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THE INFLUENCE OF VOLCANO ERUPTION EXPERIMENTS ON THE COGNITIVE DEVELOPMENT OF CHILDREN IN GROUP B1 IN TK AL-HIKMAH

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Abstract

This study aims to examine the impact of a volcanic eruption experiment on the cognitive development of early childhood students at TK Al-Hikmah Ketapang Banyuwangi. Using an experimental method with a One-Group Pretest-Posttest design, the sample consisted of 15 children from group B1. The results showed a significant increase in the children's cognitive abilities after the treatment. Before the treatment, most children were in the "Not Yet Developed" and "Starting to Develop" categories. After the treatment, there was a significant increase to the "Developing as Expected" and "Developing Very Well" categories. The Wilcoxon test indicated that this experiment positively influenced the children's cognitive development. Nature-based science learning not only enhances cognitive abilities but also motivation, social skills, and both physical and mental health of children. This method is effective in integrating direct experiences with the natural environment to prepare children for future challenges.

Keywords: Experiment, Cognitive, Early Childhood.

INTRODUCTION

Early age is known as the golden age. This is due to the very rapid brain and physical development of children during this period. Golden age covers the age range from 0 to 6 years, and is the best time to develop various potentials in children, including growing their interest in religious and moral values. Instilling these values will be an important foundation in forming good children's character in the future.

Childhood is a golden period for brain development and children's curiosity. At this time, children have high curiosity and learn to explore the world around them. This curiosity can be a strong motivator for learning to help children develop important skills and knowledge in life. Children who have high curiosity will be motivated to seek information, solve problems, and master new things.

A sense of curiosity can be fostered through fun learning activities. A pleasant learning atmosphere will increase their enthusiasm for learning. In fact, young

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children spend most of their time playing because by playing children experience a learning process. Therefore, in the process children need meaningful experience and knowledge (Eliamah et al., 2022).

Fun and interesting learning activities can foster children's curiosity and increase their enthusiasm for learning. Curiosity and enthusiasm for learning are two things that are interrelated and have an important role in early childhood development. The characteristics of curiosity possessed by young children include spontaneity; universal; diverse; and change over time (Setiawati & Ekayanti, 2021). Child-focused learning is based on the belief that children will develop and learn naturally. Therefore, the play environment is designed in such a way as to provide opportunities for children to recreate and experiment, both indoors and outdoors.

Characteristics of enthusiasm for learning include: the child's interest and attention to an activity, enthusiasm within the child to carry out the activity, responsibility; the feeling of enjoyment towards the activity they choose, the reaction shown by the child to the stimulus given by the teacher to the child. Apart from that, there are various benefits of fun and interesting activities for young children, including: encouraging learning and development; increase learning motivation; foster learning independence; develop critical thinking skills (Ningrum et al., 2021).

The above is in line with John Dewey's Contextual Learning Theory regarding learning by doing which states that children learn better when they can connect what they learn with their experiences and real life. The process of connecting the two is called critical thinking ability, which is part of a thinking process that involves active, persistent and careful consideration. The development of critical thinking skills in early childhood can be seen through questions that arise from children where adults think that these questions are impossible for children to ask (Mukti & Pangestu, 2024).

Critical thinking skills possessed by children include children being able to create concepts, analyze, evaluate, make conclusions or decisions from observations, direct experience or while studying at school. Fun activities including group discussions, exploratory activities, and small research projects can provide opportunities for children to develop their critical thinking skills can help children to make these connections and make learning more meaningful (Febriani et al., 2023).

Therefore, children need to be given knowledge from an early age, including scientific knowledge. Natural science or science is systematic knowledge about nature and the physical world obtained through observation, research and experimentation, which aims to determine the nature or basic principles of the object under study. Fundamentally, science is knowledge obtained through learning or practice. Science encompasses general truths or the application of general laws obtained through the scientific method, with a focus on the physical world. Teaching

knowledge about disasters is very suitable through science, because children can learn to understand natural phenomena that occur around them.

