

## Efforts to Improve Mathematical Skills through Loose Part Media in Children Aged 5-6 Years at PAUDQU Sahabat Ilmu

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### ABSTRACT

Mathematical ability is one of the fundamental cognitive aspects that needs to be stimulated in early childhood. However, observations at PAUDQU Sahabat Ilmu show that children aged 5–6 years still experience difficulties in mastering early mathematical indicators, such as grouping, sequencing, and recognizing simple patterns. This study aims to improve the mathematical abilities of early childhood through Loose Part media. The method used is Classroom Action Research (CAR) model Kemmis and McTaggart which was implemented in two cycles. The research subjects consisted of 6 children in group A aged 5–6 years. Data were analyzed descriptively qualitatively and quantitatively. The results showed that the use of Loose Part media provided a significant increase in children's mathematical abilities. The average ability of children increased from 45% in cycle I to 80% in cycle II. This increase proves that Loose Part media is effective in creating concrete, exploratory, and enjoyable learning in PAUD, and is able to encourage children's logical-mathematical cognitive development comprehensively.

**Keywords:** *Loose part; Math skills; early childhood.*

### INTRODUCTION

Early childhood refers to children aged 0-6 years. This is in line with Law No. 20 of 2003 concerning the National Education System, which defines early childhood as children aged 0-6 years. According to (Azizah & Mohammad, 2023; Retnaningrum & Nasrul, 2021), the 0-6 years are considered crucial because during this period, the brain is undergoing rapid development. Therefore, early childhood is often referred to as the Golden Age. Accordingly, the Golden Age is defined as a period that occurs only once in a lifetime and plays a crucial role in determining the quality of future development (Susanti et al., 2004). This period is a time that cannot be repeated. Therefore, providing educational stimulation at this age is essential to ensure that every child achieves optimal development.

Early childhood education is an effort to provide guidance aimed at children to help stimulate the growth and development of their potential and intelligence. According to (Rahmalia & Dadan, 2021), early childhood education is a means of stimulating the growth and development of a child's full potential and intelligence. The use of appropriate stimulation will play a crucial role in a child's future development. One aspect of early childhood development that requires stimulation is the cognitive aspect. Cognitive development is the process of developing thinking skills, where individuals begin to build understanding, reasoning, knowledge, and

comprehension of the various things around them (Izzuddin.A, 2021). From birth, children have the potential for active thinking, and this ability will continue to develop as they grow.

In line with the concept of the Golden Age as a fundamental period of human development, Islamic Early Childhood Education (PIAUD) views this period as a crucial phase for instilling the natural instinct (fitrah) and implementing early education (tarbiyah). From an Islamic perspective, early childhood education holds a crucial position because it is the initial phase of character formation and the foundation of faith. Islam views children as a trust and a sacred natural instinct, as stated in the Hadith of Bukhari, the Prophet Muhammad (peace be upon him), which states, "Every child is born in a state of fitrah, then it is his parents who make him a Jew, a Christian, or a Zoroastrian" (Setiyawan, 2015; Sutriyadi et al., 2022). Based on this hadith, it is clear that early education plays a significant role in maintaining the purity of a child's natural instinct so that it continues to grow. Early childhood education in Islam focuses not only on moral and spiritual development but also encompasses cognitive stimulation. In line with the development of their natural instinct, it is during this phase that children's thinking, learning, and problem-solving abilities begin to develop. Cognitive development is the level of an individual's ability to think which includes the process of problem solving, remembering, and making decisions. According to (Hafidza et al., 2024) Cognitive development is the process of growth of a child's brain's ability to use their thinking power to analyze, process, receive, store, and utilize various information obtained through the experience of seeing, hearing, and feeling something in their environment. Jean Piaget is one of the figures who researched Cognitive development which is divided into 4 stages.

Cognitive development according to Piaget in children aged 2-7 years is in the pre-operational stage, namely the stage of more symbolic thinking and the stage of logical thinking, children begin to imitate through images or objects around their environment, children form stable concepts and begin to reason (Khotimah & Agustini, 2023). According to Piaget, the cognitive development of children aged 2-7 years is in symbolic reasoning and goes through the relationship between real data and actual activities (Nasution.F. at al., 2023). Therefore, cognitive development at the preoperational stage plays an important role in the formation of aspects of children's mathematical abilities, such as the ability to count, recognize patterns, distinguish shapes and sizes, and understand simple quantitative relationships which form the basis for logical thinking and problem solving in the future.

