JOURNAL OF EARLY CHILDHOOD EDUCATION
2026, VOL. 20, NO. 1, 74-85
e-ISSN (Online Media): 2503-0566 P-ISSN (Print Media): 1693-1602
http://journal.unj.ac.id/unj/index.php/jpud

The Effect of Experiment-Based Inquiry Method on the Science Ability of Children Aged 5-6 Years at Aisyiyah Bustanul Athfal III Paranga Kindergarten, Gowa Regency: A Quasi-Experimental Study

Yola Yulinda[1]✉, Syamsuardi[2], Tasrib Akib[3], Intisari[4], Nur Alim Amri[5], Heni Safitri Hasbur[6]
[1,3,4,5,6]Early Childhood Education Teacher Education, Muhammadiyah University of Makassar, Indonesia
[2]Early Childhood Education Teacher Education, State University of Makassar, Indonesia

ABSTRACT

This study aims to analyze the influence of learning methods *Inquiry* based on experiments on the science abilities of children aged 5-6 years. The low science ability in early childhood is a concern, which is part of the aspect of cognitive development to help children understand cause-and-effect relationships, simple problem solving, and introduction to science concepts in daily life. This study used a pretest-posttest experimental design involving 17 children as research subjects. Data was collected through observation, and analysis was performed using the Wilcoxon Signed Rank Test. The results showed that the experiment-based inquiry method significantly improved children's science skills, with an increase in the average score from a pretest of 32.47 to a posttest of 59.24. These findings support Jean Piaget's theory of cognitive development which emphasizes the importance of hands-on experience to facilitate learning. This study recommends the application of experiment-based inquiry methods as an innovative approach in early childhood education to improve critical thinking skills, solve problems, understand cause and effect and get to know simple science concepts in daily life.

History Article
Submission January 19, 2025
Received May 16, 2025
Accepted July 29, 2025

KEYWORDS.
Inquiry Methods, Experiments, Science Skills, Early Childhood

DOI. 10.21009/jpud.v20i1.53207

Contact Corresponding Author: Yola Yulinda, Early Childhood Education Teacher Education, Muhammadiyah University of Makassar, Indonesia
Email: yolayulinda2003@gmail.com

1. Introduction

Education is a person's process to gain specific and significant knowledge and learning experience, with education can have an influence in development to advance a quality generation of the nation. According to Law No. 2 of 1989 "Education is a conscious effort to prepare students through guidance, learning, and training activities for their role in the future" (Behrens et al., 2025). Early childhood education is a guidance aimed at children to develop several elements of development in children, including, religious values and ethics, identity, the basics of literacy and *STEAM* (Pollarolo et al., 2024). Early childhood education is a coaching effort aimed at children from birth to the age of six. Early childhood is a group that is in a unique process of growth and development, namely growth and development patterns, intelligence, social-emotional, discussion and communication that are specific to the child's growth and development level (Akib et al., 2022). Early Childhood Education has an important role in a child's growth because this period was the golden age (*Golden Age*) to accelerate the development of children. At this stage, children form character, attitudes, and basic knowledge about their environment (Intisari et al., 2024). Early childhood education is a very important early phase, and one of the main focuses in child development is cognitive improvement, particularly science skills (Alim Amri & Yunita, 2023).

The low ability of science in early childhood is a serious concern because this ability is part of the aspect of early childhood cognitive development, science skills are also very important to help children face various simple problems that occur in their environment (Anggraini et al., 2022). There are still early childhood children who do not know the cause and effect of a problem, solve a simple problem and children are unable to distinguish shape, size, color, solid and liquid (et al., 2018). According to previous research, there are several factors that can affect early childhood science abilities, the first is learning methods that do not fully meet the characteristics of early childhood development, and the second is the lack of cognitive stimulation that supports the development of early childhood science skills (et al., 2024). According to previous research, experiment-based learning such as the application of methods *Inquiry* Experiment-based can help children improve problem-solving skills, understanding cause and effect and introducing simple experiments that they have never done before (Hastuti & Wiyanto, 2019). Children can participate directly in the situation through fun learning activities (Syamsuardi et al., 2019). It can help them learn to think critically and learn how to experiment in a simple way that they can do with simple tools and materials (Digest,

2020). It is difficult for children to do challenging learning in the classroom if children are not presented with learning that can hone a thinking pattern that can hone aspects of cognitive development, especially in early childhood science skills (Hajerah & Syamsuardi, 2019).

Teaching skills science From an early age is a wise way to educate children so that they can find an answer to a question that is able to hone the child's ability to find the cause and effect of a phenomenon, solve problems simply and be able to distinguish between size, color, shape, solid and liquid objects (Novie Azizah, Primashanti Koesmadi, et al., 2021). With significant learning methods, it can help children to develop science skills in children such as Medode *Inquiry* be a student-centered learning method that gives children the opportunity to ask questions, find answers and investigate through hands-on experience (Imaduddin, 2017). The experiment-based inquiry method is a series of learning activities that emphasize the process of thinking critically and analytically to conduct experiments, analyze and find answers to a questionable problem (Pollarolo et al., 2024).

Children who are not properly stimulated their science skills will result in aspects of their cognitive development not developing optimally, allowing children to experience obstacles when applying science learning in the classroom (Hasibuan & Suryana, 2021). Referring to the theory Jean Piaget stated that early childhood is at the pre-operational stage, where children can equip their knowledge by actively exploring the environment by getting to know various kinds of phenomena, shadows, the properties of water, the size and mass of objects (Hasibuan & Suryana, 2022). Piaget also stated that Children gain their knowledge from exploring the environment around them to see, touch, smell, feel, and hear (Hamdani et al., 2019).

To improve early childhood science skills, it can be done by applying the *Inquiry* experiment-based. method *Inquiry* Experiment-based is chosen because this method aims to involve children in tasks that require children's activities in finding the cause and effect of a phenomenon, simple problem solving through experiments and the recognition of shapes, colors, sizes, solid objects and liquid objects (Rahmawati & Hardini, 2020). Method *Inqury* Experiment-based can be done by children in the room or outside the classroom either individually or in groups (Wandini et al., 2022). In early childhood education, the ability to science in children can be improved through the application of method *Inquiry* Experiment-based in a way such as the application of water-themed learning that is adapted to the syntax of the method *Inquiry* For example, water observation activities starting from the introduction of water sources, water and color experiments, water experiments, floating object experiments, sinking, drifting and experiments on solids, liquids and gases (Paramitha Sinaga et al., 2022). Method-based interventions *Inquiry* has been shown to be effective in improving early childhood science skills (Kencana Sari et al., 2019). Children who participate in learning activities method *Inquiry* Experiment-based that are interactive and challenging show an improvement in their ability to find problems, find solutions as well as their understanding of cause and effect (Ulfah & Khoerunnisa, 2018). Other researchers have also found that the *Inquiry* Experiment-based helps children communicate, work together, and make decisions in a fun environment and supports children in exploring things around them such as water, plants, wood and rocks (Husnah, 2022).

Children who have good science skills are able to face challenging learning, such as honing critical thinking skills, and problem solving, understand the cause and effect of the occurrence and get acquainted with simple experiments such as solid, liquid, gas, floating, sinking and floating experiments and use their experience and knowledge to answer questions they do not yet know (Fitria, 2017). This shows how important innovative and targeted learning methods are to support the development of skills science Early (Alim Amri, 2021). The experiential learning method has several advantages, including being able to increase understanding, motivation to learn, and develop critical thinking skills, problem solving, and collaboration or cooperation between students (Hasbi & Wulandari, 2020). Based on the statement, the *Inquiry* Experiment-based expected to improve the ability science in children.

