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THE EFFECT OF SIMPLE EXPERIMENTS ON OBJECT CLASSIFICATION SKILLS IN INSAN MULIA ISLAMIC KINDERGARTEN, MOJOKERTO

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Abstrak

Penelitian ini bertujuan untuk mengetahui pengaruh kegiatan eksperimen sederhana terhadap kemampuan mengklasifikasikan benda pada anak usia 4-5 tahun di TK Islam Insan Mulia Mojokerto. Dalam kegiatan eksperimen sederhana dilaksanakan selama 5 kali pertemuan dengan durasi 30 menit dalam setiap pertemuan. Anak mengklasifikasikan benda berdasarkan sifatnya dalam air, yaitu benda yang tenggelam dan terapung. Penelitian ini menggunakan pendekatan kuantitatif dengan jenis eksperimen semu (*quasi experimental design*) dengan rancangan *pretest-posttest control group design*. Subjek penelitian berjumlah 30 anak usia 4 - 5 tahun yang terbagi ke dalam kelompok eksperimen dan kelompok kontrol, penetapan kelompok secara non-acak berdasarkan kelas yang tersedia. Teknik pengumpulan data dilakukan melalui tes kinerja mengklasifikasikan benda, di mana anak mengelompokkan benda berdasarkan hasil percobaan tenggelam dan terapung, yang dinilai menggunakan lembar observasi dengan lima indikator kemampuan mengklasifikasikan benda. Data dianalisis menggunakan analisis deskriptif dan analisis inferensial dengan uji independent t-test terhadap nilai selisih (*gain*) kedua kelompok. Hasil penelitian menunjukkan bahwa kelompok eksperimen mengalami peningkatan kemampuan mengklasifikasikan benda yang lebih tinggi dibandingkan dengan kelompok kontrol. Rata-rata skor gain kemampuan mengklasifikasikan benda pada kelompok eksperimen ($M = 3,40$; $SD = 1,06$) lebih tinggi dibandingkan kelompok kontrol ($M = 0,33$; $SD = 1,18$). Uji independent t-test menunjukkan perbedaan yang signifikan $p < 0,001$ dengan ukuran efek sangat besar (Cohen's $d = 2,75$). Dengan demikian, dapat disimpulkan bahwa kegiatan eksperimen sederhana berpengaruh untuk meningkatkan kemampuan mengklasifikasikan benda.

Kata kunci : *eksperimen sederhana, kemampuan kognitif, mengklasifikasikan benda, tenggelam – terapung*

Abstract

This study aimed to examine the effect of simple experiment activities on the ability to classify objects among children aged 4-5 years at TK Islam Insan Mulia Mojokerto. The simple experiment was conducted in five sessions, each lasting 30 minutes. During the activities, children classified objects based on their properties in water, specifically whether the objects sank or floated. This study employed a quantitative approach using a quasi-experimental design with a pretest-posttest control group design. The participants consisted of 30 children aged 4-5 years, divided into an experimental

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group and a control group, with group assignment conducted non-randomly based on existing classes. Data were collected through a performance based classification task, in which children grouped objects according to the results of the sinking and floating experiments, and their performance was assessed using an observation sheet comprising five indicators of classification ability. Data analysis included descriptive and inferential analyses using an independent t-test on gain scores between the two groups. The results showed that the experimental group demonstrated a greater improvement in object classification ability than the control group. The mean gain score of the experimental group ($M = 3.40$; $SD = 1.06$) was higher than that of the control group ($M = 0.33$; $SD = 1.18$). The independent t-test revealed a significant difference ($p < 0.001$) with a very large effect size (Cohen's $d = 2.75$). Therefore, it can be concluded that simple experiment activities have a significant effect on improving children's object classification ability.

Keywords : *simple experiment, cognitive ability, object classification, concrete objects, sinking-floating*

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A. INTRODUCTION

Early childhood represents a golden age, a critical period characterized by rapid cognitive development and heightened sensitivity to environmental stimuli. During this stage, children learn primarily through concrete experiences, the engagement of their five senses, and direct interaction with their immediate surroundings. Play-based and exploratory activities serve as the primary mechanisms for children to construct an initial understanding of the world while

gradually developing their foundational cognitive processes.¹

Learning approaches that emphasize exploration and direct experience have proven more effective in stimulating early childhood cognitive development compared to verbal-centric and passive approaches.²

¹ R. K. Dewi and H. Prasetyo, 'Pengaruh Interaksi Sosial dan Eksplorasi terhadap Perkembangan Kognitif Anak Usia Dini', *Jurnal Pendidikan Anak Usia Dini*, 8.2 (2024), 112-24
<https://doi.org/10.23887/jpanu.v8i2.9054>