Science activities will help children develop curiosity, continue to search for and discover various knowledge concepts, and develop them as they get older (Rahma, 2020). Science is systematic knowledge about the surrounding environment obtained through observation and research. The introduction of science in early childhood does not mean studying science formally, but rather to foster critical nature, curiosity, thoroughness, exploration to find answers, and the ability to think regularly through fun experimental activities. There is a learning method in PAUD that can help children recognize the phenomena of objects and events through fun activities, namely the science play method.

The science learning process for children can be implemented through a learning model with a fun and curious atmosphere. Science learning gives children the opportunity to participate in constructing their own knowledge (Enjelika et al., 2022). Science learning provides children with the opportunity to observe objects directly more closely, rather than just hearing explanations from the teacher. Science activities consist of 4 important core components, namely: (1) observation, (2) prediction, (3) conducting experiments and interpreting. Providing direct experience is an emphasized part of science learning. Science is a concept of knowledge obtained from the results of observations, experiments and natural phenomena and the contents of the universe. Science helps children understand natural phenomena and develop curiosity about the world around them. Awareness of the importance of learning science is given from an early age, if we are aware that the world is dynamic and continues to develop and change over time (Hikam & Nursari, 2020).

Science learning should be integrated with other sciences such as mathematics. Mathematics and science are two fundamental and important fields of knowledge for children to learn. Mathematics helps children develop logical thinking, problem solving and critical thinking skills. When children explore, they can also take measurements and read numbers (Izzuddin, 2019). Science learning can be done using experimental methods. This method is a procedure carried out under certain conditions to prove a hypothesis. Experiments provide ample opportunities for children to be actively involved in conducting experiments by experiencing and proving for themselves something they are learning. Experiments are part of the science learning process (Rahma, 2020).

According to The National Science Education Standard, science is taught through the discovery inquiry method, which involves direct learning and exploration to answer children's questions, ultimately leading to the discovery of scientific concepts. Science learning can also be done through the demonstration method, where the teacher provides explanations, examples and conducts experiments in front of students. This demonstration method can provide illustrations and explain

information to children, as well as improve their thinking abilities in terms of recognizing, remembering, convergent and evaluative thinking (Cahyani et al., 2015).

Before carrying out learning, the learning steps must be designed according to the learning method that will be used. In order for the implementation of this demonstration method to be effective, several steps that need to be taken by the teacher are explained by experts. The steps of the demonstration method are (1) there is a problem that must be solved, (2) according to the level of students' cognitive abilities, (3) the concept or principle discovered must be written clearly, (4) the necessary tools or materials must be available, (5) the classroom atmosphere must be arranged in such a way, (6) the teacher provides opportunities for students to collect data, (7) they must be able to provide answers correctly according to the data required by students (Ramadhan & Surya, 2017).

The results of research conducted by Pangaribuan et al., (2022) show that the use of demonstration methods in science learning can improve children's learning outcomes. In cycle I, the demonstration method is used during the learning process, followed by giving a post-cycle I test. Cycle II is carried out with similar activities, but with improvements based on deficiencies found in cycle I. After cycle II, a post-cycle II test is also given to measure children's understanding of the material being taught. Researchers concluded that the demonstration method was effective in improving children's understanding and learning outcomes of the material presented.

Before the researcher conducted the research, the researcher first made observations on group B1 children at Al-Hikmah Kindergarten Ketapang Banyuwangi. Researchers obtained results namely that children's cognitive abilities in exploring what happened from a phenomenon were in the beginning to develop (MB) category. This is due to the lack of teachers in providing experimental activities where children can try directly so that with experience the child can improve their cognitive abilities. In accordance with these problems, the researchers wanted to test the effect of a volcanic eruption experiment on the cognitive development of children in group B1 at Al-Hikmah Kindergarten Ketapang Banyuwangi. The aim of this research is to determine the effect of volcanic eruption experimental activities on the cognitive development of children in group B1 at Al-Hikmah Kindergarten Ketapang Banyuwangi.

RESEARCH METHODS

This research is included in the type of quantitative research, using experimental methods. Experimental research is a research method that aims to determine the effect of a particular treatment (Arifin, 2020). In this context, researchers used a Pre-Experimental experimental design with the One-Group Pretest-Posttest Design type. Sugiyono (Utami et al., 2014) explained that the aim of this design is to increase the accuracy of treatment results. This is possible because

this design allows for comparisons between conditions before and after treatment. This research design is depicted as in the illustration below.

