

Improving Early Mathematical Skills Using Kinesthetic Games

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Abstract-The purpose of this research is to improve the early childhood mathematical ability through the kinesthetic game. The subjects of this research were the children of group B at TK Damhil Gorontalo. The study was conducted from October to December 2017. The method used in this research was classroom action research. The procedure of the research include: a) planning, b) implementation, c) observation and d) reflection. The data were collected by observation, assessment, document analysis, and sound and image recordings. The data were analyzed using statistical-descriptive analysis. The result showed that early childhood math ability has improved. The first cycle assessment was 70% and increased by 90% in the second cycle. The conclusion of this research was the kinesthetic games can significantly improve children's early math ability and that children enjoyed the lesson as it is in accordance with children's learning style.

Keywords-Early Mathematics, Kinesthetic Games

I. INTRODUCTION

One of the aspects of improving children's cognitive ability is to optimize their early mathematical skills. Throughout early mathematical learning, children are introduced to mathematical skills in order to understand the concept of early mathematics [1]. Mathematical skills incorporated into children's everyday life started off when they get up in the morning until they go to bed at night. Therefore, by introducing early mathematical skills, children will build their characters and develop positive thinking.

Early childhood teachers and educators should not be hasty when it comes to teaching early math because early learners are not in the state of scholarly learning like in elementary or high school. Instead, they need to learn by playing. Through play, the children learn the concepts and facts in the world around them. If mathematical ability in early childhood is conducted through games and supported by an appropriate environment, early learners especially kindergarten students aged 5-6 years old should have been able to master early math skills as in classifying, ordering, matching, comparing and enumerating [2]. This is in accordance with the

standard curriculum as stated in the NCTM (National Council of Teachers of Mathematics) [3]

Unfortunately, in reality, teacher's pay less attention to the characteristics of the children's development when teaching math. Besides, the learning process which tends to be monotonous and complicated, causing math to be considered as a terrifying lesson that students always want to avoid and it lasts until they reach secondary education. In fact, the improper basis disposition of math learning in early childhood has caused students to disfavor the lesson.

Based on the findings from the interview with the teacher of group B (Mrs. Rahmi Taha, S.Pd) conducted on 6 November 2017, the writer found that many children have not yet been able to develop their mathematical ability. This was shown from the children's daily worksheets and the initial evaluation conducted by the writer for the daily activity plan in semester one of academic year 2017/2018, from 20 children in group B. The result showed that out of 20 children, there were only 30% of the number to have well-developed math skills, meanwhile, 70% of the number have yet to be seen. Thus, the indication signifies that the math skills of early childhood are unpleasant.

The results of the research conducted by Money, et.al showed that children can learn mathematics through games and explorations such as storytelling, singing, imagination, kinesthetic, and role-play. Learning math through play and exploration become more interesting and exciting because students can participate in the activities encompassed around them. In addition, game-based learning is essential to develop creativity, train kinesthetic sense, and improve concentration, perseverance and body endurance for balancing their physical activity.

As the background of the problem explained above, the writer conducted further observations regarding the process of learning activities on early childhood specifically in kindergarten in order to recognize, understand and adept early childhood mathematical development through action research in the process of early childhood math learning by using

kinesthetic games. Kinesthetic includes the individual's ability to express idea, concept, strength, and skills associated with bodily-kinesthetic intelligence. Through kinesthetic games, children will find things they might love that are related to movements, such as exercise, gymnastics, art activities (gestures and songs, acting, choreography), and other fine motoric skills. Thus, this action research is expected to be able to immensely improve and enhance the learning outcomes in early childhood math.

II. THEORETICAL FRAMEWORK

A. Early Childhood Math Concept

Mathematics is one type of knowledge required in the human daily basis. For instance, when we go shopping, we need to select and count the number of objects that will be purchased and the price to be paid. When we go somewhere, we need to remember the direction the place we visited how long it takes there and choose the quickest path to arrive.

Smith [4] explained several concepts of early childhood math; a) matching is the concept of one to one correspondence, b) classification, c) comparing, and d) ordering or seriation. According to Kennedy (2008) the concepts of early childhood math include; a) matching and discriminating, comparing and contrasting, b) classifying, sorting and grouping, c) ordering, sequence, and seriation.