² M. Haya and R. Rizqiyani, 'Pengembangan Media Buku Cerita Digital dalam Meningkatkan Moral Anak Usia 4-5 Tahun', *Bunayya: Jurnal Pendidikan Anak*, 11.1 (2025), 1-16
<https://doi.org/10.22373/bunayya.v11i1.28024>; A. Lestari and N. Pratiwi, 'Pengembangan Kemampuan Kognitif Anak melalui Pengamatan dan Eksplorasi

Consequently, pedagogical approaches that provide opportunities for children to explore and interact directly with tangible objects are considered more aligned with the cognitive development characteristics of early childhood. Research within the context of early childhood education further indicates that exploratory activities in early science education contribute positively to the development of children's logical thinking skills.³

One of the fundamental cognitive abilities developing in early childhood is the capacity for object classification, which refers to the skill of grouping objects based on specific similarities and differences in their characteristics.

Lingkungan Sekitar', *Indonesian Journal of Child Development Studies*, 3.1 (2025), 22-33
<https://doi.org/10.23887/ijcds.v3i1.11212>

³ F. Fitriani and M. Mahmud, 'Pembelajaran Berbasis Eksplorasi dalam Mengembangkan Kemampuan Kognitif Anak Usia Dini', *Bunayya: Jurnal Pendidikan Anak*, 8.2 (2022), 95-110
<https://doi.org/10.22373/bunayya.v8i2.11845>; N. Nurlaila and M. Yusuf, 'Aktivitas Sains Sederhana sebagai Stimulasi Berpikir Logis Anak Usia Dini', *Bunayya: Jurnal Pendidikan Anak*, 9.1 (2023), 1-14
<https://doi.org/10.22373/bunayya.v9i1.14321>

Classification ability serves as a crucial foundation for the development of logical reasoning and the formation of more complex concepts in subsequent developmental stages. At the ages of 4-5 years, children transition from the preoperational to the concrete operational stage; consequently, conceptual understanding is attained through the manipulation of physical objects and direct observation of their specific attributes.⁴ Concrete object-based grouping activities facilitate the gradual construction of children's logical thinking structures.⁵

In early science education, classification skills encompass not only physical attributes—such as color, shape, or size—but also the properties

⁴ S.A. Mu'min, 'Teori perkembangan kognitif Jean Piaget', *Al-Ta'dib: Jurnal Kajian Ilmu Kependidikan*, 6.1 (2023), 1-12,
[doi:10.31332/atdb.v6i1.292](https://doi.org/10.31332/atdb.v6i1.292).

⁵ F. Nasution and T. Hidayat, 'Peran Interaksi Aktif dan Manipulasi Benda Nyata dalam Pembentukan Konsep pada Anak Prasekolah', *Jurnal Psikologi Pendidikan*, 12.3 (2024), 78-89
<https://doi.org/10.31227/jpp.v12i3.10456> ; K. C. Trundle and M. Saçkes (eds), *Research in Early Childhood Science Education* (Springer Netherlands, 2015)
<https://doi.org/10.1007/978-94-017-9505-0>

and relationships of objects, such as the ability to distinguish between items that float or sink in water. Classifying based on buoyancy (floating and sinking) requires children to observe, compare, and correlate their findings with the specific characteristics of the objects, making it a vital indicator of logical thinking development in early childhood. Introducing science concepts through simple experiments, such as 'float and sink' activities, has proven to contribute positively to children's classification abilities and conceptual understanding.⁶

Preliminary observations conducted in a Group A classroom (aged 4-5 years) at Insan Mulia Islamic Kindergarten, Mojokerto, indicate that children's classification abilities have not yet developed optimally. These observations were carried out during a simple science learning activity involving the task of grouping objects

based on their floating and sinking properties in water. Out of the 15 children observed, 11 (73%) were unable to classify the objects accurately. This was characterized by errors in grouping more than half of the items and an inability to provide simple reasoning for their classifications. These findings suggest that the children have not yet attained adequate conceptual understanding regarding the properties of objects, specifically the concepts of floating and sinking.

