

Implementation of Origami Construction to Improve Logical Thinking Ability on Early Age Children

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Abstract—This study aims to gain a conception of the application of origami construction for escalating the logical thinking ability on early age children. The method used in this study is descriptive research with qualitative research approach. The subjects are students of Class A in *Kelompok Bermain* (playgroup) Mutiara Ibu, Bandung, Indonesia. The result shows that the application of origami construction can improve the logical thinking of the students. It has been shown by their ability to 1) classify subject according its color, shape, and size (3 variations); 2) mention number symbols of 1-10; and 3) match the number with their symbols.

Keywords: *logical thinking, origami construction, early age children*

I. INTRODUCTION

Cognitive ability in early childhood is a main factor determining the child success in the future. As stated by Cunha et.al. [1], the skill attained in early childhood will affect the skills attained in later stages of life. Heckman and Masterov [2] and Cohrsen, et.al.[3] also state that the cognitive ability will affects the likelihood of acquiring higher education and advanced training, and the economic returns in terms of wages and quality of jobs. One of the cognitive ability is the mathematical ability which is equipment to for the children to gain success [3].

The intellectual development of early age (0-year to pre-school age) children is very delicate. In this age, the child's entire potential can be optimally developed with the assistance of the people surrounding the child, such as parents or teachers. One of the developing ability is the cognitive ability, which closely related to the child's condition [4]. Sujiono and Sujiono stated that a child is a small human who has potential to be developed [5]. Children have special characteristic which differs from adults. A child is always active, dynamic, enthusiastic, and curious on everything he sees and hears, as if he never stops learning.

The children are considered in the early age if they are 0-8-year-old [6]. Activities done by early age children can optimize their whole development aspects. The educators became one of the factors to support growth and development of the children. The educators are the best facilitators who give the right stimuli to the early age children.

One of the important aspects that need to be developed is the cognitive skill. Lack of cognitive skill will lead to difficulties in acknowledging the cause and effect of the events occurred in the environment. Santrock stated that the cognitive development involves the children's think, see the world, and using what they learnt [7]. One part of the cognitive development is logical thinking, which linked to mathematical skills.

Logical thinking is important for daily life aspect, since it is supporting the success of every activity, especially in decision making [8]. The problems found related to logical thinking learning, especially in community-based-school (known as Pos PAUD in Indonesia) are the learning activities were not using interesting media or learning tools, the students were not able to sort objects, and the students were not able to organize and classify objects. From the observation done in Bandung, Indonesia, there were 34% of local kindergarten schools which not orienting their mathematical learning strategy to the childhood development principle. Apparently, those kindergartens were community based school, known as Pos PAUD, with house-wives—without proper training in education—acting as teachers [9]. In the recent observation in Pos PAUD Kober Mutiara Ibu showed that there were 60% of 16 students whose logical thinking ability were not developed yet. The condition was caused by the learning activity which has not used tangible media. So, the children were easily bored during the activity. The children also lacking in opportunity to find their own learning media, to use the media they had found, and to utilize the media as they see fit. Hence, it affects their aspect of cognitive ability.

Origami has been used for early age learning, especially to develop the students fine motor skill [9,10]. Respitawulan, Afrianti, and Permanasari had made hypothetical learning strategy using origami construction to develop the children early mathematical ability [9]. Origami was chosen since it is already well known in early child learning, though it mostly used for fine motor skill development. Also, the media used are paper, which is cheap and easy to find. Respitawulan and Afrianti showed that the limited trial gave significant improvement in the knowledge of early childhood mathematics learning of the participating teachers [12]. However, the strategy has not been tested on the early age children. Thus, it is important to gain a conception of the implementation of origami construction for escalating the logical thinking ability on early age children.

II. MATHEMATICS FOR EARLY AGE CHILDREN

One of the pillars of the early age learning basic concepts is the principles of learning implementation, including: 1) oriented to the needs of children, 2) child learning in accordance with child development, 3) learning through play, 4) enabling environment, 5) stimulating creativity and innovation, 6) develop life skills, 7) utilize environmental potential, and 8) learning in accordance with socio-cultural conditions.

