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IMPROVING METACOGNITIONAL ABILITIES IN LEARNING MATHEMATICS THROUGH SIMPLE NUMBER OPERATIONS IN EARLY CHIDREN AT RA AL-HUDA WAJAK-MALANG

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ABSTRACT

Abstract: *The mathematics learning of early childhood education will be used in the theme of simple number operations. To be applied in everyday life. Mathematics has. The purpose of the study is to describe metacognitive abilities in mathematics learning through simple number operations. The research methodology used is classroom action research (Action Research) using observation data, interviews, and documentation and classroom actions through two cycles including cycle I and cycle II for six meetings. The results and discussion of the study found the importance of mathematics learning by designing appropriate learning strategies. Learning strategies are related to learning techniques that will be presented such as mathematics learning techniques using creative and innovative games. It is proven that the overall data analysis on the average pre-cycle results reached 55% with the technique of recognizing numbers orally. Then, the cycle at the first meeting achieved an average result of 71.25% with a learning concept that combines story problems and playing number classification with number symbols. The results of the cycle at the second meeting achieved an average result of 77.5% with the concept of learning to arrange symbolic numbers and guess numbers and number symbols. Meanwhile, the cycle's third meeting achieved 89.5% success rate, incorporating the concept of learning mathematics through memory circuit games and learning mathematics through an outdoor setting. This demonstrates the success of children's critical thinking skills through stages of understanding supported by innovative and creative learning strategies. Metacognitive skills, as a form of critical problem-solving, contribute to the realization of the concept of enjoyable mathematics learning.*

Abstrak: Pembelajaran matematika anak usia dini yang akan digunakan dalam tema operasi bilangan sederhana. Untuk diterapkan dalam kehidupan sehari-hari. Matematika memiki. Tujuan penelitian untuk mendeskripsikan kemampuan metakognisi dalam pembelajaran matematika melalui operasi bilangan sederhana. Metodologi penelitian yang digunakan penelitian tindakan kelas (Action Research) dengan menggunakan data observasi, wawancara, dan dokumentasi dan tindakan kelas melalui dua siklus meliputi siklus I dan siklus II selama enam kali pertemuan. Hasil dan pembahasan penelitian menemukan pentingnya pembelajaran matematika dengan merancang stategi pembelajaran secara tepat. Strategi pembelajaran berkaitan dengan teknik belajar yang akan disajikan seperti teknik belajar matematika dengan menggunakan permainan kreatif dan inovatif. Terbukti analisis data secara keseluruhan pada hasil rata-rata pra-siklus mencapai 55% dengan teknik pengenalan angka secara lisan. Kemudian, siklus pada pertemuan ke-1 mencapai hasil rata-rata sebanyak 71,25% dengan konsep belajar yang mengombinasikan soal cerita dan bermain klasifikasi angka dengan lambang bilangan. Hasil siklus pada pertemuan ke-2 mencapai hasil rata-rata sebanyak 77,5% dengan konsep belajar menyusun simbolik angka dan tebak angka dan lambang bilangan. Sedangkan, hasil siklus pada pertemuan ke-3 mencapai 89,5% dengan konsep belajar matematika melalui permainan sirkuit memory dengan belajar matematika melalui nuansa outdoor. Hal ini, dapat disimpulkan keberhasilan cara berfikir kritis anak melalui tahapan pemahaman yang didukung dengan strategi belajar yang inovatif dan kreatif. Kemampuan metakognitif sebagai bentuk pemecahan masalah secara kritis dalam mewujudkan konsep belajar matematika secara menyenangkan.

