



The Effect of Contextual-Based Discovery Learning Model on Improving Science Abilities of Children Aged 5-6 Years

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ABSTRACT

This study aims to determine the effect of a context-based discovery learning model through floating and sinking experimental activities on the science abilities of children aged 5-6 years at Raudhatul Jannah Kindergarten. This study employs a quantitative approach with a quasi-experimental research type using a pretest-posttest control group design. The research sample consisted of 20 children, comprising 10 children in the experimental group and 10 children in the control group, selected using a purposive sampling technique. Data collection techniques were carried out through observation, tests, and documentation. Data analysis used descriptive statistics as well as nonparametric tests, namely the *Wilcoxon Signed Rank Test* and *Mann-Whitney U Test*, with the assistance of SPSS. The results showed that the science abilities of children in the experimental group experienced a more optimal improvement compared to the control group. The results of the *Wilcoxon Signed Rank Test* in the experimental group showed an Asymp. Sig. (2-tailed) value of $0.004 < 0.05$, indicating a significant effect of the application of the context-based discovery learning model on the science abilities of children aged 5-6 years. Improved science skills were observed in children's ability to observe, predict, classify, and draw conclusions from simple experiments through floating and sinking experimental activities.

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1. Introduction

Early Childhood Education (ECE) represents a critical stage of education in developing all aspects of child development, including cognitive development and scientific thinking skills from an early age. At the age of 5-6 years, children begin to learn to understand their environment through direct experience, exploration, and interaction with objects around them, so learning needs to be designed actively, meaningfully, and in accordance with the characteristics of early childhood development (Wayan et al., 2025).

One important aspect of development that needs to be cultivated in early childhood is science ability. Science abilities in children aged 5-6 years include the capacity to observe, predict, classify, and draw conclusions from simple observations based on direct experiences. These abilities are important to develop because they can help children understand their surrounding environment through exploration activities and simple



experiments that actively involve children in the learning process ([Hasmawaty, Usman, 2023](#)).

Science learning in early childhood should be conducted through activities that provide opportunities for children to try, explore, and discover knowledge independently. However, based on preliminary observations conducted at Raudhatul Jannah Kindergarten in the 5-6 year age group, it was found that children's science abilities were still not developing optimally. Some children still experienced difficulties in observing changes in objects, predicting the results of simple experiments, classifying objects based on certain properties, and conveying observation results in a simple manner. Furthermore, science learning in the classroom was still dominated by teacher-centered demonstration methods, where children more frequently listened to the teacher's explanations rather than being directly involved in experimental activities.

Learning activities that lack direct child involvement can negatively affect the development of early childhood science abilities. Children become less active in observing simple phenomena in their surroundings, less practiced in predicting experimental outcomes, and unaccustomed to conveying their observation results simply. In fact, science learning in early childhood should provide concrete experiences so that children can understand scientific concepts through fun exploration activities and simple experiments ([Ratnaningsih, 2025](#)).

One learning model that can be used to improve children's science abilities is the context-based discovery learning model. The discovery learning model provides opportunities for children to discover learning concepts through activities such as observing, predicting, classifying, and drawing conclusions based on direct learning experiences. Contextual learning helps children understand concepts through objects and real experiences close to their daily lives, making learning more meaningful for young children ([Fitriana, 2023](#)). Learning that involves direct experience and the child's surrounding environment can also increase children's engagement in the learning process and help children build a more concrete understanding ([Manga et al., 2025](#)).

One science learning activity that aligns with the characteristics of early childhood is the floating and sinking experiment. This activity provides opportunities for children to observe objects that float and sink in water, predict experimental outcomes, classify objects based on their properties, and draw conclusions from simple observations. Through these activities, children can understand scientific concepts concretely because they are directly involved in the exploration and simple experimentation process ([Schwichow & Zoupidis, 2024](#)).