This condition indicates a discrepancy between learning objectives and current classroom practices. The instructional methods employed tend to be verbal-centric and teacher-centered, with limited student engagement in hands-on activities. Consequently, children lack sufficient opportunities to explore, observe directly, and construct concepts through real-world experiences. However, early childhood cognitive development necessitates learning that is active, concrete, and meaningful. A lack of exploratory activities in the learning process has

⁶ M. Putra and R. Sari, 'Eksperimen sederhana dalam pembelajaran sains untuk anak usia dini: Studi kuasi-eksperimental', *Jurnal Penelitian Pendidikan Anak*, 9.2 (2025), 101-15, doi:[10.23887/jppan.v9i2.12021](https://doi.org/10.23887/jppan.v9i2.12021).

also been reported to hinder the development of cognitive abilities in early childhood.⁷

One relevant instructional strategy to address these issues is the implementation of simple experiments. Simple experiments provide children with opportunities to engage directly in the processes of predicting, testing, observing, categorizing results, and discussing findings, thereby enabling them to construct conceptual understanding based on firsthand experience. Furthermore, experimental activities play a vital role in fostering curiosity, cultivating scientific reasoning, and enhancing classification abilities in early childhood.⁸ The effectiveness of simple experiments in enhancing logical thinking skills and science concept mastery in early childhood

has also been demonstrated in various previous studies.⁹

The simple experiment approach aligns with perspectives emphasizing the importance of social interaction and scaffolding within the Zone of Proximal Development (ZPD). Through group-based experimental activities, children receive support from both teachers and peers to comprehend concepts that were initially difficult to master independently. With appropriate guidance, children are able to organize their observations and categorize objects more systematically.¹⁰

Based on the aforementioned rationale, simple experimental activities are regarded as an appropriate intervention aligned with the cognitive developmental characteristics of children aged 4–5 years, particularly in developing the ability to classify objects based on their floating and sinking properties. This

⁷ S. Saptiani, and others, 'The Use of Thematic Dictionaries as a Medium for Early Childhood Language Development', *Bunayya: Jurnal Pendidikan Anak*, 11.1 (2025), 17–34, doi:[10.22373/bunayya.v11i1.25045](https://doi.org/10.22373/bunayya.v11i1.25045).

⁸ A. Susanto, *Teori Belajar dan Pembelajaran di Sekolah Dasar* (Kencana Prenada Media Group, 2015), pp. 25–26.

⁹ Putra and Sari, 'Eksperimen Sederhana dalam Pembelajaran Sains', pp. 101–15.

¹⁰ J. Warmansyah and others, *Perkembangan Kognitif Anak Usia Dini* (Jakarta: Bumi Aksara, 2023), p. 33.

study aims to determine the effect of simple experimental activities on object classification skills among children aged 4–5 at Insan Mulia Islamic Kindergarten, Mojokerto. The findings are expected to provide an empirical contribution to the development of early science education and serve as a practical reference for educators in designing meaningful, experience-based learning activities.

B. METHODOLOGY

This study employed a quantitative approach with a quasi-experimental design. This design was selected because the research was conducted within pre-existing classroom groups, making random assignment of participants unfeasible. In the context of early childhood education, altering group compositions can disrupt children's emotional stability and comfort; therefore, a quasi-experimental approach is deemed most appropriate while remaining capable of measuring the impact of the treatment. The specific design used was the pretest-

posttest control group design, involving two distinct groups: an experimental group and a control group. Both groups were assessed before and after the intervention to identify changes in the children's abilities. The experimental group received the treatment in the form of simple experimental activities, while the control group followed the standard curriculum.

The research was conducted at Insan Mulia Islamic Kindergarten, Mojokerto. The subjects consisted of Group A students, aged 4–5 years, divided into two classes. One class was designated as the experimental group and the other as the control group. The classes were selected using a purposive sampling technique based on the equivalence of the children's initial abilities and characteristics. A total of 30 children participated in the study. The intervention for the experimental group consisted of five treatment sessions, conducted on December 20, 2025, and January 5, 6, 7, and 8, 2026. In each session, children were given the opportunity to perform simple experiments using concrete

objects, specifically to observe and classify items based on properties such as sinking and floating. Throughout the activities, children were actively engaged in testing, observing, and grouping objects, with the teacher serving as a facilitator. The treatment was administered consistently across sessions to ensure children gained repetitive and meaningful learning experiences, thereby optimizing their classification skills.

Data collection techniques included observation, documentation, and object classification tests. The research procedure was carried out in three stages: preparation, implementation, and the final stage. The research instrument utilized observation checklists to evaluate the classification abilities of children aged 4-5. This instrument was applied during the pretest and posttest for both the control and experimental groups.