Mathematical abilities are closely related to children's cognitive development. According to (Ayumi & Masganti, 2025) children's early mathematical abilities are closely related to children's cognitive development, namely the concept of counting.

This statement is in line with (Sufa & Ch.Evy, 2023) In early childhood education, the introduction and learning of mathematical concepts is part of the development of children's cognitive aspects. Through these activities, children not only learn to understand numbers and shapes, but are also trained to think logically, solve problems, and develop critical thinking skills from an early age. Jean Piaget researched Cognitive development which is divided into 4 stages. Cognitive development according to Piaget in children aged 2-7 years is in the pre-operational stage, namely the stage of more symbolic thinking and the stage of logical thinking, children begin to imitate through images or objects around their environment, children form stable concepts and begin to reason (Khotimah & Agustini, 2023) According to Piaget, children's cognitive development at the age of 2-7 years is in symbolic reasoning and goes through the relationship between real data and actual activities (Nasution, et al: 2023). Therefore, cognitive development in the preoperational stage plays a crucial role in developing aspects of children's mathematical abilities, such as counting, recognizing patterns, distinguishing shapes and sizes, and understanding simple quantitative relationships, which form the basis for logical thinking and problem-solving later in life.

Early childhood mathematical abilities are inseparable from cognitive development, particularly logical thinking. According to Minister of Education and Culture Regulation No. 137 of 2014 concerning National Early Childhood Education Standards, children's cognitive abilities encompass three main areas: problem solving, logical thinking, and symbolic thinking. Therefore, it can be concluded that early childhood mathematical abilities are a form of applying logical thinking in quantitative contexts and patterns of relationships between objects. Through grouping, sequencing, and pattern recognition, children learn to build systematic thought structures, which form the foundation for the development of mathematical cognitive abilities.

According to the (National Council of Teachers of Mathematics, 2022), the mathematics learning standards for early childhood include number operations, matching, grouping (classification), sequencing (seriation), geometry, measurement, patterns, and graphs, which align with the early childhood learning outcomes established by the Indonesian Ministry of Education as indicators for providing mathematics instruction to early childhood students. Decree of the Head of BSKAP No. 008/H/KR/2022 of 2022 concerning Learning Outcomes in Early Childhood Education covers the basic elements of literacy, mathematics, science, technology, and engineering. Within these learning outcomes, children can recognize and see relationships between patterns, symbols, and data and use them to solve problems in everyday life.

However, in the field, early childhood mathematics skills have not yet developed optimally. Some children still have difficulty grouping objects by color or shape, sorting objects by size, and recognizing repeating patterns. This situation indicates that stimulation of children's logical-mathematical cognitive aspects has not been fully facilitated. The challenges faced by teachers related to the use of conventional methods with minimal exploration require Pedagogical Innovation that aligns with the Play-Based Learning philosophy as a fundamental principle in Early Childhood Education (Safitri & Anik, 2021). Therefore, this study is based on the idea that Loose Part media is an innovative solution that bridges this gap. This media not only facilitates the development of children's mathematical abilities through active exploration, but also emphasizes that loose parts create an open play environment that allows children to imagine without limits and explore their potential naturally (Haryanto & Anik, 2024), making it relevant to the spirit of curriculum renewal and current pedagogical practices in Indonesia. Loose Part media are loose materials that can be combined, arranged, and manipulated by children according to their creativity. Through playing with Loose Part media, children gain direct experience in observing, grouping, sorting, and creating patterns based on color, shape, and size. Thus, the use of Loose Part media is expected to help teachers in developing early childhood mathematics skills through an active, creative play process and stimulating cognitive development.

## **METHODS**

### **Subjects of Research**

This research uses a classroom action research method. Classroom action research is closely related to the issues of teaching practices carried out by teachers. Classroom action research is an observation of learning activities, including actions that are intentionally created and occur simultaneously in a classroom (Machali, 2022).