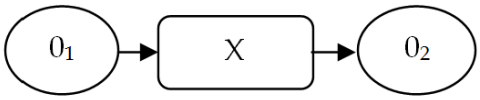

Figure 1 Desain *One Group Pretest Posttest*

Information:

O1: This is a pretest or score obtained before being given treatment in the form of a volcanic eruption experimental science activity.

X: Is a treatment or treatment in the form of a volcanic eruption experimental science activity.

O2: This is a posttest or score obtained after being given treatment in the form of a volcanic eruption experimental science activity.

This research was conducted at Al-Hikmah Ketapang Banyuwangi Kindergarten in May 2024. The population of this study were children from group B1 who were at Al-Hikmah Ketapang Banyuwangi Kindergarten, with a total of 15 children. The sampling technique used was a saturated sample. According to Sugiyono (Pratama, 2019), a saturated sample means that all members of the population were sampled. Therefore, all 15 children from group B1 were used as samples in this study.

This research was carried out through several stages. First, researchers collect pretest data through tests. After obtaining the data, the researchers carried out treatment for 3 days by providing activities in the form of volcanic eruption experiments. Treatment is carried out in groups, where 1 group consists of 5 children. So there were 3 groups during treatment. After the treatment was completed, the researcher collected posttest data. Data collection was carried out by tests given to children. This test was carried out twice, namely before (pretest) and after (posttest) the treatment, to measure children's cognitive abilities before and after treatment and to see whether there was an influence from the volcanic eruption experimental science activity on the cognitive development of children in group B1 at Kindergarten Al- Wisdom of Ketapang Banyuwangi.

Data analysis was carried out using SPSS Version 25. After analysis, researchers will determine indicators of the success of singing activities on children's language development. Below is the range of values that are the assessment indicators designed by researchers.

Table 1. Assessment Indicators

No.	Criteria	Score
1	Not yet developed (BB)	0-25%
2	Starting to develop (MB)	26-50%
3	Developing according to expectations (BSH)	51-75%
4	Developing very well (BSB)	76-100%

Before an instrument is used in research, it must go through a validity and reliability test to ensure whether the instrument is valid or not. If the instrument is not valid, it cannot be used in research. From the validity test, it was found that all instruments were said to be valid. The reliability test shows that the instrument is said to be reliable so that all instruments can be used in research. The data analysis technique uses the Wilcoxon test using SPSS 25.

RESEARCH RESULTS AND DISCUSSION

Based on research conducted at the Al-Hikmah Ketapang Banyuwangi Kindergarten with a sample of 20 children in Group B1, the following results were obtained:

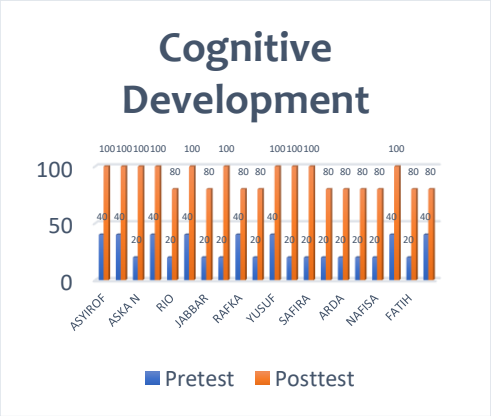

Figure 2 Percentage Results

Based on the picture above, it is known that during the pretest there were 12 children in the "Not Yet Developing" (BB) category and 8 children were in the "Starting to Develop" (MB) category. However, after being given the treatment, the results obtained by the children increased, namely that there were 10 children in the "Developing According to Expectations (BSH) category and there were 10 children in the "Very Well Developing" category.