INTRODUCTION

Education of early childhood is an important foundation in developing children's metacognitive abilities. Early childhood education is the initial foundation in individual development that will determine the quality of the child's future development. Education is one of the right steps in stimulating all aspects of development including cognitive, language, social-emotional, physical motor, as well as moral and religious aspects, which are expressed in the form of mathematical activities. Mathematics has a very broad and detailed conceptual scope in describing authentic results that are appropriate to the child's age level (Elmali & Kilic., 2025). One of the important basic materials introduced in early childhood learning includes understanding the concept of simple number operations. The depth of mathematical concepts is complex, meaning that if children have learned simple mathematical material (Eberhart, et.al., 2025), children will gain broad insights and knowledge to apply in their social lives. The depth of concepts that will be provided in learning involves the meaning of numbers, words and images, and the form of learning objectives is carried out to facilitate children's metacognitive understanding in learning simple number operations (Faizah & Sulistyaningtyas., 2024).

Metacognitive abilities emphasize that the learning activity process involves critical understanding, information processing, reasoning, and problem solving (Huda et al., 2025). Metacognition at the preoperational stage can understand symbolic abilities, representing objects through language, images, and simple symbols (Clements & Sarama, 2009). The development of the concept of number operations helps children understand the relationship between object representations and number symbols. In addition, it is reinforced by Bruner's theory of number recognition in early childhood through three stages including enactive as an action, iconic referring to images or visuals of objects, and symbolic forms of symbols or numbers (Clark & Henderson, 2023; Novakova, 2024). The introduction of number operations in children is carried out gradually, aiming to train the metacognitive abilities of children aged 4-5 years requiring a long-term process (Elizabeth, et al., 2014). Thus, children will understand the quality of themselves based on their critical thinking skills, which is done through simple mathematical techniques to the most difficult levels. Furthermore, metacognitive mathematics can stimulate logical thinking skills, focusing on more concrete problem-solving. Mathematics is implemented through several indicators, including counting numbers, classifying numbers using symbols, connecting numbers to numbers, and recognizing simple addition and subtraction. This plays a crucial role in strengthening children's metacognitive structures in simple mathematics instruction for early childhood.

Mathematics learning is a collaborative process in understanding abstract concepts, structures, and patterns in solving complex problems (Prayitno., 2023). The application of mathematical concepts is close to everyday life. This concept aims to train problem-solving skills that have logical and critical patterns. Mathematics has a mathematical characteristic. Here, children will be tested on their abilities in mathematical number operations in the solution process. This term is known as Adversity Quotient, which is an intelligence and ability to face difficulties and obstacles that will affect success (Siregar, 2025). Mathematical abilities provide meaning in

connecting various ideas and understanding interrelated mathematical ideas such as numerical problems and quantity patterns in an abstract manner (Elia, et.al., 2023; Telaumbanua, et al., 2024). The ability to recognize simple number operations explains the basic concepts of numbers and number symbols, connecting the meaning between the form of number symbols and symbolic objects that are continuous (Joseph. et al., 2025).

The development of symbolic abilities, namely the ability to use words, images, movements, or sounds as representations of certain objects or concepts (Durroh et al., 2025). At this stage, the use of media rich in symbols is essential so that children can connect abstract experiences with concrete concepts in mathematics. Mathematics cannot be done conventionally. Instead, it is done with concrete mathematical concepts. The results of a survey by researchers at RA Al-Huda Wajak, showed that many teachers still cannot understand learning strategies for early childhood education levels. They prefer to apply mathematical learning systems similar to those in elementary school education. This will affect children's metacognitive abilities in a fun way. Mathematical concepts need to be introduced in simpler ways for children. This is the challenge for teachers in analyzing techniques/methods in completing simple mathematical number operations material for early childhood. In the context of learning numbers and number symbols, a learning strategy is needed, namely by using symbolic learning media.