Several previous studies have shown that the discovery learning model has a positive effect on the development of early childhood abilities. Research conducted by [Azian & Mukminin \(2023\)](#) showed that the application of the discovery learning model in science learning can help improve the cognitive development of children aged 5-6 years. Other research by [Acep \(2023\)](#) also demonstrated that the discovery learning model can enhance critical thinking skills in early childhood through exploratory learning activities. Additionally, research by [Ilyas et al. \(2025\)](#) showed that learning involving direct experience and active child interaction can help improve engagement and thinking abilities in early childhood during the learning process.

Nevertheless, research that specifically examines the effect of context-based discovery learning through floating and sinking experimental activities on the science abilities of children aged 5-6 years remains limited. Therefore, this study aims to determine the effect of context-based discovery learning through floating and sinking experimental activities on the science abilities of children aged 5-6 years at Raudhatul Jannah Kindergarten.

2. Methods

This study employs a quantitative approach with a quasi-experimental research type. The quantitative approach is used to collect and analyze numerical data to determine the effect of the context-based discovery learning model on the science abilities of children aged 5-6 years. The research design used is the pretest-posttest control group design, which involves an experimental group and a control group to compare children's abilities before and after treatment is given.

The population in this study consisted of all children aged 5-6 years at Raudhatul Jannah Kindergarten. The research sample comprised 20 children, consisting of 10 children in the experimental group and 10 children in the control group. The sampling technique used was purposive sampling, taking into consideration the relatively comparable developmental characteristics of children based on initial observations and pretest results of children's science abilities.

The independent variable in this study is the context-based discovery learning model through floating and sinking experimental activities, while the dependent variable is the science ability of children aged 5-6 years. Data collection techniques were carried out through observation, tests, and documentation. Observation was used to observe children's science abilities during the learning process based on indicators of observing, predicting, classifying, and concluding. Tests were conducted through pretest and posttest to determine the improvement in children's science abilities before and after treatment. Documentation was used as supporting data during the research activities.

The research procedure was carried out through several stages: administering pretests to both the experimental and control groups, implementing learning using the context-based discovery learning model through floating and sinking experimental activities in the experimental group, and conventional learning in the form of teacher demonstration in the control group. After treatment was given, both groups were given posttests to determine the improvement in children's science abilities.

Data analysis used descriptive statistics and nonparametric statistics with the assistance of SPSS. Hypothesis testing used the *Wilcoxon Signed Rank Test* and *Mann-Whitney U Test*. The decision-making criterion was that if the significance value (2-tailed) < 0.05 , then there is a significant effect of the context-based discovery learning model on the science abilities of children aged 5-6 years.

3. Result and Discussion

The research results were obtained from pretest and posttest data on the science abilities of children aged 5-6 years in both the experimental and control groups. Data analysis was conducted using descriptive statistics and nonparametric statistics through the *Wilcoxon Signed Rank Test* and *Mann-Whitney U Test*.

Descriptive Statistical Analysis

Table 1. Frequency Distribution of Children's Science Abilities in the Experimental Group (Pretest)

Interval	Category	Frequency	Percentage
8-14	Not Developed (BB)	0	0%
15-18	Beginning to Develop (MB)	10	100%
19-22	Developing as Expected (BSH)	0	0%
23-32	Very Well Developed (BSB)	0	0%
Total		10	100%

Based on Table 1, the pretest results in the experimental group showed that all children were in the Beginning to Develop (MB) category with a percentage of 100%. This indicates that children's science abilities before treatment were still not developing optimally, particularly in the abilities to observe, predict, classify, and draw conclusions from simple experiments.

Table 2. Frequency Distribution of Children's Science Abilities in the Experimental Group (Posttest)

Interval	Category	Frequency	Percentage
8-14	Not Developed (BB)	0	0%
15-18	Beginning to Develop (MB)	0	0%
19-22	Developing as Expected (BSH)	0	0%
23-32	Very Well Developed (BSB)	10	100%
Total		10	100%

Based on Table 2, the posttest results in the experimental group showed an improvement in children's science abilities after the implementation of the context-based discovery learning model through floating and sinking experimental activities. All children were in the Very Well Developed (BSB) category with a percentage of 100%. These results indicate that learning that actively involves children through experimental activities can improve the science abilities of children aged 5-6 years.