Previous research has also shown that the *Inquiry* experiment-based can be used to improve the ability to Science in Early Childhood (Hamdani et al., 2019). This method involves children to learn hands-on experience by solving problems as well as hands-on experiments in a simple way (. et al., 2018). The experiment-based Inquiry method is a method that emphasizes students to learn directly to find an answer to a question that they do not know the reason for (Ernawati et al., 2018). Method *Inquiry* experiment-based is one of the a suitable method to be applied in improving the ability science Early Childhood (Rahmi, 2019). Experimental activities carried out in this learning method can involve educators and students to collaborate and can create an interesting, challenging and fun learning process (Wingsi & Yaswinda, 2020). Many studies have clearly linked method *Inquiry* Experiment-based with the ability to science children, there is a lot of evidence that this method is successful in creating active, innovative, challenged learning and creating a more lively and enjoyable classroom atmosphere (Dewi, 2012). Method application *Inquiry* Experiment-based learning activities have been proven effective in improving children's science (Melita Rahardjo, 2019). Activities designed to help children recognize their potential through hands-on experiences and various forms of interactive activities (Nurhafizah, 2017). Method *Inquiry* Experiment-based Offering solutions with experiment-based learning concepts tailored to learning syntax *Inquiry* namely (1) adaptation, the teacher prepares students to focus on the learning activities carried out, (2) problem formulation, namely students are asked several questions whose answers still contain mystery, (3) assumption formulation, students give uncertain answers so that in this case it is still necessary to seek the truth, (4) search for data, students are guided to find answers from problem formulations based on the data obtained, (5) assessing assumptions, namely the data that students have obtained

and then tested based on existing facts to provide answers from the questionable, (6) formulating conclusions, as the last stage to provide answers based on existing data and of course having passed the hypothesis test stage (Suharti, 2021). Most current research concentrates on the benefits of the *Inquiry* experiment-based on child development without paying attention to the impact of the method on cognitive function, especially problem solving and understanding of the cause and effect that occurs (Segara et al., 2023). Therefore, this study aims to test how effective it is method *Inquiry* Experiment-based in improving the ability science Children aged 5-6 years. It is hoped that the research will augment the current literature by offering creative methods to build early childhood cognitive skills, especially science skills. In addition, this study will provide advice for educators on how to use this method in student learning.

2. Theorectical Study

2.1 *Science Abilities in Early Childhood*

The ability of science is the capacity to use scientific knowledge, identify questions and draw conclusions based on facts and data to understand the universe and make decisions from the changes that occur due to human activities (Arohman et al., 2016). Science is the science that studies nature, related to the environment and oneself (Şimşek & Kabapinar, 2010). Science learning is learning that directly involves children and the environment (Subkhi Mahmasani, 2020). According to Putra (2013: 56) science learning is learning that emphasizes the process of seeking knowledge rather than knowledge transfer (Siswanto et al., 2019). Children are seen as learning subjects who need to be actively involved in the learning process, while teachers are just facilitators who guide and coordinate children's learning activities(Elfrida et al., 2022). Through science learning, children are educated and trained to be skilled in obtaining and processing information through thinking activities by following scientific procedures (methods), as well as skilled in making observations, measurements, classifications, drawing conclusions and communicating findings (Hinostroza et al., 2024).

Learning science early begins with introducing nature and the environment (Egitim, 2024). This will enrich the child's experience (Dewi, 2012). Children learn to experiment, explore, and investigate in the surrounding environment (Mugaloglu & Saribas, 2010). As a result, children are able to build a knowledge that can later be used in adulthood (Dostál & Klement, 2015). Basically, every child has a soul of general knowledge and science, like a child who likes to observe, likes to ask questions, has great curiosity and likes to try new things (Dostál & Klement, 2015). Therefore, introducing the natural environment and various natural events accompanied by their causes and effects on children is very important because cause and effect is an expression that can provide reasons why an event can occur (Dostál & Klement, 2015). Science can be interpreted as things that stimulate increased curiosity, interest and problem-solving, so as to give rise to thoughts and actions such as thinking, relating concepts and events, and observing. One of the science standards for Kindergarten is science as inquiry (Bunterm et al., 2012). Based on the 2013 Curriculum, the core competencies of early childhood knowledge are expected to be able to recognize the surrounding environment by: observing with the senses (seeing, hearing, smelling, feeling, touching); inquiring; collect information; reasoning; and communicate through play activities (Novie Azizah, Koesmadi, et al., 2021). The essence of Natural Sciences (Science) can be instilled in children as early as possible. In addition, children's understanding of science is more functional, if it is carefully developed through learning activities in kindergarten (Firda & Suharni, 2022). Science can be used as a vehicle in developing other characters such as stimulating high curiosity, discipline, thoroughness, objectivity and openness to new things (Abu Hashish et al., 2024). High curiosity can stimulate the development of high-level thinking skills such as the ability to analyze, evaluate and synthesize (Ogan-Bekiroğlu & Arslan, 2014).

Initial science skills that are included in the field of basic skill development are a logical approach but still consider the stages of the child's thinking ability in relation to various experiments or certain methods (Veryawan et al., 2021). Science is a science whose results of observation can actually be tested through theoretical experiments whose truth and development are consistently developed so that it can be trusted and guided by the knowledge in accordance with the truth or mere reality (Unlu et al., 2015). Conducting science learning in early childhood can improve children's cognitive development, understand simple science concepts and their relationship with daily life around children, through various learning activities about the environment to develop children's knowledge so that children have process skills, realize the greatness and power of the creator of the universe and are able to solve various problems they face using scientific methods and be scientific. Science ability in children is the capacity to use scientific knowledge, identify questions, and draw conclusions based on facts and evidence. Science involves understanding nature, the environment, and oneself through logical approaches and scientific methods that are appropriate to the stages of children's thinking development. Science learning in early childhood emphasizes the process of exploration and hands-on experience with the surrounding environment to develop scientific cognition, curiosity, process skills, and attitudes. Children who are invited to experiment, observe, and analyze in the surrounding environment can build knowledge that is useful for their future lives. In addition, the introduction of science also encourages the development of characters such as discipline, thoroughness, objectivity, and openness to new things. Through learning based on nature and the environment, children can understand the concept of cause and effect, hone their thinking skills, and realize the greatness of the creator of the universe. Science is not just the transfer of knowledge, but an active learning process that involves observation, measurement, classification, drawing

conclusions, and communicating results. In this way, children not only understand simple science concepts but are also able to solve problems and make decisions related to changes that occur due to human activities.

2. 2. *Experiment-Based Inquiry Method*

Inquiry comes from the word *Inquiry* which is an English word that means; investigations/requests for information; The free translation for this concept is "Learners are asked to search and discover on their own" (Mukrimaa et al., 2016). In this class action research *Inquiry* As a teaching and learning method, students are placed as learning subjects, which means that students have a big role in determining the atmosphere and learning methods (Gillies, 2023). In this method, students are encouraged to be actively involved in the teaching and learning process(Ndruru & Harefa, 2023).

Learning Motode *Inquiry* is a learning method that in principle invites students to actively ask questions (Zahroh et al., 2023). In addition, the inquiry method invites students to experiment independently during the learning process (Zahroh et al., 2023), the teacher plays the role of a mediator or supervisor of students (Cahyadi et al., 2023). The benefits of the inquiry learning method are, (1) Able to develop questioning skills (Cahyadi et al., 2023), research, and communication (Humaidi et al., 2021): (2) Increase cooperation between students or groups to get maximum learning outcomes (Haryana & Chairunnisa, 2022): (3) Able to solve problems (Choirudin et al., 2021), create a solution (Safitri et al., 2023), and address real-life questions and problems. Learning the inquiry method is the art of creating situations in such a way that students are able to take on the role of scientists. inquiry is an extension of the process *Discovery*, which is used more deeply, *Inquiry*.