The introduction of mathematics in early childhood could be more easily understood if the children are given the opportunity to learn from self-experience or using concrete objects because, in the early stages, children have only learned through symbols and are not able to think systematically. Minetola (2004) stated several steps for early childhood math started from small number recognition, learning to count object, enhancing the concept of counting based on ability to divide numbers, dividing close numbers, operating one multiplication or more, adding zero and one, and adding two until five.

Schwartz gave guidelines and rules regarding early math for children, as followed; (1) children learn from the concrete towards the representational and abstract thinking, (2) children's comprehension of early math merges through the experience in creating a collection of concrete objects, (3) the initial progress of the children starting from the recognizable ones to the unrecognizable ones, (4) children learn math from the simple knowledge towards the complex knowledge and skills. These rules administer the early math learning to fit the characteristics of cognitive development and the needs of pre-kindergarten and kindergarten students.

Based on the theoretical study explained above, it should be noted that mathematical skills are obtained by children from various processes. Math skills can be applied in the form of a concept to solve problems that are manifested in classifying, matching, sorting, comparing and enumerating. This early experience of mathematics is the basis to understand advanced math concepts.

B. Kinesthetic Games

Tadkiroatun said that play is an activity in regards to enjoyment without considering the final result [5]. Play-based activity can be conducted voluntarily, without coercion or pressure from other parties. Described that play is a fun activity conducted for the interest of the activity itself. Freud and Erikson cited from Santrock argued that play is a form of human adaptability which is beneficial to help children in overcoming anxiety and conflicts [6]. Piaget cited in Santrock explained that a game is a medium to improve children's cognitive development. Referring to those opinions presented, the kinesthetic game in this research was conducted in the form of kinesthetic movement in improving the early mathematical ability of early childhood.

The kinesthetic game is carried out with kinesthetic movements involving the big muscle which goal of the movement itself is not necessary. Fundamental movements in kinesthetic skills are running, jumping and throwing. The process of the movement formation does not occur automatically, it is acquired from the accumulation of study and practice by perceiving motion and doing repetitive movements with the awareness to do the correct movements. Hence, the motoric skill is the ability to perform efficiently and effectively. Skills generally are the terms often associated with one's ability to perform a specific purpose.

Children with good kinesthetic ability are more likely to perform quick and precise response against the situation that demands physical responses. One essential principle to build one's kinesthetic ability is to improve the movements' skills. Researchers have theorized that the brain develops when children are playing. There is a possibility that the brain is likely to function simultaneously with motoric development at an early age.

Thus kinesthetic ability is important to be developed and early stimulated on children. Kinesthetic skills can be developed through games allowing children to actively and freely move. This way, the development of kinesthetic ability is aligned with the children's brain development because physical activities unconsciously give a tremendous impact on brain development. The brain will be stimulated to work more actively and provide an accurate physical response in certain situations.

III. METHOD OF THE RESEARCH

The method used in this research is classroom action research. Using the spiral cycle model developed by Kemmis and Taggart, the steps include 1) planning, 2) action, 3) observation, 4) reflection [7]. The subjects in this research were 20 children of group B in TK Damhil Gorontalo.

The technique of data collection in this research used the assessment tests that measure early childhood math learning achievement. Assessment tests are conducted to measure the improvement of early childhood math learning before and after the action. Assessment tests designed by the writer refer to the aspects of early childhood math development and the daily schedule plan used in the school. The data were collected from observation notes, documentation and records of results in the field monitoring actions. The technique of data analysis used was statistical-descriptive analysis by using a formula to determine the percentage of the completeness and incompleteness with the following formula

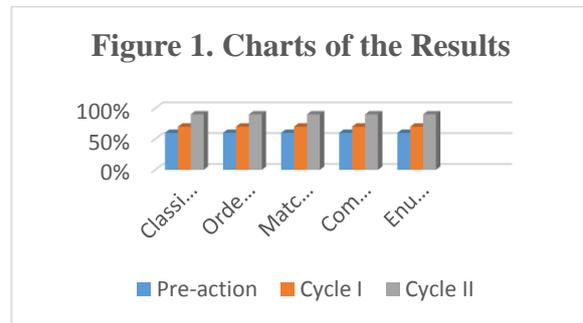
IV. RESULT AND DISCUSSION

The results of this study aim to identify the development of early childhood math skills; the elaboration of the conclusions about early childhood math concepts such as classifying, sorting, comparing, and matching to enumerating. Moreover, it also lays out the concept of kinesthetic games including the feasibility of media, techniques and rules in the game, the children's interest and enthusiasm during the game, interaction among the peers in the group, and repetition in order to obtain optimal outcomes.

