e-ISSN: 3063-7899

Proceeding of International Conference on Healthy Living (INCOHELIV)
(Volume 1, 2024)

Exploring geometric shape recognition in early childhood: Insights from the pre-operational stage

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Abstract

Purpose: At the age of 2-7 years, based on Piaget's theory, children are in the pre-operational stage. At this stage, children have the ability to understand mathematical concepts concretely through sensory and interactive experiences. Strategies are needed to improve the children's cognitive abilities. This research aims to provide an overview of early childhood cognitive development at the pre-operational stage in the introduction of geometric shapes.

Method: Researchers used a descriptive qualitative approach to interpret and explain patterns of behavior of children who are in the pre-operational stage. Data collection techniques included structured interviews and observations with checklists based on Jean Piaget's cognitive theory. Respondents in this study were selected using a purposive sampling technique. The respondents consisted of five children aged 6-7 years from the Islamic Kindergarten 'Aqila who were not familiar with geometric shapes.

Result: The results of this study indicate that children who are the subjects of the study exhibit behavior patterns consistent with Piaget's theory in the pre-operational stage, Children are able to recognize shapes through interactive learning experiences.

Conclusion: Based on the results, it is necessary for parents and teachers to pay attention to the child's cognitive development stage when teaching geometric concepts.

Keywords: *cognitive; pre-operational; geometric shapes*

INTRODUCTION

Early childhood education is aimed at and developed for young children, providing educational stimulation that helps promote the growth and development of children. This type of education is very important because it lays the foundation for the child's personality. Therefore, it must be designed according to the child's development stage, addressing various aspects of development: cognitive, language, socio-emotional, and physical motor skills.

Children should be given stimuli through play, as play is their natural world. When children play, they feel excited and happy. Learning activities should be designed in a way that children do not realize they are learning. Ayuningtyas (2020) supports that through play, children can develop cognitive, language, socio-emotional, and physical motor abilities. Mayke emphasizes in her book that learning while playing provides a good opportunity for children to control, repeat, discover, be thorough, and obtain different ideas and understanding (Triharso, 2013).

According to Piaget (Piaget, J., & Inhelder, B. 1969; Piaget, J. 1952; Piaget, J. 1963; Piaget, J. 1970; Piaget, J. 1969) "Cognitive" development involves the child adapting and defining objects and events in the surrounding environment (Nurani, 2004) Although the way of thinking of early

childhood is shaped through their experiences, children actively define the information they have gained based on these experiences. Mena (2004) suggests that cognitive development is crucial because it is related to children's activeness, brain memory, language, and problem-solving abilities. Therefore, it needs to be developed through the learning process.

Brain development in children is essentially acquired through their experiences. Children in the pre-operational stage use sensory-motor skills, where they progress in talking action, understanding the world with words and images based on their environmental experiences. Children begin to develop their understanding and reasoning, make plans, and imitate with creativity (Pratiwi, 2017). This shows that children in the pre-operational stage need experiential learning for brain development.

In the early childhood education (PAUD) curriculum there is material to recognize geometric shapes so that pre-mathematics concepts can be used to solve problems in everyday life. Teaching geometric shapes requires methods that attract early childhood attention and use various approaches to engage children effectively. However, based on observation at the Samarinda 'Aqila Islamic Kindergarten, the learning delivery was monotonous and repetitive, causing boredom, lack of enthusiasm, and difficulty understanding the material. Therefore, active and varied learning methods are needed to foster cooperation among peers. Based on this background, using cardboard board media in various geometric shapes as learning tools can make children feel happy and excited to learn. This approach can help improve their creative thinking skills through the introduction of geometric shapes.

METHOD

Researchers used a qualitative approach with a descriptive design to analyze the data. The research was conducted at the Islamic Kindergarten ‘Aqila in Samarinda. The subjects of the study were five children aged five to six years who attended 'Aqila Islamic Kindergarten. Data collection involved observation and interview techniques, utilizing observation and interview sheets that recorded children's activities related to exploring and imagining with cardboard board media and their understanding of geometric shapes. The study was conducted over fourteen meetings to maximize the introduction of geometric shapes to children in the pre-operational development stage.

In this study, researchers also acted implementers and evaluators, observing and assessing the cognitive development of each child during the learning process, considering that each child captures learning differently based on their background. During the observation, the researchers also documented the learning process. Data processing in this study considered the background of each child to facilitate the learning process. To obtain accurate and clear data, researchers used the following techniques:

1. Observation : Observation is a data collection technique used to obtain accurate and clear information by observing children's behavior. Researchers observed how children explored with cardboard board media and understanding of geometric shapes through this media.
2. Literature Study : A literature study is the process of investigating and analyzing a collection of works or literature that are relevant to the research topic being studied.

3. Interview : An interview is a data collection technique used to obtain information directly from the source through conversation or question-and-answer sessions about children's cognitive development and understanding of geometric shapes (Satori, 2014).

RESULT

Research Findings

This qualitative study focused on observation, interviews, and documentation to assess the introduction of geometric shapes to early childhood in the pre-operational stage and identify any learning obstacles. An observer assisted in monitoring each session. Data was collected through triangulation of observation and interviews, highlighting the use of cardboard board media at Aqila Samarinda Islamic Kindergarten.

1. Analysis of Child Growth in the First Step (Pre-Operational Stage)

In the first step, children were introduced to the names of geometric shapes using cardboard media. Observations showed that children gradually learned to remember the shapes' names. Initially, three children could identify four shapes, while two could identify three. As sessions progressed, children adapted and improved their recognition. The practice of matching shapes on the cardboard board at the beginning and end of each session, along with rewards, maintained their interest and motivation. The key factor influencing children's ability to remember shapes was the involvement of parents at home. Children who discussed their learning with their parents and received reinforcement at home showed better progress.