Inquiry is one of the methods that emphasizes student activities where students are required to be able to find and find for themselves what is asked and requires students to think critically, systematically, and logically and at the same time involve the mental process of students (Agista et al., 2023). Inquiry is formed on the basis of discovery where students are required to use their thinking skills and other abilities where students will be formed into small groups consisting of 4 or 5 people and they will help each other solve problems given by teachers using their thinking skills (Muhamad Dah et al., 2024). This method does not aim to teach a science concept to children, but rather invites children to explore natural phenomena through direct interaction with objects (Ali Putri & Nisfa, 2022).

3. METHOD

3.1 Research and Subject Approach

This study uses a quantitative approach with the type of experimental research with the form of *pre-experimental designs*. The research design is to use *One Group Pre-Test Post-Test Design*. The subjects of this study were 17 students and only involved one group as an experimental group. Use of techniques *purposive sampling* to determine whether or not someone enters as a sample based on a specific purpose (Firmansyah & Dede, 2022). This research was conducted at Aisyiyah Busnatul Athfal III Paranga Kindergarten, where research participants must meet certain criteria, such as children aged 5-6 years and have never applied the method *Inquiry* experiment-based. The experiment was carried out through three stages, namely *Pre-test, Treatment.* and *Post-test.*

Table 1. One *Group Pretest-Posttest Design*

Pretest	*Treatment*	*Posttest*
O1	X	O2

Information:

O1 = *Pre-test* score or observation of children's *science* ability before being given *experiment-based* inquiry *method* learning treatment.

X = *The treatment* provided is the learning of *experiment-based* inquiry methods.

O2 = Post-test *score* of improving children's science skills after being given experiment-based inquiry *method* learning treatment.

3.2 *Data Collection and Analysis Techniques*

Research instruments are tools that help researchers collect data (Scott, 2013). The data to be collected determines the type of research instrument chosen. However, in this study, the instrument used is an observation guideline. The data analysis technique used is nonparametric statistics using *Wilcoxon Signed Rank Test* (Wilcoxon Marked Rating Test) to evaluate differences in the treatment of study subjects. It is used for two paired samples and the data does not distribute normally with n<25 samples (A, 2016). Test procedure *Wilcoxon Signed Rank Test* can be done by determining the hypothesis, then testing the hypothesis with a significant level of 0.005 or 5%. Conclusion drawing and statistical testing based on hypothesis testing will be carried out using IBM *SPSS* 25.

Capability achievement science Children aged 5-6 years can be identified through several indicators that include the child's basic ability to understand the world around him by building an understanding of the relationship between cause and effect and the introduction of daily problem-solving strategies, sorting objects based on size from smallest to largest or vice versa and getting to know simple science concepts in daily life (Education et al., 2024). Children at the age of five to six are at a stage of cognitive development that is very important to develop (Nurani et al., 2024). At this point, their understanding of their environment becomes more complex, which allows them to build a foundation of scientific thinking (Arum Sekar Sari, 2021). Various indicators indicate early childhood science abilities, these include their understanding of cause-and-effect relationships, the ability to solve everyday problems, the ability to sort objects by size, and their understanding of the simple science concepts they use every day(Valdes et al., 2025). Understanding of cause-and-effect relationships is the first ability that reflects the advancement of early childhood science(Behrens et al., 2025). Children begin to understand that every event has a reason and an effect (Orr & Lavy, 2024). For example, they will see that when water is mixed with sand, it produces a different texture than dry sand (De Lannoye et al., 2024). Children learn that certain actions will have certain outcomes (May, 2021). For example, children will see the ball fall to the ground when they drop the ball. This experience helps them intuitively understand gravity (Arsy & Octarya, 2022). Problem-solving ability depends on a cause-and-effect understanding (Fischer et al., 2023). Children who know the relationship between actions and outcomes tend to be better at making plans to achieve goals(Amri et al., 2024) .

In the development of early childhood science skills, there are several items that must be developed, such as developing an understanding of cause and effect, solving problems, recognizing sizes and shapes, and recognizing simple science concepts in daily life. This ability develops gradually and daily life affects it. Children can improve these science skills through a variety of exploratory activities (Damayanti et al., 2024). For example, if children are asked to make a boat that can float out of paper, they will try different designs until they find the one that works. Observation, prediction and evaluation are part of the scientific process. Critical thinking skills are also important for problem-solving. Children are asked to ask, "Why does something happen?" or "How can we prevent something from happening?" For example, when ice melts in the sun, children can talk about the reason the ice melts and how to keep the ice cold.

Understanding the concept of floating and sinking is an important part of learning science in children. This concept helps children understand the basic principles of physics, such as density and lift. Children can learn about this concept through water play activities. For example, they may be given various objects such as rocks, wood, balls, or sponges, and are invited to predict whether those objects will float or sink when put into the water. Through this experiment, children learned that objects lighter than water tend to float, while heavier objects will sink. In addition, they can also be taught about how the boat works. Although the ship is made of heavy materials, such as iron, its design allows it to float due to its even weight distribution and the air cavities inside.

Science is not only limited to laboratories or formal experiments, but it is also present in everyday life. Children can learn simple science concepts through everyday activities (Aryani et al., 2024). For example, when they help parents cook, they can learn about chemical changes, such as how flour and water can turn into dough. In addition, activities such as playing in the park, observing animals, or planting plants also offer opportunities to learn science. Children can learn about the life cycle of plants, how plants need water and sunlight to grow, or how certain animals have unique behaviors to survive. Everyday activities such as washing hands can also be used to teach science concepts. For example, they can learn that soap helps remove dirt and germs due to the chemical properties of soap that can dissolve

4. Results And Discussion

4.1 Results

The results of this study aim to analyze the effect of the application of the *Inquiry* based on experiments on the science abilities of children aged 5-6 years. The observational guideline tool collects data by measuring three main components: understanding cause and effect and solving everyday problems, recognizing objects based on size from smallest to largest or vice versa, recognizing simple science concepts in daily life. The Wilcoxon Signed Rank Test was used to compare the pre-test and post-test scores of the experimental group.