Mathematical media will help students understand number operations in a fun way. Number operations are related to the symbolic recognition of image shapes, image illustrations, and number symbols (Gable & Fozi., 2023). The techniques that will be used are identifying the number of numbers, classifying numbers in number symbols, connecting the number of images symbolically, and finding new results from simple addition and subtraction of numbers (Onoshakpokaiye, 2023; Outhwaite, et.al., 2024). Number operations can be considered very basic mathematical material. They have a role in deepening mathematics at a more logical level. Number operations at the early childhood education level, the introduction of numbers 1-10 or 11-20, can continue to the introduction of the next number. Numbers can be converted in social learning spaces such as buying food, drinks, and toys. According to research conducted by Yuli, et al., (2025) explaining that the mathematical process seems complex, but if children are able to understand number operations, it will be the first step that is interconnected with understanding the next mathematical material. Therefore, a learning strategy is needed to facilitate children's understanding of mathematical operations. Considering children's current development, recognizing numbers is no longer subjective but has entered the objective realm. Children can memorize very high numbers. However, the obstacle is their inability to understand the tens digit symbol. Therefore, children are able to recognize number symbols and need to deepen their understanding of the concept of number symbols. The purpose of this study is to describe the improvement of metacognitive abilities in mathematics learning and the concept of learning mathematics through simple number operations for children in group A2 at RA Al-Huda Wajak, Malang.

RESEARCH METHODOLOGY

This study uses classroom action research. In general, the classroom action research (CAR) approach is a form of approach that explains explicit case studies or becomes one of the phenomena that require periodic action aimed at overcoming problems that have been experienced. This type of classroom action research (CAR) is research that describes the process and results of providing treatment or actions carried out in the classroom with the aim of improving the quality of learning (Sugiyono, 2013). The study was conducted at RA Al-Huda Wajak in the even semester of the 2024/2025 academic year for 4 weeks. The research subjects were 21 children in group A2 RA Al-Huda Wajak consisting of 9 boys and 12 girls with an age range of 4-5 years. The selection of subjects was based on the results of initial observations that showed the ability to recognize numbers and symbols was still low. This was reinforced by observational data where children were able to memorize numbers symbolically. However, they still did not understand the concept of number symbols such as 10 (ten). The case study faced by the researcher in providing actions to introduce number symbols by combining several symbols visually.

The implementation of CAR follows the Kemmis & McTaggart three-stage model in each cycle: planning, action, observation, and reflection. In Cycle I, the actions given focused on basic number recognition, the use of number cards, and practice matching numbers with their symbols. Reflection at the end of the cycle showed that some children still had difficulty connecting number symbols with the appropriate quantities. This finding became the basis for improvements in Cycle II, where the actions were reinforced with more concrete and interactive media, such as counting games with real objects, and tiered guidance (scaffolding). Changes in actions were made to increase child engagement, clarify the relationship between symbols and quantities, and the differences in strategies between Cycles I and II aimed to ensure optimal improvement in children's ability to recognize number operations.

Data collection techniques by Abubakar, (2021) use observation, interviews, and documentation. Observation data will be related to observations and designing learning strategies for mathematical number operations for early childhood. Interviews will be conducted in trials of mathematical materials to children in a more enjoyable way in the form of learning activities. Assessment indicators include: (1) stating the sequence of numbers 1-10, (2) pointing to number symbols 1-10, (3) connecting numbers with objects, and (4) writing simple number symbols. The data analysis technique uses quantitative descriptive analysis by calculating the percentage of indicator achievement. The research success criteria are set at a minimum of 50%. If it is not met, then it is necessary to analyze the researcher's data to improve the repetition of the form of learning strategies in achieving the validity of the findings based on classroom action research variables.