This research uses a specific CAR model. The research model used is the Kemmis & McTaggart Model, which consists of four components: planning, action, observation, and reflection. These components, which are strands, form a cycle. According to Afandi, a cycle is a series of activities consisting of planning, action, observation, and reflection (Arif & Shinta, 2023). The author used the Kemmis and McTaggart cycle because it is highly suitable for use in classroom research. This research uses the Classroom Action Research (CAR) method with the Kemmis and McTaggart model, implemented in two cycles. Each cycle consists of four stages: planning, action, observation, and reflection. This method was chosen because it is considered the most appropriate for directly improving the learning process in the classroom through planned and systematic actions. This research was conducted at

PAUDQU Sahabat Ilmu in the even semester of the 2024/2025 academic year with the research subjects being 6 children in group A.

### **Instruments and Interview Questions**

The research began with a planning phase, which included the development of a Daily Learning Implementation Plan (RPPH) using Loose Part media to develop children's math skills. The next phase was implementation, where teachers implemented learning activities according to the established plan. During the observation phase, researchers and collaborators observed teacher and child activities during the learning process using observation sheets. A reflection phase then followed to analyze the observation results and identify successes and challenges, which were then used as a basis for improvements in the next cycle.

The research instruments used included child activity observation sheets to assess grouping, sequencing, and pattern recognition skills using Loose Part media, as well as teacher observation sheets to determine the effectiveness of the learning activities. Furthermore, documentation in the form of activity photographs and field notes was used to strengthen the observation data. Data collection was conducted through direct observation during the activities, referring to indicators of early childhood cognitive development as stipulated in Minister of Education and Culture Regulation No. 137 of 2014 concerning National Early Childhood Education Standards.

### **Data Collection**

The data obtained were analyzed descriptively using quantitative and qualitative methods. The results of observations of children's abilities are presented in the form of percentages of development levels categorized as Not Yet Developing (BB), Starting to Develop (MB), Developing as Expected (BSH), and Developing Very Well (BSB). Qualitative data in the form of observation and reflection results are used to support quantitative findings, so that a comprehensive picture is obtained regarding the improvement of children's mathematical abilities through the application of Loose Part media.

## **RESULTS AND DISCUSSION**

This research was conducted in two cycles with the aim of improving the mathematical abilities of children aged 5–6 years through the use of Loose Parts media. Observations focused on three main indicators: children's ability to group objects based on attributes, sort objects by size, and recognize simple patterns.

During the first cycle, children were introduced to various Loose Parts materials, such as bottle caps, colorful buttons, popsicle sticks, and plastic straws. Observations showed that most children still needed guidance in grouping objects by color and shape. The activity of sorting objects from smallest to largest was still

carried out with teacher assistance, and only a small number of children were able to recognize and correctly continue the pattern. Children appeared hesitant to use Loose Parts media because they were not yet accustomed to exploratory activities that require independence and creativity.

Based on the reflection on the implementation of Cycle I, the teacher refined the learning strategy in Cycle II by providing more concrete examples, increasing the variety of materials, and increasing children's engagement during the activities. In subsequent activities, children appeared more enthusiastic and active in using Loose Part materials to create patterns and group objects according to their attributes. They began to experiment and collaborate with their peers in arranging objects according to size. Observations showed significant improvement compared to the previous cycle.

The results of observations of the improvement in early childhood mathematics skills across each indicator are presented in Table 1 below.

**Table 1.** Improving Children's Mathematical Skills Through Loose Part

| No | Ability indicators                         | Cycle I (%) | Cycle II (%) | Description                                     |
|----|--|-------------|--------------|---|
| 1  | Classifying objects based on attributes    | 40          | 80           | BSB   |
| 2  | Ordering objects by size                   | 45          | 73           | BSH   |
| 3  | Recognizing and continuing simple patterns | 50          | 86           | BSB   |
|    | <b>Average</b>                             | <b>45</b>   | <b>80</b>    | <b>There was an overall increase in ability</b> |

Based on the data in Table 1, there is an increase in children's abilities across each indicator. Average ability increased from 45% in cycle I to 80% in cycle II. This indicates that the use of Loose Part media has a positive effect on the development of children's mathematical abilities. In addition to improving children's abilities, observations were also made of teacher and child activities during the learning process. The results of these observations are presented in Table 2 below.