Table 2. Pre-test table

Yes	Name	Value	Predicate
1	Af	17	BB
2	Za	19	BB
3	U.s.	20	BB
4	Mz	18	BB
5	Fx	51	BSH
6	HM	16	BB
7	Al	22	BB
8	Ks	51	BSH
9	Fi	21	BB
10	Sa	51	BSH

Yes	Name	Value	Predicate
11	Ah	34	BB
12	Gi	32	BB
13	Na	24	BB
14	Az	51	BSH
15	An	26	BB
16	Gia	50	BSH
17	Sq	49	BSH

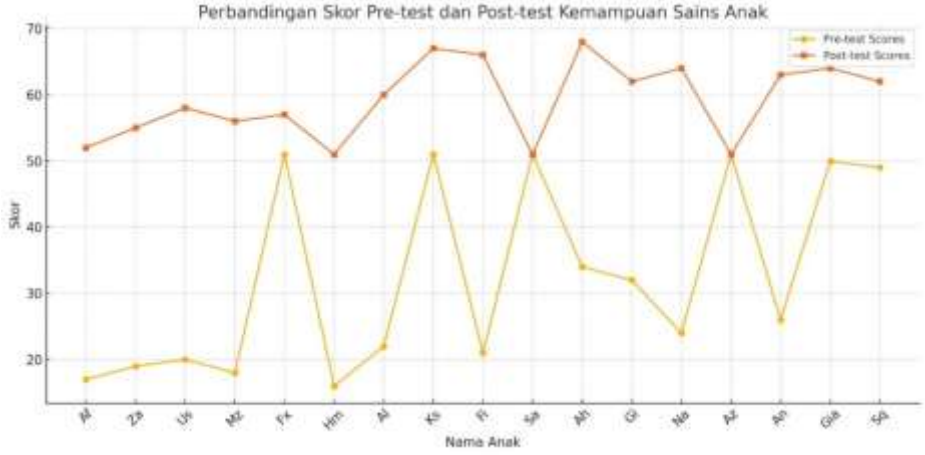
Before treatment, the results of the pre-test showed that the child's science ability was low on average, with most participants having difficulty in understanding cause and effect and solving everyday problems, recognizing objects based on size from smallest to largest or vice versa, recognizing simple science concepts in daily life.

Table 3. Post-test table

Yes	Name	Value	Predicate
1	Af	52	BSH
2	Za	55	BSH
3	U.s.	58	BSH
4	Mz	56	BSH
5	Fx	57	BSH
6	HM	51	BSH
7	Al	60	BSB
8	Ks	67	BSB
9	Fi	66	BSB
10	Sa	51	BSH
11	Ah	68	BSB
12	Gi	62	BSB
13	Na	64	BSB
14	Az	51	BSH
15	An	63	BSB
16	Gia	64	BSB
17	Sq	62	BSB

After treatment, the results of the post-test showed a significant improvement in science skills, with some children being able to understand cause and effect and solve everyday problems, recognize objects based on size from smallest to largest or vice versa, recognize simple science concepts in everyday life.

The following is a comparison chart of pre-test and post-test scores of science abilities of children aged 5–6 years. This graph shows a significant increase after the application of the experiment-based inquiry method.



4.2 Quantitative Result

Table 4. *Descriptive Statistics*

	N	Minimum	Maximum	Mean	Std. Deviation
Pre-test	17	16	51	32,47	14,509
Post-test	17	51	68	59,24	5,858
Valid N (*listwise*)	17				

Table 4 shows the average score on *Post-test* (59,24) is much higher than *Pre-test* (32,47), showing that the *Inquiry* can improve early childhood science skills. Lower standard deviation score (Std. Deviation) on *Post-test* (5,858)

showed that the improvement achieved was more evenly distributed among the participants, indicating the uniform effectiveness of the treatment. This study had no control group, and the sample size was small (n=15). To improve the validity of the results, further research is recommended to use *True Experimental Design* with the control group. The development of more standardized instruments can also lead to more honest results. Therefore, the findings of this study show that the *Inquiry* Experiment-based can be an effective method to improve the ability to science Children aged 5-6 years. This research is also relevant to be applied in the early childhood education environment.

To test the hypothesis that the use of *experiment-based* inquiry methods has a significant influence on the science ability of children aged 5-6 years, quantitative research results were obtained from the comparison of *pre-test* and *post-test* scores using *the Wilcoxon Signed Rank Test* **method.**

Table 5. Nonparametric Statistical Test

The Wilcoxon test is used to find out if there are significant differences between data that do not meet the assumption of normality.

	Posttest - Pretest
Z	-3,411b
Asymp. Sig. (2-tailed)	,001

a. Wilcoxon signed ranks test
b. Based on negative rank

The value of Z indicates the result of statistical calculations, which consist of the difference in the ranking of the increase and decrease between *Pre-test* and *Post-test*. Higher upgrade ratings, which means most of the grades *Post-test* higher than *pre-test*. Asymp. Sig. (2-tailed) = 0.001 this is the value *p-value* from the two-way test. The results are considered statistically significant because *p-value* (0.001) is smaller than the significance level found, which is usually 0.05. That is, the score *Pre-test* and *Post-test* very different. So, the results of the treatment have a significant effect. Method *Inquiry* Experiment-based significantly improves the ability science Children aged 5-6 years.

4.1 Qualitative Results

Qualitative results were obtained from direct observation during the method application session *Inquiry* experiment-based, which shows changes in learners' behavior. Children can understand cause and effect and solve daily problems, recognize objects based on size from smallest to largest or vice versa, recognize simple science concepts in daily life and can solve various challenges given. The results obtained are summarized in several key findings that illustrate the indicators of ability science Children: the child's basic ability to understand the world around him by building an understanding of the cause and effect influenced by natural laws and the recognition of daily problem-solving strategies, sorting objects by size from smallest to largest or vice versa and getting to know simple concepts in daily life.

The first indicator is understanding the causes and effects of natural laws and problem-solving strategies: The results of observations show that children are able to understand the core of the problems given in the learning method *Inquiry* Experiment-based courses designed to challenge them to recognize natural law causes and effects, as well as problem-solving strategies. Children are introduced to the various properties of water during learning activities on the theme of water. It helps them understand causal relationships based on natural laws and teaches them that everything in the world has a scientifically explainable reason. On the first day, the teacher invited the children to see various examples of water, such as water in a glass, water outdoors (e.g. rain), and so on. The activity of observing water in various containers provides a basic understanding of the fact that the shape of liquid water is always changing according to the container. Children realize that water does not have a fixed shape when water is transferred from one container to another with different shapes. In this process, it is proven that water, as a liquid substance, has flexible properties and has the ability to deform, but its volume remains constant. They see firsthand how when they wash their hands or soak their feet in water. Children are invited to improve their problem-solving skills through water-themed learning activities. They are trained to think critically, try different solutions, and evaluate the results of their actions during these activities. They learn in a fun and interactive way with problem-solving methods. Children are given the opportunity to create simple hypotheses by conducting experiments with floating or sinking objects. Before attempting something, they were asked to predict whether it would float or sink. For example, when children receive a plastic toy, leaves, or rocks, they are asked to think, "Will this object float in the water?" Why? They conduct hands-on experiments to ascertain whether their predictions are correct or false.

The second indicator, sorting objects by size from smallest to largest or vice versa: Children's ability to sort objects by size is a basic skill that is very important for their cognitive development. Although children may not fully realize the importance of this skill at first, activities on water themes indirectly help children hone this skill. They began to understand the relationship between the size, shape, and function of objects through simple experiments and visual observations. When children look at different water containers, they are given the opportunity to compare the size, shape, and volume of water they can hold. For example, they can see small containers that hold only a small amount of water and large containers that hold more water. This activity teaches children to arrange objects based on the size they see and feel, as well as the volume of water they can hold.

The third indicator, getting to know the concept of simple science in daily life: Each activity on the theme of water directly connects the scientific concept with the daily life of children and helps them understand the world around them through simple but useful ideas. Thus, children not only learn scientific theories, but also discover the

relationship between what they learn and the things they do every day. Children experimented with food coloring to find out that water could absorb color. This activity teaches the basic concept of solution, which is when a substance (food coloring) dissolves in water and changes the color of the water. This is especially relevant in everyday life because children often see water change color when mixed with other ingredients.

The reflection stage, the reflection session provides an important opportunity for children to unify and deepen their understanding of the role of water in daily life. These activities encourage them to think more deeply about the scientific concepts they have learned over the course of the week and allow them to relate scientific concepts such as water shape change, the role of water in supporting plant life, and flotation with what they have learned before. For example, through this reflection, children can think more critically about the role of water in the various activities they do on a daily basis. They may be aware that they use water for a variety of purposes, such as drinking it to maintain their health, cleansing their bodies and objects around them, and caring for the plants that grow around them.

