Improving The Cognitive Skills Of 4–5-Year-Old Children In Introducing Science Through Experimental Methods In State Children's Preschool In The 2024/2025 Academic Year

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Abstract

To analyze how to improve children's cognitive development (introduction to science) through experimental methods in early childhood education for the 2024/2025 school year. With the formulation of the problem How to improve children's cognitive development (introduction to science) through experimental methods in PAUD Anak Negeri for the 2024/2025 school year?. This research is a class action research (PTK) with a research model from the design of Kemmis and Mc Taggart which consists of four main activities, namely planning, implementation, observation or observation and reflection. This research was carried out with II cycles, each cycle consisted of four meetings. The subjects of this study are class A children aged 4-5 years in PAUD Anak Negeri which totals 13 children. The results of the study showed that in the pre-action consisting of 13 children before carrying out learning activities using the color mixing experiment method and the rainbow walking experiment that reached the criteria of developing very well (BSB) there were no or 0 children, 6 children achieved the development of the keriteria as expected (BSH), 6 children reached the keriteria began to develop (MB) and 2 children who were still in the keriteria had not developed (BB) so that the completeness obtained in Actions in this pre-cycle reached 23.07%. The achievement of children in the first cycle of 13 children after the action of the researcher using the color mixing experiment method increased to 61.4% then from the action in the first cycle the completeness achieved was 61.5%. Then continued in cycle II out of 13 children, there were 10 children who achieved very good ketal cariteria (BSB), 3 children were in the chiriteria developing according to expectations (BSH), so the completeness achieved in the action in cycle II reached 84.6% completeness. Therefore, from the results that have been seen from cycle II, namely that it has reached the limit of completeness planned by the researcher, therefore the research activity was completed at the cycle II stage because it has been said to be successful in research activities using experimental methods to improve the cognitive of children aged 4-5 years in the introduction of science in PAUD Anak Negara.

Keywords: *Child Cognition, Science, Experimental Methods*

INTRODUCTION

Early childhood is at different stages of growth and development. Children's growth and development patterns are consistent with their developmental levels, including fine and gross motor coordination, thinking skills, creativity, language, and communication. These patterns encompass intellectual intelligence (IQ), emotional intelligence (EQ), spiritual intelligence (SQ), or religious intelligence (RQ). Early childhood growth and development need to be directed toward laying the right foundations for holistic human growth and development (Mansur, Arif Rohman, 2019).

Development is an effort to change, and this change is not quantitative, but qualitative. Development is not emphasized in material terms, but rather in functional aspects. According to Yusuf Syamsu, development is the changes experienced by an individual or organism towards maturity, which occur systematically, progressively, and continuously, both physically and psychologically (Yusuf, 2001).

The developmental aspects that must be developed or stimulated in children from an early age include religious and moral values, physical motor skills, language, socio-emotional skills, and cognitive skills. These five developmental aspects are crucial for us as teachers and parents to develop or stimulate children from an early age (Mawarni Purnamasari & Na'imah, 2020).

One aspect of development that is crucial for us to stimulate and develop in children is cognitive development. According to (Ardila, 2020), cognitive development is a thought process, namely an individual's ability to connect, evaluate, and consider an event or occurrence. Furthermore, cognitive processes are related to the level of intelligence that characterizes a person with diverse interests, particularly those directed toward ideas and learning (Susanto, 2011).

Meanwhile, according to Jean Piaget's theory in 2007 in (Sujiono, 2016) concluded that cognitive development is "a general term that encompasses all models of understanding, namely perception, imagination, capturing meaning, assessment and reasoning. Cognitive development is not only the result of the maturity of the organism, nor the influence of the environment, but the interaction between the two. In addition (Khadijah, 2016) revealed that cognitive abilities can be categorized into cognitive development of general knowledge and science, cognitive development of the concept of shape, color, size and pattern.

Appropriate learning methods are essential for stimulating children's cognitive development, particularly in introducing them to science (Hidayah, 2023). One method considered effective is the experimental method. Experimental methods allow children to be directly involved in the learning process through observation, experimentation, and exploration. Through this method, children not only receive information but also actively participate in expressing ideas and opinions based on what they already know (Ambarwati & Karim, 2022).

Several studies have shown that experimental methods can increase children's interest, motivation, and understanding of science concepts. For example, research conducted by Suryana (2018) showed that using experimental methods in science learning in early childhood education (PAUD) can improve children's ability to observe, predict, and draw conclusions. Furthermore, research conducted by Dewi, N. K. A & Pratiwi (2020) also found that experimental methods are effective in stimulating children's critical thinking and can develop their creativity.