Table 3. Pretest & Posttest Statistics of the Control Group

	N	Minimum	Maximum	Mean	Std. Deviation
Pretest Control	10	15	16	15.10	0.32
Posttest Control	10	17	20	18.70	1.16
Valid N (listwise)	10				

Based on Table 3, the mean score of children's science abilities in the control group before treatment was 15.10, which increased to 18.70 after learning took place. Although there was an improvement, these results still indicate that the development of science abilities in the control group was not optimal compared to the experimental group.

Table 4. Frequency Distribution of Children's Science Abilities in the Control Group (Pretest)

Interval	Category	Frequency	Percentage
8-14	Not Developed (BB)	0	0%
15-18	Beginning to Develop (MB)	10	100%
19-22	Developing as Expected (BSH)	0	0%
23-32	Very Well Developed (BSB)	0	0%
Total		10	100%

Based on Table 4, the pretest results in the control group showed that all children were in the Beginning to Develop (MB) category with a percentage of 100%. This indicates that the initial abilities of children in the control group were relatively comparable to those in the experimental group before treatment was given.

Table 5. Frequency Distribution of Children's Science Abilities in the Control Group (Posttest)

Interval	Category	Frequency	Percentage
8-14	Not Developed (BB)	0	0%
15-18	Beginning to Develop (MB)	4	40%
19-22	Developing as Expected (BSH)	6	60%
23-32	Very Well Developed (BSB)	0	0%
Total		10	100%

Based on Table 5, the posttest results in the control group showed an improvement in children's science abilities after participating in conventional learning. A total of 4 children (40%) were in the Beginning to Develop (MB) category and 6 children (60%) were in the Developing as Expected (BSH) category. However, no children reached the Very Well Developed (BSB) category, so the improvement in the control group was still lower compared to the experimental group.

Nonparametric Statistical Analysis

Nonparametric statistical analysis was conducted to determine the effect of the context-based discovery learning model on the science abilities of children aged 5-6 years. Data analysis was performed using the *Wilcoxon Signed Rank Test* and *Mann-Whitney U Test* with the assistance of SPSS.

Table 6. Results of the *Wilcoxon Signed Rank Test* for Science Abilities in the Experimental Group

	PosttestKontrol - PretestKontrol
Z	-2,859 ^b
Asymp. Sig. (2-tailed)	,004

a. Wilcoxon Signed Ranks Test

b. Based on negative ranks.

Based on Table 6, the results of the *Wilcoxon Signed Rank Test* in the experimental group showed that the Asymp. Sig. (2-tailed) value was less than 0.05. This indicates that there is a significant difference between children's science abilities before and after treatment using the context-based discovery learning model through floating and sinking experimental activities. The improvement in children's science abilities occurred because learning was conducted through direct experimental activities, making children more active in observing, predicting, classifying objects, and drawing conclusions from simple experiments. Learning that involves real experiences helps children understand scientific concepts more concretely and meaningfully.

The findings of this study are in line with research by Azian & Mukminin (2023), which showed that the discovery learning model can improve early childhood science abilities through learning activities involving exploration and direct experience. Research by Acep (2023) also demonstrated that the discovery learning model can enhance children's critical thinking skills through active and exploratory learning.

Table 7. Results of the Wilcoxon Test for Children's Science Abilities in the Control Group

	PosttestKontrol - PretestKontrol
Z	-2,827 ^b
Asymp. Sig. (2-tailed)	,005

a. Wilcoxon Signed Ranks Test

b. Based on negative ranks.