The results of the study showed that the *Inquiry* experiment-based such as water, color, oil, property of objects, water and plants as well as floats and sinks, making a significant contribution to the ability to science Early Childhood. This activity involves many elements, ranging from understanding a cause and effect and problem-solving strategy, sorting objects based on size from smallest to largest or vice versa and getting to know the concept of science in daily life. All of these aspects help improve science skills in early childhood. While activities such as experiments with water topics emphasize the importance for children to understand simple science concepts in life and can help develop children's understanding to cooperate and collaborate as well as jump directly into the surrounding environment to observe, analyze, experiment and explore. Children are prepared to face future challenges with real experience through these activities. This study found that the learning method *Inquiry* Experiment-based effective in improving the ability to science early childhood to hone the skills of observing, analyzing, experimenting with logical thinking and simple problem solving.

5 *Discussion*

The discussion in this article highlights the role of learning methods *Inquiry* Experiment-based as an innovative approach that supports the development of early childhood science skills. This research shows that this approach has succeeded in improving children's cognitive aspects, including the ability to understand cause and effect, solve simple problems, and recognize science concepts in daily life. Experiment-based inquiry method places children as the center of learning(Fikri et al., 2018). In the context of early childhood education, this approach is particularly relevant because children are in the pre-operational stage of development, as described by Piaget. Children aged 5-6 years begin to demonstrate simple symbolic and logical thinking skills, but they still need hands-on experience to understand the world (Muhammad Santoso & Arif, 2021). By the *Inquiry*, children not only receive information, but are also invited to ask questions, make observations, and draw conclusions based on the experiments conducted (Scott, 2019).

The results of the study using a one-group pre-test post-test design showed a significant improvement in children's science skills after being given treatment. The average post-test score (59.24) is much higher than the pre-test (32.47). This shows that the *Inquiry* Experiment-based has a positive effect on science learning. One of the main factors for the success of this method is the active involvement of children in the learning process. Children are invited to understand concepts such as floating and drowning, which are then associated with their daily experiences, such as playing with water. In this study, children's science skills were measured through three main indicators: understanding of cause and effect and solving everyday problems, the ability to sort objects based on size, and the introduction of simple science concepts. Understanding cause and effect is an important indicator, as it is the basis of scientific thinking skills. For example, when children are invited to predict whether an object will float or sink, they not only learn about basic physics concepts, but are also trained to think critically and make hypotheses.

The first indicator, the ability to sort objects by size, involves more complex cognitive skills. Children not only visually compare the size of objects, but also learn to relate the size to the function of the object. This activity helps them understand the relationship between the physical properties of objects and the way they interact in the environment.

The second indicator, the introduction of simple science concepts, emphasizes the relevance of learning to children's daily lives. Children are invited to observe natural phenomena such as changes in the shape of water, color absorption by water, and the effect of temperature on ice. This activity not only provides conceptual understanding, but also strengthens skills of scientific processes such as observation, prediction, and evaluation.

One of the advantages of the method *Inquiry* experiment-based is its flexibility to be applied in a variety of contexts (Ulfah Sutarba, 2017). In this study, learning activities are not limited to the classroom, but are also carried out outdoors. This gives children the opportunity to explore their environment more broadly, which in turn enriches their learning experience. However, this research also has some limitations. One of them was the relatively small sample size (17 children) and the absence of a control group. These limitations can affect the generalization of research results. In addition, the use of a one-group pre-test post-test research design makes it difficult to determine whether the observed improvement is entirely due to the experiment-based inquiry method or if there are other factors influencing it.

For future studies, it is recommended to use more complex experimental designs, such as true experimental design with control groups, to improve the validity of the results. In addition, further research can explore how this method can be applied in a broader curriculum, including integration with other learning methods such as STEAM (Science, Technology, Engineering, Art, and Mathematics). The practical implication of this study is that the *Inquiry* Experiment-based can be an effective tool for educators in developing early childhood science skills. Teachers can design challenging and fun learning activities, such as experiments about the properties of water, plant observations, or exploration of objects around children. This activity not only improves children's cognitive abilities, but also builds confidence, creativity, and cooperation skills.

Overall, the results of this study show that the experiment-based inquiry method has great potential to improve early childhood science skills. With child-centered and experiential learning, this method helps children to learn actively, critically, and reflectively. Thus, this method can be an integral part of an educational strategy to prepare the younger generation to face future challenges.

Overall, this study answers the hypotheses put forward and can serve as a basis for further research. However, the limitations of this study could be an inspiration for similar research in the future. The small number of research subjects is one of its limitations, which can affect the generalization of results. The study was also limited to a specific age range (5-6 years), so the results may not be representative of all children's age groups. In addition, this study has not fully explored how the *Inquiry* Experiment-based contributes to early childhood science skills, including the ability to understand cause and effect, solve problems, recognize shapes and sizes and simple science concepts in everyday life. By taking a closer look at each of these indicators, teachers can provide more accurate insights into which learning methods are most effective for each stage of science ability. For example, learning activities about water introduction and the role of water in various activities that they do every day. They may be aware that they use water for a variety of purposes, such as drinking it to maintain their health, cleansing the body and objects around them, and caring for the plants that grow around them can help learners learn to work together in knowing cause and effect, solving problems and getting to know science concepts in a simple way. *Inquiry* experiment-based, including facilitator roles, environmental conditions, and children's participation levels. The child's learning experience during the activity can be influenced by these factors.

In addition, this study has not seen long-term results from the application of the *Inquiry* experiment-based on early childhood science skills. Further research is needed to find out the extent of the benefits of the method *Inqury* Experiment-based research has survived over time and how it affects the development of early childhood science skills. These results suggest that teachers who teach early childhood should consider using game learning methods as an alternative. This research also opens our eyes to the importance of non-conventional methods to support children's cognitive development. The limitations in this study may help improve the quality of future research and provide a better understanding of how the method *Inqury* Experiment-based functions as a learning strategy that helps early childhood learn to understand cause and effect, solve problems, recognize forms, and recognize simple science concepts. This research also expands knowledge on how structured learning methods such as experiment-based inquiry can improve children's science skills.

5. Conclusion

The results of the study show that the learning method *Inquiry* Experiment-based can improve early childhood science skills. Application of learning methods *Inquiry* Experiment-based exercises have a significant impact on improving the science skills of children aged 5-6 years. Improved ability is seen in three main aspects: The child's basic ability to understand the world around him by building an understanding of causal relationships influenced by natural laws and the introduction of daily problem-solving strategies, sorting objects by size from smallest to largest or vice versa and getting to know simple concepts in daily life. This method not only trains children's cognitive skills, specifically on children's science skills, but also builds confidence, creativity, and the ability to work together. The results of this study support the theory of experiment-based learning and are relevant to be applied in early childhood education as an effective alternative to non-conventional learning. However, this study has some limitations that can be corrected in future studies. One factor that affects the generalization of results is the limited number of study subjects. The study also focused on a specific age range, so the results may not be representative of early childhood outside of that range. To determine the changes that occur over time, further observations are needed to determine the long-term impact of the application of the method *Inquiry* experiment-based on early childhood science skills. In the future, addressing these limitations will improve the quality of research and improve understanding of how effective methods are *Inquiry* Experiment-based in improving early childhood science skills. To evaluate the impact on a more diverse early childhood population, further research may expand the age range of participants. Variations in the design of method activities *Inquiry* Experiment-based can also be customized to better suit the nature of the subject being studied.