2. Analysis of Child Growth in the Second Step (Pre-Operational Stage)

In the second step, children were introduced to the characteristics of geometric shapes and continued to match shapes on the cardboard board. Observations indicated improvement, with two children identifying two characteristics and others following suit hesitantly. Regular practice and rewards continued to motivate the children. Parental support remained crucial in reinforcing learning at home. The development observed aligns with Piaget's theory (Piaget, J., & Inhelder, B. 1969; Piaget, J. 1952; Piaget, J. 1963; Piaget, J. 1970; Piaget, J. 1969) indicating that children begin to use language and mental representations to understand their world.

3. Analysis of Child Growth in the Third Step (Pre-Operational Stage)

The third step involved identifying everyday objects resembling geometric shapes. For example, children learned to associate rectangles with doors and circles with soccer balls. Observations showed that this practical approach helped children understand and remember shapes more easily. During this step, three children could confidently name rectangles, while two were still hesitant. The varied learning activities and direct examples provided effective stimulation for their cognitive development. Parental involvement and the use of engaging, varied learning methods were key to maintaining children's interest and comprehension.

Data Analysis

Processing and analyzing data from observations and interviews aimed to make objective decisions and validate findings. The research at Aqila Samarinda Islamic Kindergarten from January 16 to February 1, 2024, aimed to evaluate the introduction of geometric cardboard board media in early childhood education for children aged 4-7 years (pre-operational stage).

Factors Influencing Learning and Understanding:

1. Parental Involvement:
   - Emotional Support and Cognitive Stimulation: Positive interactions, such as playing and reading together, support cognitive development.
   - Role Models: Parents' positive attitudes towards learning influence children's approach to learning challenges.
   - Communication and Collaboration: Involvement in school activities and regular communication with educators enhance learning support.
2. Egocentricity: Children at this stage often see the world from their own perspective, which can hinder their ability to understand abstract concepts and other people's viewpoints.
3. Lack of Conservation: Children have difficulty understanding that the properties of objects remain constant despite changes in shape or arrangement. For example, they may not grasp that the amount of water remains the same when poured into different containers.
4. Transductive Thinking: Children may incorrectly project attributes from one object to another, such as assuming objects of the same color have the same size or weight. This can complicate their understanding of different concepts.

Summary from Observations and Interviews: The study found that children's ability to understand and retain learning varied based on several factors, including parental involvement and the nature of learning activities. Children who received emotional and cognitive support from their parents and engaged in varied, hands-on learning activities showed better progress in recognizing and understanding geometric shapes.

DISCUSSION

Through the process of analyzing the data, this section outlines important considerations for supporting the growth and development of both active and inactive children. The research findings will be provided to the principal of Aqila Samarinda Islamic Kindergarten to ensure that all children, including those not directly involved in the study, benefit gradually and evenly. The four main factors affecting children's growth and development in the learning process are parental or guardian factors, egocentricity, lack of conservation, and transductive thinking.

Parental or guardian factors are crucial for children's growth and development in the learning process. Emotional support and cognitive stimulation provided by parents can significantly enhance children's learning. Parents serve as important role models, and their attitudes towards learning and problem-solving directly influence their children's approach to these activities. Open communication between parents and educators, along with active parental involvement in school activities, improves the learning experience.

Egocentricity is a common trait in children at the pre-operational stage, making it essential for children to receive stimulation, affection, and direction from parents at home and teachers at

school. This guidance helps them see perspectives other than their own and aids their cognitive development.

Children at this stage also struggle with the concept of conservation, where they find it difficult to understand that quantities remain constant despite changes in shape or arrangement. To address this, parents and teachers must introduce learning concepts gradually, helping children grasp these abstract concepts more effectively.Another cognitive limitation in this stage is transductive thinking, where children incorrectly associate attributes from one object to another without understanding the differences. Gradual learning is necessary to help children overcome this limitation.

To support child development in the pre-operational stage (ages 2-7), parents and teachers must actively collaborate to provide consistent learning experiences and monitor children's growth. Increased awareness and proactive engagement in the learning process by both parents and teachers are essential to maximize children's recognition and understanding of various shapes and concepts. Providing emotional encouragement and cognitive stimulation is crucial, and guidance should be gradual to ensure children understand the learning provided both at school and at home.

CONCLUSION

From the results and discussion of this research on the introduction of geometric shapes in early childhood, several key takeaways can be highlighted. The use of cardboard boards as a learning medium proved to be effective in teaching the names and characteristics of geometric shapes to pre-operational age children. Observations and interviews revealed that children made significant progress in understanding geometric concepts.

Data analysis demonstrated that factors such as parental support, role models, and effective communication and collaboration are crucial in influencing children's ability to comprehend and retain learning. However, challenges such as egocentricity and a lack of transductive thinking need to be addressed to enhance early childhood learning processes.

The research underscored the importance of providing appropriate sensory stimulation and motivation to foster learning. Emotional encouragement, cognitive stimulation, and direction from both parents and teachers play a vital role in children's learning journeys.

To ensure optimal growth and development, it is imperative for parents and teachers to actively collaborate in providing engaging learning experiences, monitoring children's progress, and offering emotional and cognitive support tailored to the child's developmental stage. By doing so, children will be better equipped to understand and remember what they learn, enabling them to reach their full potential from an early age.

These findings emphasize the need for a holistic approach that involves both home and school environments working together to support the cognitive and emotional development of young children. By implementing these strategies, we can create a nurturing and effective learning environment that helps children thrive and succeed in their early years.

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