Furthermore, the data analysis technique used was the Wilcoxon test to determine the effect of science learning with nature-based plant parts introduction activities on the cognitive development of early childhood at the Al-Hikmah Kindergarten Ketapang Banyuwangi obtained as follows:

Tabel 2. Ranks

Ranks

		N	Mean Rank	Sum of Ranks
Posttest - Pretest	Negative Ranks	0[a]	.00	.00
	Positive Ranks	20[b]	10.50	210.00
	Ties	0[c]		
	Total	20		

a. Posttest < Pretest
b. Posttest > Pretest
c. Posttest = Pretest

Based on the Ranks table above, it is known that the negative rating between science learning and the activity of introducing nature-based plant parts for the pretest and posttest is 0, both in the N value, Mean Ranks, and Sum of Ranks. Value 0. This indicates there is no decrease in value from pretest to posttest. A positive rating indicates there are 20 data, meaning that all students experienced an increase from pretest to posttest. This means that cognitive abilities through learning the science of volcanic eruption experiments did not decrease after being given treatment, with an average positive rating of 10.50 and a total of positive ratings of 210.00. To find out the effect of science learning on children's cognitive development at Al-Hikmah Ketapang Banyuwangi Kindergarten, it can be seen in the following table:

Table 3. Wilcoxon test

Test Statistics[a]

	Posttest - Pretest
Z	-4.089[b]
Asymp. Sig. (2-tailed)	.000

a. Wilcoxon Signed Ranks Test
b. Based on negative ranks.

Based on the Wilcoxon test, the Asymp (2-tailed) value was obtained at 0.000 < 0.05, which shows that there is a difference in the pretest and posttest scores obtained by children or it can be said that experimental science learning of volcanic eruptions can have a significant effect on the vocabulary mastery of children in group B1 in Al-Hikmah Kindergarten Ketapang Banyuwangi.

Nature-based science learning is an approach that integrates direct experience with the environment around children to develop their understanding of scientific concepts. This method invites children to explore and interact with nature, which not only enriches their knowledge but also improves observation, problem solving and critical thinking skills.

This is supported by the findings (Yaswinda et al., 2023) that cognitive abilities in early childhood can be improved through environmental-based science games. Varied science learning attracts children's interest, creating enthusiasm. With activities to introduce floating objects, floating objects, sinking objects and mixing colors, it stimulates children's curiosity to solve problems. Problem solving shows that children experience cognitive development.

Outdoor activities and direct interaction with nature can increase children's interest and motivation towards science. They are more enthusiastic and involved in the learning process because they feel learning is a fun and interesting activity. Through exploration and observation, children learn to ask questions, seek answers, and solve problems. This develops critical thinking skills which are very important in their cognitive development.

Through learning science, volcanic eruption experiments, children can learn through direct experience with nature and tend to have a better and long-lasting understanding. Through direct observation and interaction, children can understand basic science concepts in more depth.

Outdoor learning activities and direct interaction with nature can increase children's interest and motivation towards science. Fun and interesting learning makes children more enthusiastic about learning. Outdoor activities often involve cooperation and collaboration, which helps children develop social and emotional skills. They learn to cooperate, communicate, and respect other people's opinions.

Interacting with nature and doing outdoor activities also has physical and mental health benefits. Children become more physically active and also gain psychological benefits from being in a natural environment.

Through exploration and observation, children are invited to ask questions, seek answers, and solve problems. This develops critical thinking skills which are very important in their cognitive development. Nature-based science learning needs to be integrated into the early childhood education curriculum. This can be done by

designing programs and activities that allow children to learn through direct experiences with nature.

Educators need to be provided with adequate training and resources to implement nature-based science learning. They must understand effective methods and strategies to encourage children to learn through exploration and direct observation. Schools need to provide facilities and resources that support nature-based science learning. This includes access to natural environments such as school gardens, parks, or other green areas. Parents also need to be involved in the learning process. They can be encouraged to invite their children to carry out nature exploration activities at home or in their surrounding environment.

Good and appropriate science learning will give children the ability to think conceptually and develop their logic. All potential possessed by children requires good handling efforts through several components, starting from how the teacher designs the learning process and the environment (Mustika & Nurwidaningsih, 2018).

CONCLUSION

Based on the results of research conducted at the Al-Hikmah Ketapang Banyuwangi Kindergarten, it is known that through learning science, volcanic eruption experiments can improve the cognitive abilities of group B1 children. Nature-based science learning not only improves children's cognitive development but also provides many other benefits, such as increasing interest, motivation, social skills, and physical and mental health. With the right support, this method can be effectively integrated into early childhood education to prepare children to face future challenges.

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