6 References

. A. A. D. K. S., . D. I. G. A. O. N. P. M. K., & . L. A. T. S. P. ,M. P. (2018). The Effect of the Problem Based Learning Model on the Initial Science Ability of Children in the B2 Early Childhood Group of Permata Buni Kuta for the 2017/2018 Academic Year. *Journal of Early Childhood Education Undiksha*, *6*(1), 21–32. https://doi.org/10.23887/paud.v6i1.15051

A, R. (2016). Problem Based Learning Improves Higher Order Thinking Skills of Grade VIII Students of SMPN 1 Daha Utara and SMPN 2 Daha Utara. *Mathematics Education*, *2*(3), 154–163.

Abu Hashish, E. A., Al Najjar, H., Alharbi, M., Alotaibi, M., & Alqahtany, M. M. (2024). Faculty and students perspectives towards game-based learning in health sciences higher education. *Heliyon*, *10*(12). https://doi.org/10.1016/j.heliyon.2024.e32898

Agista, H., Haliza, N. A., Husaini, N. A., Setiawati, D., & Noviani, D. (2023). Application of the Inquiry Method; Advantages and Disadvantages in Fiqh Learning. *Journal of Indonesian Education (PJPI),* *1*(1), 77–86. https://doi.org/10.00000/pjpi.v1n12023

Akib, T., Syamsuadi, A., & Dharma, S. (2022). The Effect of the Implementation of Online Learning on the Learning Independence of Elementary School Students. *Treasures of Education*, *16*(2), 104. https://doi.org/10.30595/jkp.v16i2.14068

Ali Putri, F. K., & Nisfa, N. L. (2022). Learning Science Inquiry in Early Childhood. *Golden Ink: Journal of Early Childhood Islamic Education*, *1*(1), 29–42. https://doi.org/10.35878/tintaemas.v1i1.384

Alim Amri. (2021). The Effect of Using Scrabble Games in Improving Early Reading Ability. *Journal of Panrita*, *2*(1), 23–27. https://doi.org/10.35906/panrita.v2i1.153

Alim Amri, N., & Yunita, A. (2023). The Effect of Reward on Early Childhood Learning Motivation Group A at Aisyiyah Minasa Upa Kindergarten. *Didactic : PGSD Scientific Journal STKIP Subang*, *8*(2), 2940–2947. https://doi.org/10.36989/didaktik.v8i2.616

Amri, N. A., Hasbur, H. S., Makassar, U. M., Makassar, U. N., Media, A., Childhood, E., & Purwanti, D. (2024). *THE INFLUENCE OF THE USE OF AUDIOVISUAL MEDIA ON THE EXPRESSIVE LANGUAGE ABILITIES*. *9*(2), 124–135.

Anggraini, V., Priyanto, A., & Yeni, I. (2022). E-Magazine Media Innovation for Stimulation of Early Childhood Science Skills. *Journal of Tambusai Education*, *6*(1), 11530–11537.

Arohman, M., Saefudin, & Priyandoko, D. (2016). Students' Science Literacy Ability in Ecosystem Learning. *XIII National Seminar on Biology Education FKIP UNS, 13*(1), 90–92.

Arsy, Y. N., & Octarya, Z. (2022). The Effectiveness of Experimental Learning Strategies Based on the Process Oriented Guided Inquiry Learning Method (Pogil). *Journal of Natural Science Learning*, *01*(01), 68–74.

Arum Sekar Sari, W. (2021). The Importance of Science and the Role of Parents in Teaching Science to Children at Home. *Journal of Early Childhood Education*, *1*(1), 52–66. https://doi.org/10.33367/piaud.v1i1.1572

Aryani, N., Rizka, N., Artamevia, F., Liyana, N., & Nazli, M. (2024). *Higher Order Thinking Skill (HOTS) through STEAM Learning for Early Childhood*. *18*(2), 308–314.

Banawi, A. (2019). Implementation of Scientific Approach on Discovery/Inquiry Learning Syntax, Based Learning, Project Based Learning. *Biocell: Biology Science and Education*, *8*(1), 90. https://doi.org/10.33477/bs.v8i1.850

Behrens, S., Lawson, L. A. M., Bigelow, K., Dean, E., Zhang, A., Foster, L. H., & Bridges, M. S. (2025). Exploring home visitors' use and perceptions of developmental monitoring: A mixed methods study. *Early Childhood Research Quarterly*, *71*(November 2024), 1–11. https://doi.org/10.1016/j.ecresq.2024.11.011

Bunterm, T., Wattanathorn, J., Vangpoomyai, P., & Muchimapura, S. (2012). Impact of Open Inquiry in Science Education on Working Memory, Saliva Cortisol and Problem Solving Skill. *Social and Behavioral Sciences*, *46*, 5387–5391. https://doi.org/10.1016/j.sbspro.2012.06.444

Cahyadi, M. R., Ariansyah, F., & Santiago, P. V. da S. (2023). Analysis of Using Pattern Finding Strategies Skills in Mathematical Problem Solving Viewed from Gender Differences. *Delta-Phi: Journal of Mathematics Education*, *1*(1), 06–10. https://doi.org/10.61650/dpjpm.v1i1.19

Choirudin, C., Ridho'i, A. V., & Darmayanti, R. (2021). The slidesgo platform is a solution for teaching "building space" in the era of independent learning during the pandemic. *AMCA Journal of Religion and Society*, *1*(2), 47–52. https://doi.org/10.51773/ajrs.v1i2.273

Damayanti, A., Suradika, A., Roshonah, A. F., Pujiati, D., Nur Aini, A., & Rahmah, S. F. (2024). Structural Analytic Synthetic Learning Method for Early Reading Ability. *JPUD - Journal of Early Childhood Education*, *18*(1), 287–298. https://doi.org/10.21009/jpud.181.20

De Lannoye, K., Trettin, C., Belt, A., Reinecke, E. A., Goertz, R., & Arnold, L. (2024). The influence of experimental conditions on the mass loss for TGA in fire safety science. *Fire Safety Journal*, *144* (September 2023), 104079. https://doi.org/10.1016/j.firesaf.2023.104079

Dewi, A. C. (2012). Improving Early Childhood Science Skills Through Process Skills-Based Learning. *Scientific Journal of Basic Education, 1*(2). https://doi.org/10.26877/malihpeddas.v1i2.301

Dostál, J., & Klement, M. (2015). Inquiry-based Instruction and Relating Appeals of Pedagogical Theories and Practices. *Social and Behavioral Sciences*, *171*, 648–653. https://doi.org/10.1016/j.sbspro.2015.01.173

Egitim, S. (2024). Promoting gender-inclusive leadership perceptions among Japanese university students: A nine-week critical inquiry-based action learning program. *International Journal of Educational Research Open*, *7*(May). https://doi.org/10.1016/j.ijedro.2024.100362

Elfrida, E., Akib, T., & Romba, S. S. (2022). Development of language aspects through storytelling method using hand puppets for group B children at Kartika Jaya XX-34 Gowa Kindergarten. *MOTOR: AUD Research Journal*, *3*(1).