**Table 2.** Results of Teacher and Child Observations in Learning Using Loose Part

| No | Ability Indicator  | Cycle I (%) | Cycle II (%) | Description  |
|----|--|-------------|--------------|--|
| 1  | Teacher readiness in preparing media and materials                     | 75          | 95           | Teachers are more skilled and creative in preparing Loose Part materials |
| 2  | The teacher's ability to motivate and guide children during activities | 70          | 90           | Improved communication and active involvement of teachers                |
| 3  | Children's activeness in participating in learning activities          | 65          | 88           | Children are more enthusiastic and focused during activities             |
| 4  | Cooperation between children in arranging                              | 60          | 85           | Play together and share materials with friends                           |

|   |   |           |           |   |
|---|---|-----------|-----------|---|
|   | patterns and groups of objects                                  |           |           |   |
| 5 | Children's ability to complete tasks without teacher assistance | 55        | 80        | Children's independence increased in cycle II                           |
|   | <b>Average</b>  | <b>65</b> | <b>88</b> | <b>There was a significant increase in teacher and child activities</b> |

Table 2 shows that teacher and child activity increased from cycle I to cycle II. Teachers became more creative in managing activities, while children demonstrated more active and independent involvement. This improvement indicates that the successful implementation of Loose Parts not only improves children's math skills but also strengthens the teacher's role in creating a fun and participatory learning environment.

Overall, the results of this study demonstrate that the use of Loose Parts is effective in stimulating the logical cognitive abilities of early childhood. Through exploratory and manipulative activities, children learn to understand the concepts of grouping, sequence, and patterns in a concrete and enjoyable way.

The results of the study indicate that the implementation of Loose Parts media has a positive impact on improving early childhood mathematics skills. According to Table 1, there was an average increase in children's abilities from 45% in Cycle I to 80% in Cycle II. The three indicators of grouping, sorting, and pattern recognition skills experienced significant development. Children became more independent, meticulous, and able to think systematically in organizing objects based on specific attributes. This improvement demonstrates that playing with loose materials can provide concrete and meaningful learning experiences for children.

Changes in children's behavior during the learning process were also supported by increased teacher and child activity, as shown in Table 2. Teachers were increasingly able to prepare a variety of media, provide clear guidance, and create a pleasant classroom atmosphere. Children appeared more enthusiastic and bold in experimenting with various Loose Parts materials. This improvement demonstrates that the effectiveness of Loose Parts media depends not only on the materials used, but also on the teacher's ability to manage exploration-based learning.

These findings align with Jean Piaget's cognitive development theory, which states that children aged 5–6 are in the concrete preoperational stage, where their thinking processes develop through direct interaction with real objects in their environment. Through manipulative activities such as arranging, grouping, and sequencing objects, children learn to understand basic logical concepts that form the foundation for mathematical abilities. This is supported by research (Monika et al., 2023), which explains that early childhood logical thinking skills can be observed

through grouping, sequencing, and pattern recognition. These three activities appear to improve after children engage in exploratory activities using Loose Part materials.

In addition to improving mathematical abilities, Loose Part media also fosters children's social-emotional development. Observations show that children find it easier to work together, share materials with friends, and demonstrate confidence when displaying their work. These findings support the opinion (Jawarni, 2022) that flexible and manipulative learning media can enrich children's learning experiences and encourage the development of various aspects, particularly mathematical skills.

Therefore, it can be concluded that the use of Loose Part media has a comprehensive positive impact on early childhood. In addition to improving mathematical skills through classification, seriation, and patterning activities, this media also fosters creative thinking and independence. Learning becomes more enjoyable because children learn through direct experiences that are appropriate to their developmental stage.

## CONCLUSION

Based on the results of the Classroom Action Research (CAR) that has been conducted, it is concluded that the application of Loose Part media has proven to be significantly effective in improving the early mathematical abilities of children aged 5-6 years at PAUDQU Sahabat Ilmu. This effectiveness is shown by the increase in the average learning completion of children which reached 80% in Cycle II, a drastic increase from 45% in Cycle I. This increase is driven by the flexible, manipulative, and open-ended nature of Loose Part media, which provides children with the freedom to explore so that they are able to master the early mathematical indicators, namely grouping, sorting, and recognizing patterns in a concrete, independent, and fun way.

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