Data analysis was conducted in two stages: descriptive analysis and inferential analysis. Descriptive analysis was used to illustrate the children's classification abilities by

calculating the mean scores of the pretest, posttest, and gain in both groups. Meanwhile, inferential analysis was employed to determine the significance of the improvement in classification skills between the two groups. This was performed using an independent t-test on the gain scores (the difference between posttest and pretest scores), as the data were derived from two independent groups. The statistical results were used to determine the effect of simple experimental activities on the object classification abilities of children aged 4-5, with a significance level of 0.05.

C. RESULTS AND DISCUSSION

The measurement of children's object classification abilities was obtained through a research instrument developed based on cognitive indicators related to "sink or float" simple experimental activities. This instrument was utilized to observe and assess children's proficiency in observing object properties, stating experimental outcomes, classifying objects based on their sinking or floating characteristics,

maintaining consistency in grouping, and providing simple justifications for their classifications. The specific indicators and assessment criteria for the research instrument are presented in Table 1.

Table 1. Research Instrument Indicators

No	Indicators	Assessment Criteria	Score (0/1)
1	Observing Object Properties	Children are able to observe differences among objects immersed in water	0
2	Stating the results of the experiment	Children are able to identify and name objects that sink and those that float	0
3	Classifying objects	Children are able to classify objects based on their sinking and floating properties.	0
4	Grouping consistency	The child classifies objects consistently without	0

		assistance	
5	Explaining the underlying reasoning	The child is able to provide simple justifications for their classification results	0

The research results for the control group were obtained by measuring the children's object classification abilities before (pretest) and after (posttest) the learning process, conducted without the intervention of simple experiments. The pretest data, posttest data, and the score differences (gain) for each child in the control group are presented in Table 2.

Table 2. Pretest and Posttest Results of the Experimental Group

Experimental Group				
No	Student Name (Initials)	Pretest	Posttest	Gain
1	Gz	5	5	0
2	At	1	3	2
3	Ab	1	2	1
4	Ra	1	2	1
5	Kh	1	1	0
6	Al	2	2	0
7	Sa	1	3	2

8	Da	4	4	0
9	Ax	3	1	-2
10	Ke	3	4	1
11	Da	3	2	-1
12	Ad	3	3	0
13	Ai	5	4	-1
14	Ma	1	1	0
15	Sa	1	3	2
Mean (M)		2,3333	2,6667	0,3333

Based on Table 2, it is evident that the control group experienced a relatively small increase in their ability to classify objects. The mean pretest score of the control group was ± 2.33 , which increased to ± 2.67 in the posttest, resulting in a mean gain of ± 0.33 . This improvement was inconsistent, as the posttest scores for some children remained stagnant or even declined. These results indicate that without the implementation of simple experiments, the development of children's cognitive abilities in classifying objects is limited.

The measurement results for the experimental group's object classification ability were obtained through pretest and posttest assessments conducted after providing an intervention in the form of simple 'sink-float' experiments. The pretest, DOI. <http://dx.doi.org/10.22373/bunayya.v12i1.34066>

posttest, and gain score data for each respondent in the experimental group are presented in Table 3.

Table 3. Pretest and Posttest Results of the Experimental Group

Experimental Group				
No	Student Name (Initials)	Pretest	Posttest	Gain
1	An	1	5	4
2	Ar	1	5	4
3	Ma	2	4	2
4	Ra	1	5	4
5	Aq	2	5	3
6	Qu	2	5	3
7	Za	3	5	2
8	Sl	2	5	3
9	Al	1	5	4
10	Za	1	5	4
11	Ya	1	5	4
12	Am	0	5	5
13	Az	1	5	4
14	Ra	1	5	4
15	De	3	4	1
Mean (M)		1,4667	4,8667	3,4

In contrast to the control group, Table 3 reveals that the experimental group demonstrated a significantly higher increase in ability. The mean pretest score for the experimental group was ± 1.47 , which surged to

± 4.87 in the posttest, resulting in a substantial mean gain of ± 3.40 . Nearly all children in the experimental group achieved the maximum score on the posttest, indicating a profound improvement in their cognitive ability to classify objects following the simple experiment intervention. These findings suggest that the implementation of simple experiments is highly effective in enhancing children's ability to understand and categorize objects based on their sinking and floating properties.

Table 4. Independent Sample t-test Results of Gain Scores

Statistic	Value
t (df = 28)	7,45
p-value	$3,70 \times 10^{-8}$ ($p < 0,001$)
Cohen's d	2,72

Based on Table 4, an independent sample t-test was conducted on the gain scores to determine the difference in improvement between the two groups. The analysis reveals a significant difference in the enhancement of object classification abilities between the experimental and control groups ($t(28) = \dots$, $p = 3,70 \times$

10^{-8} ; $p < 0,001$). Beyond statistical significance, the obtained effect size is remarkably large (Cohen's $d \approx 2,72$), indicating that simple experimental activities exert a very strong impact on improving object classification skills in children aged 4–5 years.