Ernawati, S., Rinanto, Y., & Marjono, M. (2018). Application of Guided Inquiry Learning Model to Improve Students' Critical Thinking Skills. *Bio-Pedagogy*, *7*(1), 39. https://doi.org/10.20961/bio-pedagogi.v7i1.35727

Fikri, A. A., Ismah, V., & Paidi, P. (2018). Development of Guided Inquiry Model Learning Tools to Improve Students' Creative Thinking. *Thabiea : Journal of Natural Science Teaching*, *1*(1), 1. https://doi.org/10.21043/thabiea.v1i1.3651

Firda, A., & Suharni, S. (2022). Science Literacy Ability Level of Early Childhood Education Teachers. *Journal of Obsession: Journal of Early Childhood Education*, *6*(5), 3868–3876. https://doi.org/10.31004/obsesi.v6i5.1928

Firmansyah, D., & Dede. (2022). General Sampling Techniques in Methodology. *Scientific Journal of Holistic Education (JIPH), 1*(2), 85–114.

Fischer, B., Telser, H., Zweifel, P., von Wyl, V., Beck, K., & Weber, A. (2023). Corrigendum to 'The value of a QALY towards the end of life and its determinants: Experimental evidence' [Social Science & Medicine Volume 326 (2023) 115909] (Social Science & Medicine (2023) 326, (S0277953623002666), (10.1016/j.socscimed.2023.115909)). *Social Science and Medicine*, *332*(July). https://doi.org/10.1016/j.socscimed.2023.116092

Fitria, Y. (2017). The Effectiveness of Student Learning Competency Achievement in Science Learning in Elementary School. *Journal of Elementary School Education and Learning Innovation*, *1*(2). https://doi.org/10.24036/jippsd.v1i2.8605

Gillies, R. M. (2023). Dialogic teaching in a Year 5 classroom during cooperative inquiry-based science. *International Journal of Educational Research Open*, *5*(September). https://doi.org/10.1016/j.ijedro.2023.100290

Hajerah, & Syamsuardi. (2019). The Use of Learning Models in Makassar City Kindergarten. *Journal of CARE (Children Advisory Research and Education), 5*(2), 1–7.

Hamdani, Prayitno, & Karyanto. (2019). Improving Critical Thinking Skills Through Experimental Methods. *Proceedings Biology Education Conference*, *16*(1), 139–145.

Haryana, N. R., & Chairunnisa, T. (2022). Standardized Nutritional Care Process in Chronic Kidney Disease Stage V, Diabetes Mellitus II, Anemia and Pseudoaneurysm. *Pontianak Nutrition Journal (PNJ), 5*(1), 129. https://doi.org/10.30602/pnj.v5i1.913

Hasbi, M., & Wulandari, R. (2020). Play Science. *Ministry of Education and Culture Directorate General of Early Childhood Education, Primary and Secondary Education Directorate of Early Childhood Education*, 1–27.

Hasibuan, R., & Suryana, D. (2021). The Influence of Science Experimental Methods on the Cognitive Development of Children Aged 5-6 Years. *Journal of Obsession: Journal of Early Childhood Education*, *6*(3), 1169–1179. https://doi.org/10.31004/obsesi.v6i3.1735

Hasibuan, R., & Suryana, D. (2022). *The Influence of Science Experimental Methods on the Cognitive Development of Children Aged 5-6 Years*.

Hastuti, D. A. W., & Wiyanto. (2019). The Influence of the Guided Inquiry Learning Model with Experimental Methods on Students' Process Skills. *Unnes Physics Education Journal*, *3*(3), 288–298.

Hinostroza, J. E., Armstrong-Gallegos, S., & Villafaena, M. (2024). Roles of digital technologies in the implementation of inquiry-based learning (IBL): A systematic literature review. *Social Sciences and Humanities Open*, *9*(February). https://doi.org/10.1016/j.ssaho.2024.100874

Humaidi, H., Qohar, A., & Rahardjo, S. (2021). Student Responses to the Use of Youtube Videos as a Mathematics Online Learning Medium. *JIPM (Scientific Journal of Mathematics Education)*, *10*(2), 153. https://doi.org/10.25273/jipm.v10i2.9108

Husnah, N. (2022). Inquiry learning is guided in the era of society 5.0. *FORDETAK: National Seminar on Education: Educational Innovation in the Era of Society 5.0*, 163–168.

Imaduddin, M. (2017). Redesigning constructive early childhood science learning through steam project-based learning with Islamic nuances. *Proceedings Ancoms*, *2*(2), 950–958.

Intisari, I. (2020). Improving Children's Fine Motor Skills Through Drawing Activities at Pelangi Kindergarten, Gantarang District, Bulukumba Regency. *Celebes Education Review*, *2*(1), 8–15. https://doi.org/10.37541/cer.v2i1.359

Intisari, Purwati, D., & Usman. (2024). The Effect of the Contextual Teaching and Learning Approach on Developing Early Childhood Language Skills 5-6 Years Old. *Al-Fikru: Journal of Education and Science*, *5*(1), 85–107. https://ejournal.unzah.ac.id/index.php/alfikru/article/view/1596

Kencana Sari, F. F., Kristin, F., & Anugraheni, I. (2019). The Effectiveness of Character-Loaded Inquiry and Discovery Learning Learning Models on Grade V Students' Scientific Process Skills in Thematic Learning. *JPDI (Indonesian Journal of Basic Education), 4*(1), 1. https://doi.org/10.26737/jpdi.v4i1.929

Maya, L. S. (2021). Implementation of Experimental Methods to Develop Science Process Skills and Early Childhood Science Literacy. *Journal of Educational and Learning Technology*, *8*(1), 88–98.

Melita Rahardjo, M. (2019). Implementation of Scientific Approaches as Skill Builders of Early Childhood Science Processes. *Scholaria: Journal of Education and Culture*, *9*(2), 148–159.

Mugaloglu, E., & Saribas, D. (2010). Pre-service science teachers' competence to design an inquiry based lab lesson. *Social and Behavioral Sciences*, *2*(2), 4255–4259. https://doi.org/10.1016/j.sbspro.2010.03.674

Muhamad Dah, N., Mat Noor, M. S. A., Kamarudin, M. Z., & Syed Abdul Azziz, S. S. (2024). The impacts of open inquiry on students' learning in science: A systematic literature review. *Educational Research Review*, *43*(February). https://doi.org/10.1016/j.edurev.2024.100601

Muhammad Santoso, A., & Arif, S. (2021). The Effectiveness of the Inquiry Model with a STEM Education Approach on Students' Critical Thinking Skills. *Journal of Indonesian Science Studies*, *1*(2), 73–86. https://doi.org/10.21154/jtii.v1i2.123

Mukrimaa, S. S., Nurdyansyah, Fahyuni, E. F., YULIA CITRA, A., Schulz, N. D., د, غسان., Taniredja, T., Faridli, E. M., & Harmianto, S. (2016). Application of Inquiry Learning Method to Improve Learning Outcomes and Student Attitudes in Basic Food Subjects Class X-JBG-3 SMK N 4 Yogyakarta. *Journal of Elementary School Teacher Education Research*, *6*(August), 128.