However, the implementation of experimental methods in early childhood education (PAUD) still faces several challenges. One is the limited facilities and infrastructure to support experimental activities. Furthermore, teachers lack understanding and skills in designing and implementing experimental activities. Therefore, efforts are needed to overcome these challenges so that the experimental method can be optimally implemented in science learning in PAUD. Furthermore, children's low cognitive development is a major obstacle. Children are still confused about the cause-and-effect relationship and still don't understand the results of mixing colors in experiments.

From the results of initial observations conducted by researchers, at PAUD Anak Negeri on Thursday, February 20, 2025, researchers found several problems in PAUD Anak Negeri in group A (ages 4-5 years) some of the children's cognitive development, especially in the introduction of science, is still low or underdeveloped. This can be seen from several children who are still unable to observe and describe the characteristics of objects, most children are not yet able to still be confused about the relationship between cause and effect. Therefore, researchers are interested in using experimental methods in developing children's cognitive skills. The choice of this experimental method aims to stimulate children's cognitive development, especially in the introduction of science and can attract children's interest in participating in teaching and learning activities both in and outside the classroom.

In the experimental activities that have been carried out involving children in groups A and B. Based on the description above, this study aims to further explore the experimental method can improve cognitive abilities in the introduction of science, in PAUD. This research is expected to contribute to the development of effective experimental method learning in improving children's cognitive abilities, as well as provide recommendations for PAUD educators and managers in optimizing the use of experimental methods.

METHOD

In this study, the type of research used is classroom action research (CAR). According to (Arikunto, 2015), classroom action is defined as an observation of learning activities in the form of an action that is intentionally created and occurs collectively in a class.

The data collection techniques used were observation, interviews, and documentation. The research design used the Kemmsi and McTaggart research procedures. Research procedures are the stages in the research process. The type of

research used was classroom action research (CAR), where the indicator is the achievement of improved student learning outcomes. The classroom action research procedure was implemented in a continuous cycle, consisting of several cycles, each cycle consisting of four main activities: planning (planning), acting (do an action), observing (data collection) and reflecting (reflection) (Farhana & Awiria and Muttaqien, 2019)

The data analysis technique used is using a formula by calculating student learning completion individually and classically as follows:

Individual learning completion is calculated using the following descriptive data analysis (Ratnawulan, 2013):

$$\text{Score} = \frac{\text{Score obtained}}{\text{Maximum score}} \text{ x } 100$$

Classical learning completion is calculated using descriptive percentage analysis, namely:

$$\text{Percentage (\%)} = \frac{\text{Number of students who have completed their studies}}{\text{Total number of students}} \text{ x } 100$$

RESULTS AND DISCUSSION

Based on the results of observations conducted by researchers on Thursday, February 20, 2025 at PAUD Anak Negeri, Jambianom Hamlet, Medana Village, Tanjung District, North Lombok Regency, where children's cognitive development, especially in the introduction of science in group A, is still not developing well. It is known from the researcher's initial observations during the learning process and also from the researcher's interviews with class teachers, this can be seen by the researcher from several science learning activities showing delays in children's cognitive development.

Table 01. Recapitulation of Cognitive Ability Data of 4-5 Year Old Children in Introduction to Science from Pre-Cycle to Cycle II

NO	NO	SCORE	TO	SCORE	TO	SCORE	TO
1.	AMO	42	75	48	85.7	52	92.8
2	ANK	33	58.9	40	71.4	48	85.7
3	BAKZ	40	71.4	47	83.9	51	91
4	BKM	35	62.5	42	75	49	87.5
5	AND	34	60.7	40	71.4	48	85.7
6	I	30	53.5	34	60.7	49	87.5
7	MRAP	33	58.9	39	69.6	49	87.5
8	RIB	35	62.5	46	82.1	52	92.8
9	HBR	40	71.4	46	82.1	52	92,8
10	MDN	20	35.7	32	57.1	39	69.6
11	OF	30	53.5	35	62.5	40	71.4
12	BSAF	20	35.7	32	57.1	35	62.5
13	DON'T	35	62.5	40	71.4	47	83,9
CLASSICAL COMPLETENESS		23,07%		61,5%		84,6%	

There were 13 children in group A, 10 of whom were only able to name colors, but were still unable to differentiate the types or appearances of the colors shown, while 3 children were able to identify them well.