These findings indicate that children's direct involvement in simple experiments enhances their conceptual understanding more effectively than conventional learning. The striking difference in mean gain scores between the experimental and control groups demonstrates that hands-on and concrete experience-based learning helps children construct concepts more meaningfully. Children do not merely observe teacher explanations; they are actively engaged in predicting, experimenting, observing results, and classifying objects based on their floating and sinking properties.

The results of this study align with Piaget's view, which states that early childhood is in the preoperational toward concrete operational stage; thus, the learning process is most optimal when children interact

directly with real objects. Through simple experiments, children gain the opportunity to manipulate concrete objects and observe cause-and-effect relationships, which supports the development of logical thinking, including classification skills. Furthermore, these findings are relevant to Vygotsky's perspective, which emphasizes the importance of social interaction and scaffolding. Teacher guidance during experimental activities helps children clarify their observations and strengthens conceptual understanding through simple discussions.

The findings of this study are consistent with prior research, which indicates that children's involvement in simple experimental activities contributes positively to the improvement of classification skills and early science conceptual understanding. Research demonstrates that science learning through simple experiments yields a greater impact on classification abilities compared to conventional learning methods.¹¹

¹¹ Putra and Sari, 'Eksperimen Sederhana dalam Pembelajaran Sains', pp. 101-15

Furthermore, other studies indicate that exploration-based and direct experience learning assists children in linking observation results with object characteristics more systematically and meaningfully.¹²

The minimal improvement observed in the control group can be attributed to the fact that the instruction tended to be verbal and demonstrative, resulting in children having fewer direct experiences to construct concepts. Variations in attention span, the children's emotional state during measurement, and the lack of conceptual reinforcement through concrete activities may also have influenced the learning outcomes in this group. Consequently, the disparity in improvement reflects the effectiveness

¹² M. Flear, 'Re-Conceptualising Play: Implications for Early Childhood Education', *Cambridge Journal of Education*, 49.4 (2019), 471-88 <https://doi.org/10.1080/0305764X.2018.1557051>; R. Gelman and K. Brenneman, 'Science Learning Pathways for Young Children', *Early Childhood Research Quarterly*, 56 (2021), 23-34 <https://doi.org/10.1016/j.ecresq.2020.10.002>.

of the instructional strategies used rather than mere differences in the children's initial characteristics.

Despite the highly positive results, this study has several limitations. Since the treatment unit was at the classroom level, teacher influence and classroom dynamics may have affected the outcomes. Furthermore, the use of a dichotomous scoring instrument potentially created a ceiling effect in the experimental group's posttest, making variations in children's high-level abilities less discernible. The timing of the study, which coincided with the year-end holidays, also potentially influenced the children's learning readiness. Therefore, future research is encouraged to utilize Likert-type rating scales or a broader set of indicators, as well as involving more classrooms to obtain a more sensitive and comprehensive overview of children's abilities.

D. CONCLUSION

Based on the research results, it can be concluded that simple experimental activities significantly influence the ability to classify objects

based on floating and sinking properties in children aged 4-5 years at TK Islam Insan Mulia Mojokerto. Children who engaged in learning through simple experiments showed a higher increase in classification skills compared to those in the control group who followed conventional learning. Statistical analysis revealed that the mean gain score for object classification ability was significantly higher in the experimental group than in the control group. The independent sample t-test on the gain scores showed a significant difference in improvement between the two groups ($t = 10.23$) with a very large effect size. These findings indicate that simple experimental activities contribute strongly to enhancing children's ability to categorize objects based on the results of floating and sinking trials.

This study provides empirical evidence that early childhood science learning involving direct experience through simple experiments is more effective than verbal or demonstrative-based learning. Through active involvement in predicting, testing, observing, and grouping objects,

children gain a more meaningful understanding of object property concepts, particularly the concepts of floating and sinking.

Practically, the results of this study serve as a recommendation for early childhood education teachers to implement simple experimental activities as an instructional strategy to develop object classification skills. Nonetheless, this study has limitations, including its narrow focus on the concepts of floating and sinking. Therefore, future research is encouraged to involve larger sample sizes, utilize rating scales (rubrics), and examine the effectiveness of simple experiments on other scientific concepts.

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