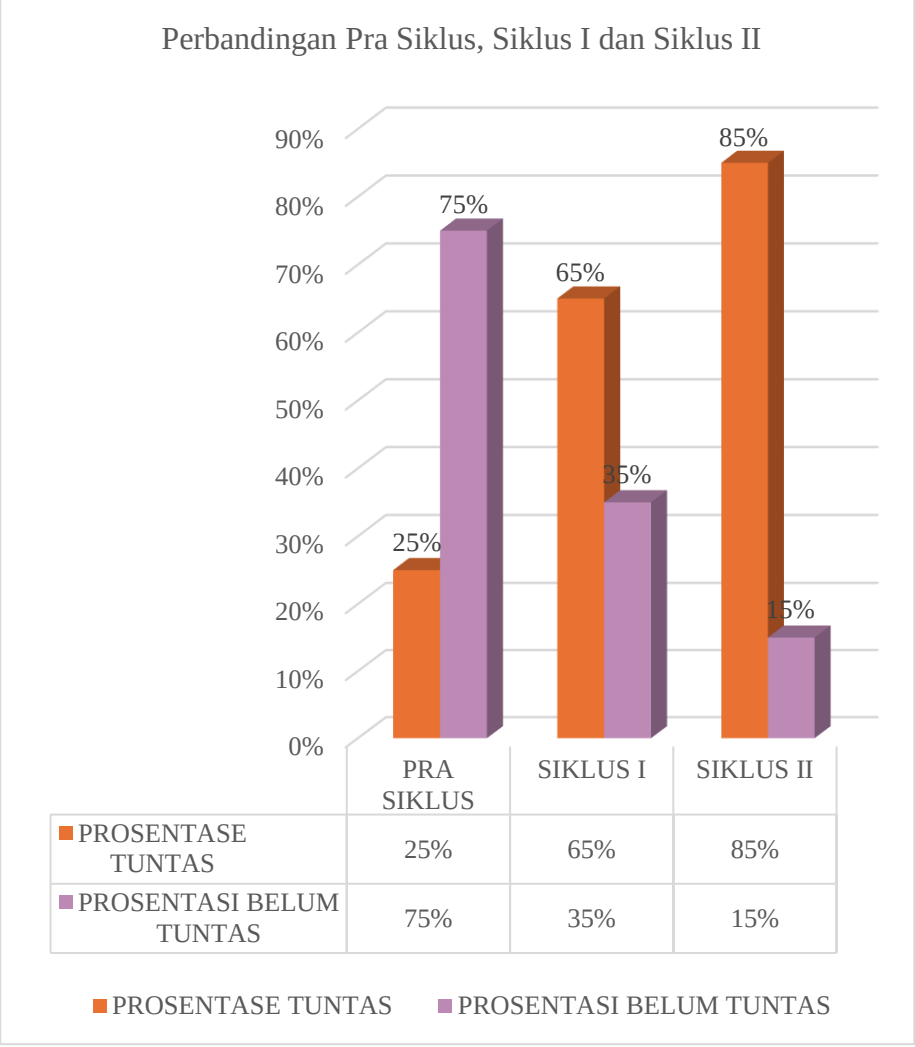

Image 2. Mathematics Learning Outcomes Pre-Cycle, Cycle I and Cycle II

Based on the comparison graph of learning outcomes in the pre-cycle, cycle II1, and cycle II, there is a significant increase in students' understanding of mathematical concepts after the implementation of Bruner's learning theory-based learning with the help of concrete objects. In the pre-cycle stage, only 25% of students achieved completion, while the other 75% had not met the Learning Objective Completion Criteria (KKTP). After the action was carried out in cycle I, the percentage of completion increased to 65%, with 35% of students still not completing it. In cycle II, learning outcomes again showed a better increase, with 85% of students having achieved completion and only 15% still not completing it.

This increase shows that the application of Bruner's learning theory has a positive impact on the understanding of mathematical concepts, especially in measurement material. Bruner's theory emphasizes the importance of learning that takes place through three stages of representation, namely enactive (direct experience using concrete objects), iconic (visualization through pictures or diagrams), and symbolic (use of numbers and abstract symbols). By using concrete objects in learning, lower grade students who are still at the concrete operational development stage find it easier to understand the concepts taught. Learning becomes more meaningful because students experience and manipulate objects directly before moving on to the abstraction stage. Thus, the application of Bruner's learning theory in mathematics learning has proven effective in improving student learning outcomes gradually and sustainably.

c. Cycle III

The test results in cycle III showed that out of a total of 20 students, 18 students had achieved scores that exceeded the Learning Objective Achievement Criteria (KKTP). As many as 90% of students completed cycle III. For other students, as many as 2 students did not meet the Achievement Criteria (KKTP). To improve the understanding of mathematical concepts in lower grade students, especially in measurement material, teachers can utilize concrete objects as learning aids. By using objects such as rulers, meters, or other measuring instruments, students can more easily understand the concepts of length, width, and volume directly. The first step that teachers can take is to introduce concrete objects that are relevant to the measurement material, then invite students to take direct measurements on objects around them.

In addition, teachers can also provide practice questions involving concrete objects to strengthen students' understanding. With this approach, students not only learn abstractly, but can also relate the concepts taught to the real world. This is expected to significantly improve students' understanding and mathematics learning outcomes.