Early childhood math games should be done through three stages of mastery of arithmetic in the mathematical path, namely:

- Mastery of concepts: understanding something using concrete objects and events.
- Transition period: a transition from a concrete understanding to the introduction of abstract symbols.
- Symbols: a visualization of various concepts.

The ability expected in the math game in PAUD can be implemented through the mastery of concepts, transitions and symbols found in all mathematical paths, which include patterns, classification of numbers, sizes, geometries, estimates, and statistics.

1) *Playing patterns*. The child is expected to recognize and arrange the patterns contained in the sequence. The practice of playing patterns starts with using easy / simple patterns, then the pattern becomes complex.

2) *Playing classification*: Children are expected to be able to group or choose objects based on the type, function, color, shape of their match in accordance with the example.

3) *Playing numbers*: The child is expected to know and understand the concepts of numbers, transitions and symbols according to the number of objects, recognizing the shape of symbols, and matching them according to the symbol of numbers.

4) *Playing size*: Children are expected to be familiar with the concept of standard measurements that are informal or natural, such as length, size, height, and contents through

natural measuring devices, including hand span, fingers, steps, ropes, and sticks.

5) *Playing geometry*: Children are expected to recognize and mention various kinds of objects, based on geometric shapes by observing objects that are around.

6) *Playing estimation*: Children are expected to have the ability to estimate something (for example time, area, amount, space) and are trained to anticipate the various possibilities that will be faced.

III. MATHEMATICS LEARNING STRATEGY FOR EARLY CHILDHOOD USING ORIGAMI

From Respitawulan et. al, [9] and Fiol et. al, **Error! Reference source not found.**, there are several learning objectives for the learning strategy, as seen in **Error! Reference source not found.**

The indicators are achieved using these main activities:

A. Indicator: Classification of Color, Shape, and Size

Using the folding papers formed into fish, boat, house, etc. with various colors, shape, and size, game activity is made with a race of putting certain color/shape/size into baskets or 'fishing' certain color/shape/size.

B. Indicator: Classification of Objects into Groups or Pairing from More than 2 Variations

Using lap book, the children will classify the objects asked into available bags alternately.

C. Indicator: Naming Number Symbol

While folding activity is demonstrated, the children are asked to mention and point the numbers.

IV. METHODS

This research was conducted in *Kober Mutiara Ibu Bandung*, Indonesia. The planned research subjects were the class teachers and 16 5-year-old children of class A. This research was conducted by researchers in collaboration with classroom teachers as subjects who carry out the action of learning. The time of research were carried out in April 2019. The implementation of learning was done in accordance with the lesson schedule and the appropriate daily lesson plan.

V. RESULTS AND DISCUSSION

Learning activities at *Kober Mutiara Ibu* starts at 08.30 - 10.30. The learning indicators of the day are: 1) classifying objects based on color, shape, and size (3 variations); 2) mention the symbol numbers 1-10; and 3) matching numbers with number symbols.

TABLE I. LEARNING ASPECT AND INDICATOR

Aspect	Indicator
Logical thinking	Classify objects based on color, shape, and size (3 variations); Classify larger number of objects to the same or similar group, or pairing from more than 2 variations; Recognize ABCD-ABCD pattern; and Sorting object based on their size, from smallest to biggest and vice versa.
Symbolic thinking	Naming number symbol 1-10; Using number symbol to count; and Matching number with its symbol.

The activities carried out include folding tulip & vase, sticking tulip and vase shapes to white HVS paper and playing fishing based on certain sizes.