Early math can be introduced through kinesthetic games by efficiently using physical movements and stimulated with balancing, dynamic and motoric skills so that children will be comfortable and engaged in the activity and thus the children will find it easier to perceive new information in mathematical concepts. There 10 kinesthetic games with developed pre-cycle; 1) agile running, 2) running zigzag, 3) running with flag, 4) guess and predict, 5) throwing the ball, 6) jump off your triangle, 7) estafette running, 8) tiptoeing, 9) where is your house 10) crawling under the hurdle.

Throughout kinesthetic games, children are not only trained in mathematical skills, but also toward their attitude simultaneously. Skills here may be performed by singing, or other motoric skills as well as the children's attitude embedded since the early age. The children's attitude can be seen by how the children are able to obey rules in the activities, from mutual respect in group activities, sensitivity and sympathy, and the attitude to accept defeat and victory in the game.

The results of the research in the implementation of the pre-action session in cycle one and cycle two showed an improvement in children's early math ability by using kinesthetic games as presented from the chart below;



Viewed from the cycle above, this research showed improvement in the outcomes. The initial assessment which was conducted on the pre-action session showed that early childhood math skills had a low percentage; hence, the writer conducted an action research to improve early childhood math skills through kinesthetic games.

This study uses two cycles, in the first cycle, the rate of success reached 70% which means that the achievement has not yet reached the expected value by the teachers and researchers. Therefore, a second cycle is required in order to overcome the first cycle by investigating the results on the first cycle that indicate insufficient value and unaccomplished aspects of early math ability. This outcome showed insignificant improvement because the practices of the children's games are conducted in a rush or the children are reluctant to do it and pay less attention to the teacher's instruction so that generates poor outcomes. Reflected on the results, the second cycle was conducted to improve the outcomes. In the second cycle, early childhood mathematical ability has increased to 90% achieved by the children understanding on how to play as well as their enjoyment and motivation during the game which was fitted to their learning style [8].

The early childhood math skills conducted has reached the goals because the kinesthetic-based learning is a suitable game to improve early childhood math ability for kindergarten learners[9]. By playing games, children feel enthusiastic and happy to participate in the activity. Besides, they are also challenged to complete all the phases in the game set with certain instructions and rules. In addition, this game-based learning not only effectively improve the early math skills but also develop other important aspects at the same time, such as socialization, independence, courage, the attitude in communication with peers, motoric skill, physical movements, language, and some other aspects [10]. This is in accordance with which stated; through active learning, the baby, toddler and young child follow their personal interests and goals through

first-hand experiences of the world around them, individually, in pairs, in groups, in families, and in the community.

Lesson planning to improve and train children's math skills should be properly and creatively prepared by the educators. It should be noted that children can be very moody and easily bored; hence, the model and the stimulation designed should be interesting and fun for them. When those two things are not acquired, the positive results are nowhere to be found but worsen the situation. To improve the early childhood math skills, the children's characteristics need to be investigated. Educators should consider their age as children are in the state of play, thus, the learning process is better performed in the form of the game[11].

This explanation is supported by the research conducted by Sarama and Clements which was published on[12] they suggest that mathematical experiences can be narrowed down into two forms, play that involves mathematics and playing with mathematics itself. [13] This implies that mathematics can be performed in two ways; the game that uses math and playing with the mathematics itself. Thus game-based learning is one of the appropriate strategies used in improving the early childhood math ability.

V. CONCLUSION

The results of the research conclude that the average percentage in the pre-action session was 60%. When the action performed in cycle I, the children's math ability has increased to 70%. Despite

the improvement, the target score has not yet to be reached. Therefore, the next action was performed in cycle II and the percentage finally reached 90% as expected, therefore, it is proven that kinesthetic games effectively improve the children's early math ability.

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