Based on Table 7, the results of the *Wilcoxon Signed Rank Test* in the control group showed an improvement in children's science abilities after learning took place. However, this improvement was not as substantial as in the experimental group because learning was still dominated by teacher explanations and demonstrations. Conventional learning made children less actively involved in exploration and experimentation activities, so the learning experiences gained by children were not yet optimal in developing science abilities. Nevertheless, conventional learning still helped children recognize the concepts of floating and sinking through teacher explanations and simple observation activities during the learning process.

Table 8. Results of the *Mann-Whitney U Test*

	NilaiPosttets
Mann-Whitney U	,000
Wilcoxon W	55,000
Z	-3,824
Asymp. Sig. (2-tailed)	,000
Exact Sig. [2*(1-tailed Sig.)]	,000 ^b

a. Grouping Variable: Kelompok

b. Not corrected for ties.

Based on Table 4.9, the results of the *Mann-Whitney U Test* showed that the Asymp. Sig. (2-tailed) value was less than 0.05. This indicates that there is a difference in science abilities between the experimental group and the control group after treatment was given. Thus, the context-based discovery learning model through floating and sinking experimental activities has a significant effect on the science abilities of children aged 5-6 years at Raudhatul Jannah Kindergarten. The significant improvement observed in the experimental group, where all 10 children reached the "Very Well Developed" category compared to none in the control group, confirms that discovery learning provides superior outcomes for developing scientific process skills in young children. This finding aligns with research by [Siahaan et al. \(2021\)](#), who found that discovery learning significantly improved science skills in kindergarten children through a scientific approach. Similarly, [Siti et al. \(2020\)](#) demonstrated that guided discovery learning effectively improved children's understanding of science concepts through classroom action research conducted in preschool settings. These studies collectively support the notion that active discovery-based approaches yield better cognitive outcomes than passive instructional methods in early childhood education.

The superiority of the discovery learning model over conventional demonstration methods can be attributed to the active role children play in constructing their own understanding through direct experience. While the control group showed modest improvement (mean score from 15.10 to 18.70), the experimental group's dramatic increase demonstrates that passive observation of teacher demonstrations cannot replace the cognitive benefits of hands-on exploration. [Yulinda et al. \(2026\)](#) found that experiment-

based inquiry methods significantly improved children's science skills, with average scores increasing from 32.47 in the pretest to 59.24 in the posttest. The researchers emphasized that hands-on experience facilitates learning by helping children understand cause-and-effect relationships and simple problem-solving in daily life contexts.

The floating and sinking experiment proved particularly effective because it engaged children in all four key scientific process skills: observing, predicting, classifying, and concluding. Children were able to observe objects placed in water, predict whether each object would float or sink, classify objects based on their properties, and draw conclusions from their observations. [Maraisane et al. \(2024\)](#) explored teachers' understanding of floating and sinking concepts in early childhood education, noting that these concepts are fundamental to building scientific literacy. Their study contributed to the limited literature on understanding basic scientific concepts such as floating and sinking in early childhood education, highlighting the importance of proper instructional approaches.

The contextual nature of the learning model, which used everyday objects familiar to children, made the scientific concepts more accessible and meaningful. When children encounter scientific phenomena through objects from their daily environment, they can more easily connect new knowledge to existing mental frameworks. [Maku et al. \(2024\)](#) demonstrated that interactive and contextual learning approaches can be an effective strategy for enhancing scientific abilities in early childhood education. Their study showed significant improvements in children's scientific understanding through interactive color mixing activities, concluding that contextual learning approaches optimally support children's cognitive development while fostering understanding of scientific concepts.

The effectiveness of contextual learning is further supported by research from Raudhatul Athfal Muslimat (2024), which found that contextual learning significantly enhances children's STEAM skills by engaging them in real-world activities that connect theory with practice. This approach fosters critical 21st-century skills including communication, collaboration, and problem-solving (Raudhatul Athfal Muslimat, 2024). Additionally, [Ulfadilah & Nurhusni \(2025\)](#) found that contextual learning effectively stimulates children's thinking skills because science media provides concrete examples that make abstract concepts more tangible. These findings reinforce the importance of connecting learning content to children's lived experiences.