From the table above, it can be seen that the values from the actions that have not been implemented until they are implemented, namely in the pre-action consisting of 13 children before carrying out learning activities using the experimental method of mixing colors and walking rainbows that reach the criteria of developing very well (BSB) are none or 0 children, 6 children reach the criteria of developing according to expectations (BSH), 6 children reach the criteria of starting to develop (MB) and 2 children who are still in the criteria of not developing (BB) so that the completeness obtained in the actions in this pre-cycle reached 23.07%. The achievement of children in cycle I of 13 children after the actions of the researcher using the experimental method of mixing colors and walking rainbows consisted of 4 children who reached the criteria of developing very well (BSB), 6 children were in the criteria of developing according to expectations (BSH) and 3 children were in the criteria of starting to develop (MB). From the actions in this cycle I, the completeness achieved was 61.5%. Then continued in cycle II, out of 13 children, 10 children reached the criteria for developing very well (BSB), 3 children were in the criteria for developing according to expectations (BSH), so the completeness achieved in the actions in cycle II reached 84.6%. So from the results that have been seen from cycle II, it has reached the limit of completeness planned by the researcher. Therefore, the research activities were completed in the cycle II stage because it was said to be successful. In the research activities using experimental methods to improve the cognitive abilities of children aged 4-5 years in the introduction of science at PAUD Anak Negeri. In this activity, children carry out learning activities individually or in groups consisting of 2 children and sometimes children advance one by one.

In the research table above, it can be seen that the results of improvements or evaluations of activities in the class have increased from the initial actions, namely in cycle I to cycle II. This is because the learning activities carried out in cycle II look at the reflection on cycle I. From the value achieved in cycle I, which is 61.5%, it is not yet said to be complete because there are several obstacles and problems, one of which is that there are children who still do not know the type of color, they can only name the color, so this is what makes the learning actions carried out in cycle I incomplete.

Therefore, from the shortcomings of cycle I, researchers and teachers made it a learning and motivation related to how researchers implemented color mixing and rainbow experiment activities well for children so that children quickly understood the activities given by researchers. So that in the action of cycle II, it succeeded in showing success, namely an increase in cognitive development in the introduction of science in children, better than the previous action, namely achieving classical completeness of 84.6% of 13 children, therefore the increase that occurred in cycle II was said to be successful.

In line with the above description, Jean Piaget (1952) in (Sujiono, 2016) stated that children's cognitive development occurs through a series of stages. According to Piaget in (Ibda, 2015), early childhood (2-7 years) is in the pre-operational stage, where they begin to develop symbolic thinking skills but are still limited in terms of logic and understanding abstract concepts. Piaget emphasized the importance of learning through direct experience and interaction with the environment to build children's knowledge. The experimental method, which involves children in hands-on activities, is in line with this theory because it allows children to construct their own knowledge through exploration and observation.

In line with this, cognitive development in science in early childhood plays a very important role in shaping the ability to think, understand, and interact with the world around them. Here are some reasons why cognitive development in science is important for early childhood: fostering curiosity, developing critical thinking skills, improving problem-solving skills, developing language skills, and building a strong foundation for future learning (Nugraha, 2008).

This is emphasized by (Mashud, 2024) who stated that researchers develop children's

cognitive abilities by using experimental methods, because experimental methods can improve children's cognitive abilities and can create a learning environment that best fosters creativity and critical thinking. Based on this conclusion, it can be stated that research that has been conducted through Improving Cognitive Abilities in Early Childhood Science Learning Through Experimental Methods has increased.

CONCLUSION

The Cognitive Level of 4-5 Year Old Children in Introduction to Science Through Experimental Methods at PAUD Anak Negeri Academic Year 2024-2025 is in the pre-action consisting of 13 children before carrying out learning activities using the experimental method of mixing colors and rainbow walks that reached the criteria of developing very well (BSB) none or 0 children, 6 children reached the criteria of developing according to expectations (BSH), 6 children reached the criteria of starting to develop (MB) and 2 children who were still in the criteria of not yet developing (BB) so that the completeness obtained in the actions in this pre-cycle reached 23.07%. The achievement of children in cycle I of 13 children after the actions of researchers using the experimental method of mixing colors increased to 61.4% then From the actions in this cycle I the completeness achieved was 61.5%. Then continued in cycle II of 13 children there are 10 children who reached the criteria of developing very well (BSB), 3 children are in the criteria of developing according to expectations (BSH), so the completeness achieved in the action in cycle II reached 84% completeness. So from the results that have been seen from cycle II, namely that it has reached the limit of completeness planned by the researcher, therefore the research activities were completed in the cycle II stage because it has been said to be successful in research activities using experimental methods to improve the cognitive of children aged 4-5 years in the introduction of science in PAUD Anak Negeri.

SUGGESTION

Suggestions for future researchers are that future researchers can use other methods or media in developing children's cognitive development, because children's cognitive development can be developed in various ways, not limited to certain methods or media.

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