The activity begins with the opening, which is to line up, sing, train gross motor using a rainbow board, then the core, resting and closing activities. The trial was held on Monday which was attended by 8 students, using the theme of plants and sub-themes of tulips. First the teacher gives an explanation of the activities that will be carried out that day. The activities are folding paper to form tulip's shape and fishing paper fishes as illustrated by **Error! Reference source not found.**

The teacher explains the equipment that will be used during the activity then gives an example of how to make the tulips. The flower that will be made consists of 3 parts, namely tulip, leaf, and vase. To make it easier for children to participate in paper folding activities, the paper are given numbers pairs according to the folding steps. Children simply need to bring together the same numbers that have been written on that piece of paper. The teacher then starts distributing folding paper to all children and the children begin to try it independently. After completion, the children's work is placed on HVS paper and can be brought home after school.

The second activity is fishing. The teacher prepares the equipment to be used, which are the container for fishing pond, origami fishes of various shapes, sizes and colors that have been attached with metal clasps and chopsticks as fishing rods that have been mounted magnets. The teacher explains how to play it. Children play alternately to fish in the pond using a fishing pole. They fish as instructed by their teacher, whether large, medium or small fish. After finishing playing, the children are asked to tidy up the equipment that has been used. The activity ended with a prayer.

The activity of folding the paper was followed by the children with enthusiasm, so that the results of the folded paper were also neat especially for children who were quite well acquainted with the symbol of numbers and their sequence.



Fig. 1. (a) Tulip and vase example; (b) Fishing game tools.

The children who already familiar with the number symbol did paper folding activities without the need to be accompanied and without the need to wait for instructions from the teacher for folding (3 children), but for those who do not yet know the number symbols (4 children), the teacher need to participate in helping and assisting them because they faced difficulties in matching numbers and symbol numbers.

When folding paper to make a flower pot or vase, steps 4 and 5 were mostly reversed, while to make leaves, 1 child finishes it faster than other friends. When fishing for paper fish, children are very enthusiastic to get as many fish as possible but there is a little problem that the container used was too small. So it makes it difficult for children to distinguish the size (big, medium, small) of the fish because the origami fish is piling up.

The teacher looked quite overwhelmed when helping children who have not been able to participate in paper folding activities to the fullest. This may be caused by several factors, such as lack of stimulation of children in fine motor aspects, explanation of the step that is not being understood by children and the environment is less conducive. Therefore, additional time is needed when the activity of folding paper so that the child is able to follow it.

Another difficulty in folding paper is that the paper used was too thick (150 gram/m²) and slippery, so another additional material is needed to glue it together. Ideally, paper folding activities are carried out well using paper that is not too thick and not slippery. Thus, when preparing materials and tools, it is necessary to check the paper used because each brand of folding paper will have different thickness and slippage.

During the fishing activities, teachers need to fix the availability of tools and materials. The container used was too small and the fishing line was too short for children to hold. Overall, paper folding and paper fishing activities are fun activities for young children. Through this game, children more quickly recognize the symbol of numbers. The enthusiasm of children is seen when the activity takes place and they ask that the next day can play again like that.

After the implementation of learning activities, it can be seen that all children are able to classify objects based on color, shape and size. As many as 7 children are able to recognize the ABC-ABC pattern, and all children are able to sort objects by size from the smallest to the largest and vice versa.

This is in accordance with the findings from Henniger [13], Gasteiger [14], and Cohrssen [3] i.e. play situations can foster the development of mathematical learning in kindergarten and in school sustainably.

VI. CONCLUSION

Based on the results of the implementation of origami construction in *Kober Mutiara Ibu*, it shows the child's ability to improve. However, there needs to be improvements in the learning equipment available in the learning kit, especially the type of origami paper used needs to be thinner and not slippery. As for fishing activities, the size of the provided container needs to be quite large and the rope on the fishing line should be longer. The size of the fish used must be more easily distinguished, between large-medium-small. Almost all students participate in the activity with enthusiasm and experience an increase in the indicators of the intended learning.

ACKNOWLEDGMENT

We would like to give our gratitude to LPPM Unisba for supporting our research through "Hibah Penelitian Dosen Muda" 2019.

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