The *Wilcoxon Signed Rank Test* results showing significant improvement ($p = 0.004$) in the experimental group underscore the importance of providing children with opportunities for self-discovery rather than simply transmitting information. Children in the discovery learning condition actively constructed knowledge through experimentation, which led to deeper understanding and retention. [Maraisane & Jita \(2025\)](#) explored how teachers in the reception grade taught floating and sinking concepts, finding that teachers' strategies to implement inquiry-based learning were often limited, resulting in low learner engagement and active participation. Their study concluded that teachers need to be capacitated with instructional strategies appropriate for conveying scientific knowledge ([Maraisane & Jita, 2025](#)).

The *Mann-Whitney U Test* results confirming significant differences between experimental and control groups ($p = 0.000$) provide strong evidence that discovery learning is more effective than conventional instruction for developing science abilities in early childhood. This finding supports research by [Rizandi \(2023\)](#), who examined the contextual teaching and learning approach for developing scientific literacy in early childhood, finding that contextual approaches significantly enhance children's ability to understand and apply scientific concepts. The contextual approach encourages students to make connections between knowledge and its application in daily lives, making learning more meaningful and enduring ([Rizandi, 2023](#)).

The study's findings have important implications for early childhood teacher preparation and professional development. Teachers need to be trained not only in science content knowledge but also in pedagogical strategies that facilitate discovery learning rather than relying solely on demonstration methods. [Parwoto et al. \(2023\)](#) demonstrated that learning actively involving children through exploratory activities can increase engagement and children's abilities in the learning process. Furthermore, studies on guided discovery learning have shown that structured guidance can enhance observational and predictive capabilities in young children ([Siti et al., 2020](#)).

The success of the floating and sinking experiment suggests that simple, low-cost experiments using everyday materials can be highly effective for developing science process skills in early childhood settings. Teachers do not need expensive equipment or complex laboratory setups to facilitate meaningful science learning. This finding is supported by research on experimental methods in early childhood, which emphasizes that introducing basic science concepts through simple experiments is very important to stimulate curiosity, develop critical thinking skills, and build an initial understanding of natural phenomena ([Yulinda et al., 2026](#)). Simple experimental methods serve as an effective means to build basic science concepts in kindergarten settings.

The research provides compelling evidence that context-based discovery learning through simple experiments like floating and sinking significantly enhances early childhood science abilities. The combination of active discovery, concrete experience, and contextual relevance creates optimal conditions for young children to develop scientific process skills that will serve as foundations for future science learning. These findings align with broader research demonstrating that inquiry-based approaches in early childhood education effectively support cognitive development and scientific literacy ([Maku et al., 2024](#); [Raudhatul Athfal Muslimat, 2024](#)). Early childhood educators should therefore prioritize discovery-based, experiential learning approaches that engage children actively in exploring and understanding the world around them.

4. Conclusion

Based on the results of the research, it can be concluded that the implementation of the Montessori Phonics Pink Series method at Blooming Islamic Montessori Kindergarten is carried out systematically through the use of structured language materials, starting from the recognition of letter sounds (phonemes), combining phonemes into three-letter words (CVC/three letter words), to reading simple words and sentences. The learning process takes place in a prepared environment that is organized according to Montessori principles, child-centered, and gives children the freedom to choose and repeat activities according to their readiness and interests, with the teacher acting as a facilitator who guides and observes the child's development.

This method has proven to be effective in stimulating early reading skills, which is shown through improving children's ability to recognize letter sounds correctly, blending sounds into three-letter words, and reading simple words independently. The success of the implementation is supported by the readiness of the learning environment, the availability of complete and structured Montessori materials, and the competence of teachers in understanding and applying Montessori philosophy. The obstacles encountered are related to differences in the level of readiness, maturity, and concentration range of children who are diverse.

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