A comparison between the results of Pre-Cycle, Cycle I, Cycle II and Cycle III can be seen in the following image:

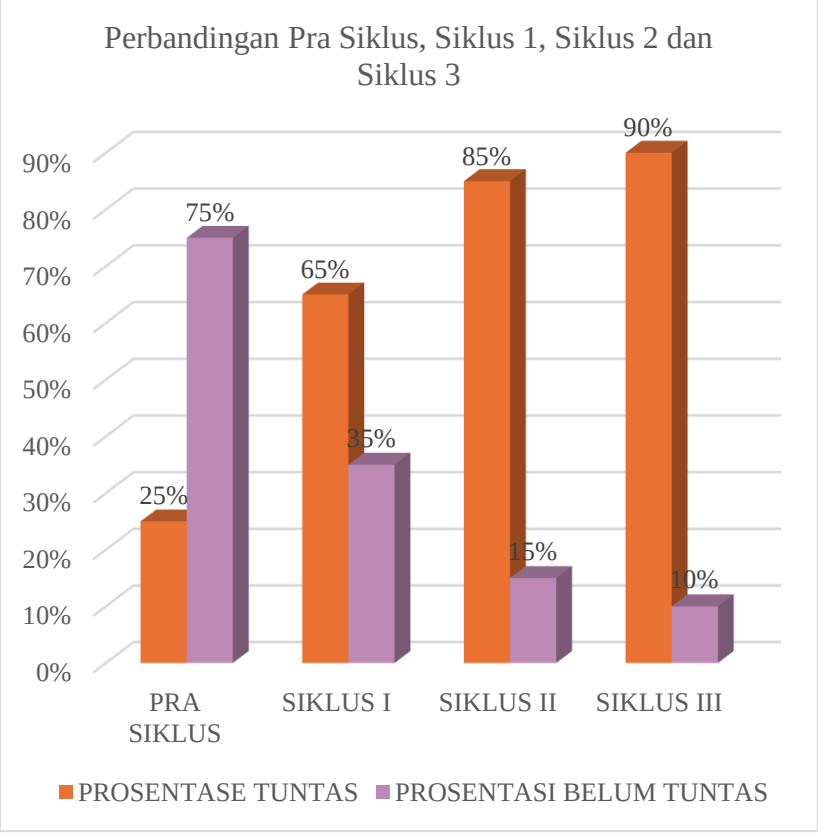

Image 3. Mathematics Learning Outcomes Pre-Cycle, Cycle I, Cycle II and Cycle III

Based on the data presented in the graph, especially the results in Cycle III, it can be concluded that the achievement of this classroom action research has been very successful. The target achievement set, namely more than 75% of students achieving a Mathematics KKTP score of 70, has been exceeded in Cycle III with 90% of students achieving completion.

Consistent improvement from Pre-Cycle to Cycle III indicates that the application of Bruner's learning theory with the help of concrete objects is gradually able to improve students' understanding of mathematical concepts in measurement material. Cycle III is evidence of the peak of the success of the implementation of actions that have been planned and evaluated in previous cycles.

Therefore, this classroom action research can be considered successful in improving the understanding of mathematical concepts of measurement material in grade 3 students of Cimrutu 01 Patimuan Elementary School through the implementation of Bruner's learning theory assisted by concrete objects.

4. CONCLUSION

This classroom action research aims to improve the understanding of mathematical concepts of measurement material in grade 3 students of SD Negeri Cimrutu 01 Patimuan through the implementation of Bruner's learning theory assisted by concrete objects. The research was carried out in three cycles, with stages of planning, action, observation, and reflection in each cycle.

The results of the study showed a significant increase in students' understanding of mathematical concepts in measurement material after the application of learning based on Bruner's learning theory with the help of concrete objects. This increase was seen gradually from Pre-Cycle to Cycle III.

1) Pre-Cycle: The level of student learning completion before the action only reached 25%, with 75% of students not yet achieving the Learning Objective Completion Criteria (KKTP).
2) Cycle I: After the implementation of the actions in the first cycle, the learning completion rate increased to 65%, with 35% of students still not completing it. This increase shows that the introduction of the concept of measurement through the manipulation of concrete objects (enactive stage) began to have a positive impact on students' understanding.
3) Cycle II: In the second cycle, the learning completion rate increased again to 85%, with only 15% of students not yet completing it. This increase indicates that Bruner's learning stages, namely enactive, iconic (visualization), and symbolic, gradually help students internalize the concept of measurement. However, there are still some obstacles such as differences in students' learning speed and focus during learning.
4) Cycle III: In the third cycle, learning outcomes showed the most significant improvement, with 90% of students achieving learning completion and only 10% of students not completing it. This result exceeded the target of research achievement set, namely more than 75% of students achieving a score above the Mathematics KKTP of 70.

The consistent improvement of each cycle proves that the implementation of Bruner's learning theory assisted by concrete objects effectively improves the understanding of mathematical concepts of measurement material in grade 3 students. Learning that starts from real experiences with concrete objects, continued with visual representation, to symbolic understanding, is in accordance with the stages of cognitive development of lower grade students and helps them build a deeper and more meaningful understanding.

Thus, it can be concluded that this classroom action research has succeeded in improving the understanding of mathematical concepts of measurement material in grade 3 students of SD Negeri Cimrutu 01 Patimuan through the implementation of Bruner's learning theory assisted by concrete objects. The use of concrete objects as learning aids allows students to understand concepts more realistically and contextually, thereby significantly improving their learning outcomes. This study recommends that teachers, especially in lower grades, can utilize concrete objects in mathematics learning, especially in abstract materials, to facilitate students' understanding of concepts more effectively.

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