Ndruru, S., & Harefa, Y. (2023). Analysis of Guided Inquiry Learning Methods on Students' Critical Thinking Skills. *Journal of Education and Counseling (JPDK), 5*(4), 686–702. https://doi.org/10.31004/jpdk.v5i4.18058

Novie Azizah, E., Koesmadi, D. P., & Widyaningsih, I. (2021). The Influence of Experimental Methods through Realia Media on Early Childhood Science Ability. *Scientific Journal of Citra Bakti Education*, *8*(1), 82–91. https://doi.org/10.38048/jipcb.v8i1.159

Novie Azizah, E., Primashanti Koesmadi, D., & Intan Widyaningsih. (2021). THE EFFECT OF EXPERIMENTAL METHODS THROUGH REALIA MEDIA ON EARLY CHILDHOOD SCIENCE ABILITIES. *Scientific Journal of*

Citra Bakti Education, *8*(1), 82–91. https://doi.org/10.38048/JIPCB.V8I1.159
Nurani, Y., Niken Pratiwi, Situmorang, R., & Ni Gusti Ayu Made Yeni Lestari. (2024). Children's Character Learning Model Based on Indonesian Local Wisdom: Implemented to Early Childhood Education in Play Centers. *Journal of Early Childhood Education*, *18*(1), 99–111. https://doi.org/10.21009/jpud.181.07
Nurhafizah. (2017). Strategy for Developing Science Ability of Kindergarten Children in Koto Tangah Padang. *Pedagogy: Journal of Early Childhood and Early Childhood Education*, *3*(3b), 72–77.
Ogan-Bekiroğlu, F., & Arslan, A. (2014). Examination of the Effects of Model-based Inquiry on Students' Outcomes: Scientific Process Skills and Conceptual Knowledge. *Social and Behavioral Sciences*, *141*, 1187–1191. https://doi.org/10.1016/j.sbspro.2014.05.202
Orr, S., & Lavy, S. (2024). Teaching who you are: Preliminary findings linking teachers' and students' social-emotional skills. *Social and Emotional Learning: Research, Practice, and Policy*, *4*(August), 100062. https://doi.org/10.1016/j.sel.2024.100062
Paramitha Sinaga, F., Hidayat, M., Study, P. S., Physics, P., University of Jambi, F., State Senior Secondary School, S., & Jambi, K. (2022). ANALYSIS OF THE USE OF TEACHING METHODS (DEMONSTRATION METHOD, EXPERIMENTAL METHOD, INQUIRY METHOD, AND DISCOVERY METHOD) AT SMA NEGERI 11 JAMBI CITY Keywords: Teaching Learning Process, methods, teachers ANALYSIS OF THE USE OF TEACHING METHODS (DEMONSTRATION M. *October 2022*, *5*(2), 103–110.
Education, K., Technology, D. A. N., Standard, B., & Education, D. A. N. A. (2024). *Ministry of Education, Culture, Research, and Technology*. *021*.
Pollarolo, E., Papavlasopoulou, S., Granone, F., & Reikerås, E. (2024). Play with coding toys in early childhood education and Care: Teachers' pedagogical Strategies, views and impact on children's development a systematic literature review. *Entertainment Computing*, *50*(February), 100637. https://doi.org/10.1016/j.entcom.2024.100637
Rahmawati, L., & Hardini, A. T. A. (2020). The Effect of the Online-Based Inquiry Learning Model on Learning Outcomes and Argumentation Skills on Social Studies Learning Content in Elementary Schools. *Journal of Basic Education*, *4*(4), 1035–1043. https://doi.org/10.31004/basicedu.v4i4.496
Rahmi, P. (2019). Introduction to children's science through skill-based games of basic science processes. *Journal of Education*, *5*(2), 43–55.
S, A. R. N., Naba, A. H., & Ruswiyani, E. (2024). *Implementation of Early Childhood Critical Thinking Skills through Steam Wax Experiment in Raudhatul Athfal*. *2*, 321–328.
Safitri, N. D., Pgri, U., Pasuruan, W., Darmayanti, R., Setio, A., & Sekaryanti, R. (2023). Application of Vygotsky Theory in High School Mathematics Learning Material Limit Functions. *Journal of Mathematics and Science Education), 11*(1), 39–48. https://doi.org/10.25273/jems.v11i1.14099
Segara, B., Choirudin, C., Setiawan, A., Saidun Anwar, M., & Arif, V. R. (2023). Inquiry Method: Improving Mathematics Learning Outcomes of Junior High School Students in Flat Building Broad Material. *Journal of Classroom Action Research*, *1*(1), 18–22. https://doi.org/10.61650/jptk.v1i1.48
Şimşek, P., & Kabapinar, F. (2010). The effects of inquiry-based learning on elementary students' conceptual understanding of matter, scientific process skills and science attitudes. *Social and Behavioral Sciences*, *2*(2), 1190–1194. https://doi.org/10.1016/j.sbspro.2010.03.170
Siswanto, S., Zaelansyah, Z., Susanti, E., & Fransiska, J. (2019). Early Childhood Learning Methods in Superior and Successful Generations. *Paramurobi: Journal of Islamic Religious Education*, *2*(2), 35–44. https://doi.org/10.32699/paramurobi.v2i2.1295
Subkhi Mahmasani. (2020). *View metadata, citation and similar papers at core.ac.uk*. *3*(2), 274–282.
Sugiyono. (2013). *Quantitative, Qualitative, and RD Research Methods*. Alphabet.
Suharti. (2021). Improving Science Learning Outcomes of Energy Materials and Their Changes Using Project Methods. *Journal of Education Informatic Technology and Science*, *3*(2), 51–60. https://doi.org/10.37859/jeits.v3i2.2799
Syamsuardi, Hajerah, & Amri, N. A. (2019). Development of Pop-Up Book Media for Kindergarten Teachers in Tanralili District, Maros Regency, South Sulawesi Province. *Raudhatul Athfal: Journal of Early Childhood Islamic Education*, *3*(2), 149–157. https://doi.org/10.19109/ra.v3i2.4566
Ulfah, M., & Khoerunnisa, Y. (2018). The Effect of the Use of Inquiry Learning Strategies on the Intelligence of Early Childhood Naturalists in Majalengka Regency. *Al-Athfal : Journal of Child Education*, *4*(1), 31–50. https://doi.org/10.14421/al-athfal.2018.41-03
Ulfah Sutarba, M. (2017). The application of inquiry-based experimental learning to the sub-concept of water pollution to improve student learning outcomes and students' scientific attitudes. *BIOSSPHERE: Journal of Biology and Biology Education*, *2*(1), 1–7. https://doi.org/10.23969/biosfer.v2i1.304
Unlu, Z. K., Dokme, I., & Tufekci, A. (2015). An Action Research on Teaching Science through Technology Supported Inquiry - based Learning: A Pilot Study. *Social and Behavioral Sciences*, *186*, 46–52. https://doi.org/10.1016/j.sbspro.2015.04.183
Valdes, V., Sullivan, E. F., Tofail, F., Thompson, L. M., Kakon, S. H., Shama, T., Haque, R., & Nelson, C. A. (2025). Trajectories and social determinants of child cognitive development: a prospective cohort study from infancy through middle childhood in Dhaka, Bangladesh. *The Lancet Regional Health - Southeast Asia*, *32*, 100511. https://doi.org/10.1016/j.lansea.2024.100511
Veryawan, V., Tan, M., & Syarfina, S. (2021). Magic box playing activities in an effort to improve early childhood science skills. *Yaa Bunayya*, *5*(1), 44–52.
Wandini, R. R., Bariya, C., Lubis, H. A., Nur, N. M., & Mardhatillah, S. (2022). Experimental Method on the Learning Process of Changing the Shape of Objects in Elementary School. *Journal of Education and Counseling*, *4*(3), 1349–1358.
Wingsi, M. S., & Yaswinda. (2020). Analysis of Science Experiments related to the Environment on Children's Critical Thinking Skills in Kindergarten. *Journal of Tambusai Education*, *4*, 1228–1236.
Zahroh, U., Darmayanti, R., C, C., & Soebagyo, R. I. (2023). Project-Based Learning Training and Assistance for Prospective High School Teacher. *Journal of Innovation and Development of Community Service Outcomes*, *1*(2), 115–121. https://doi.org/10.61650/jip-dimas.v1i2.237