RESULTS AND DISCUSSION

This research was conducted in three stages: pre-cycle, cycle I, and cycle II. The pre-cycle included an oral pre-test on number operations, specifically recognizing and naming numbers. Children were expected to name numbers by observing several number symbols. The naming stage required memorization skills integrated into the child's memory. Reflection on data analysis during

the pre-test showed that 15 out of 21 students had moderate memory skills in memorizing mathematics. Therefore, the researcher developed a learning strategy for each cycle and meeting to hone children's metacognitive skills in mathematics learning through simple number operations. The design for each cycle included techniques such as student worksheets, playing with numbers, and learning mathematics through nature. Cycle 2 employed play-while-learning techniques, including classifying numbers and symbols, guessing symbols, and playing math games using pictures. Learning was conducted according to the Kemmis & McTaggart model. The data generated on the improvement of metacognitive skills in mathematics learning for early childhood shows a comprehensive recapitulation of the results, as shown in Table 1.1. As follows :

Table 4.1 Summary of Metacognitive Ability Results in Number Operations Learning

Stage	Cycle 1	Cycle 2	Percentage of data analysis	Category
Pre-Cycle	0	0	55%	Children's metacognitive abilities appear to be quite low.
Meeting 1	70,5	72	71,25%	The child's metacognitive abilities appear good.
Meeting 2	75	79,5	77,25%	The child's metacognitive abilities appear to be very good.
Meeting 3	87	92	89,5%	The child's metacognitive abilities appear to be very good.
Average	**77,5**	**81,16**	**79 %**	The child's metacognitive abilities appear good.

Table 4.1 explains the improvement of metacognitive abilities in learning number operations. It begins with the pre-cycle stage, a stage where trials are conducted before the cycle trials are carried out in each meeting. Researchers used an oral pre-test technique. The concept given in the pre-cycle determines children's thinking abilities in remembering numbers from small to large. Children stop at the number 20. However, based on field data analysis, there are still some children who are still confused in communicating numbers in the context of saying them. Often saying numbers by jumping around such as 1, 2, 3, 4, 5, 7, 8, some still say the numbers 1, 2, 4, 5, 7, 9. In addition, there are children who communicate numbers fluently without teacher assistance. This reaches a percentage of 55% of the results achieved in the pre-cycle stage. Children's success in learning mathematics is 5 children who still jump around in saying numbers simply.

Continuing on, the researcher's design entered the first cycle stage, the 1st meeting reached 70.5%, the results achieved by using the children's worksheet (LKA) technique through the design concept of simple mathematical number operations. The results of observations at the 1st meeting showed that children completed the learning activities of mathematical number operations through the design concept of combining one picture with another that has a simple story meaning. The success of learning number operations reached 7 children who completed quickly and accurately. The 2nd meeting reached 75%, the results achieved by using the technique of playing to recognize numbers. Where children were invited to work in teams or groups. Directed in arranging numbers randomly and relay. This activity had an impact on the success of learning

with a total of 9 children who completed quickly and compactly. Meanwhile, at the 3rd meeting reached 87%, the results achieved by using mathematics learning techniques with a natural nuance. This concept identifies objects in the surrounding environment such as twigs, plastic, leaves, paper, candy wrappers and children try to collect and start to count the number of objects obtained. This learning strategy meets the criteria for learning success reaching 10 children who have a competitive and careful attitude. Researchers reflected on the success of the data, including some students still lacking focus during the learning process. Furthermore, children's number memorization skills were more focused on actions rather than verbalization. This means that children sometimes forget when asked to practice speed in pronouncing numbers compared to more play-based skills. Despite the shortcomings in designing the learning strategy, researchers decided to continue to Cycle II.

In cycle II, the first meeting achieved 72% of the learning activities, playing with number symbols. The learning system is a relay with a memory circuit game. Where children understand numbers through their memory. This activity is carried out individually with assessment criteria of speed, accuracy, and agility. Children's abilities are greatly developed through the memory circuit game, with maximum familiarity with 12 children who meet the assessment criteria. In the second meeting, the learning activities of number operations reached 79.5% by guessing numbers and number symbols quickly and consistently. This learning is inspired by the game of Monopoly where there are small cards containing questions and children must answer correctly. If not, the child will be tasked with circling pictures of various cities until they find the question again. The learning achievement of 15 children who participated well. Of course, this game is very competitive. Meanwhile, in the third meeting, the learning activity reached 92% through learning techniques using mathematical games inspired by the game Super Deal. If children answer correctly, they will be awarded stars. If the stars collected are too many, the group is allowed to take an early break. The number operations learning activity using math games reached 19 out of 21 students. The graph of the increase in metacognitive abilities in mathematics learning through simple number operations is shown in Figure 4.1. As follows:

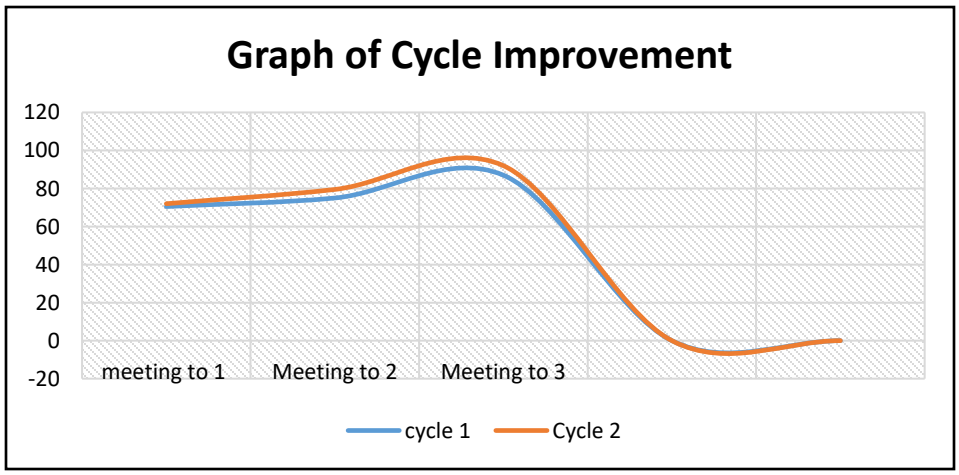

Figure 4.1. Graph of Cycle Improvement at Each Meeting in Mathematical Number Operations Learning

In Figure 4.1 and Table 4.1, the graphical data analysis of the achievement of the results of increasing metacognitive abilities in each cycle at each meeting. These results were analyzed to find more concrete data findings through data analysis techniques with an average percentage between cycles I and II for six meetings. Data analysis at the first meeting of each cycle showed an average of 71.25% with a percentage increase in children's metacognitive abilities of 1.5% with aspects of fast, precise and careful assessment. While at the second meeting reached an average of 77.25% with a percentage increase in children's metacognitive abilities of 4.5% with aspects of competitive, careful, consistent assessment. Then, at the third meeting the average was 89.5% with a percentage increase in children's metacognitive abilities of 5% with aspects of competitive and careful assessment in learning mathematical number operations in learning strategies through playing with numbers and number symbols. This activity is very effective in training children's memory in communicating numbers and number symbols correctly.

CONCLUSIONS AND SUGGESTIONS

The results of classroom action research conducted in two cycles at RA Al-Huda Wajak, it can be concluded that children's metacognitive abilities can be trained through learning strategies with game patterns. The findings based on the average cycle in mathematical number operation learning activities reached 71.25% in the 1st meeting with aspects of fast, precise and careful assessment through story problems and memory circuits to recognize numbers in the counting learning process. Also, the learning stage in the 2nd meeting reached 77.25% with aspects of competitive, careful, and consistent assessment. The learning strategy used to arrange numbers and guess numbers in number symbols. Meanwhile, in the 3rd meeting reached 89.5% with aspects of competitive and careful assessment. The learning strategy carried out by the researcher was a natural-themed mathematical game. This research can be an inspiration in learning abstract or complex mathematics for students based on the child's age level as a relevant alternative in developing early literacy and numeracy skills. Further research can examine the application of this method in different age groups and contexts or integrate it with other approaches more comprehensively and contribute to the development of innovative learning practices.

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