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Effectiveness of Using Demonstration and Experiment Methods on Learning Outcomes

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Abstract: The purpose of this study was to determine and measure the differences in the effects of the demonstration method and the experimental method on the learning outcomes of fourth-grade elementary school students in the Gebog Kudus sub-district. This research employed a quasi-experimental design with a pretest-posttest control group format. The population consisted of all fourth-grade students in the Gebog District, with a sample of 52 students, divided equally into an experimental group (26 students) and a control group (26 students). Nonprobability sampling was used to select participants. Data were collected using multiple-choice tests and questionnaires, and analyzed through descriptive analysis, validity and reliability testing of questions, item difficulty level tests, different tests, normality tests, homogeneity tests, t-tests, and N-gain score tests. The results indicate: (1) a significant difference in the effects of the demonstration and experimental methods, with a sig (2-tailed) value of 0.000 < 0.05. The average scores were 71.96 for the control group (demonstration method) and 81.38 for the experimental group (experimental method); (2) the demonstration method was found to be less effective, with an effectiveness value of 11.78% or 0.1178, while the experimental method was categorized as quite effective, with an N-gain of 41.35% or 0.4135. The study suggests that teachers should consider using experimental methods in science subjects to enhance student learning outcomes, especially in science.

Keywords: Effectiveness, demonstration, experiment, learning outcomes

1. Introduction

Changes to the curriculum policy in education were established by the Ministry of Education, Culture, Research, and Technology, as stated in Number 162/M/2021 regarding driving schools that implement the Independent Curriculum. This curriculum, introduced as a final option, can be implemented in educational units from 2022 to 2024. This policy was created in response to a perceived decline in the quality of learning during the Covid-19 pandemic, referred to as "Learning Loss." This decline has affected both the overall quality of education and the specific quality of learning. According to Rumini et al. (2003), the quality of learning, which ultimately produces learning outcomes, is influenced by various internal and external factors. Internal factors include physiological and psychological aspects, such as intelligence, motivation, achievement, and cognitive abilities. External factors encompass environmental and instrumental aspects, such as teachers, curriculum, methods, and learning media (Sulistiyowati & Fajrie, 2023).

Currently, many educators focus on achieving curriculum targets, prioritizing memorization over understanding. Students are not trained to discover knowledge or find concepts independently, resulting in a quick loss of the taught material. This is evident in classrooms dominated by teacher-led activities, leading to low student engagement and poor learning outcomes. This issue is also present in the Gebog sub-district, where science learning remains teacher-centered, relying on lecture and discussion methods, causing students to be passive. This approach emphasizes curriculum demands and textual delivery over developing learning abilities and individual growth. Such conditions hinder the expected development of student abilities and activities, leading to unsatisfactory learning outcomes. Students often feel bored and disinterested due to a lack of creative teaching methods, one-way communication, and insufficient interaction between teachers and students. Teachers have not utilized appropriate learning methods or adequate learning resources. According to Friedman et al. (2011), various strategies and methods can be employed to enhance students' ideological intelligence through the learning process. In elementary schools, strategies and methods must align with student characteristics.

In the era of the independent curriculum, the learning approach has shifted towards individual development, exploration, and deep understanding. Two relevant methods in this context are the demonstration and experimental methods. Both play a crucial role in supporting independent learning, allowing students to be active participants in acquiring knowledge. The demonstration method involves using concrete examples or practical presentations to illustrate concepts, processes, or principles. According to Mustamir (2019), the demonstration method presents learning material by directly showing objects or processes, facilitating learning in a visual and practical manner. This method helps students understand abstract concepts, gain deeper understanding, and develop practical skills by making concepts more tangible and relevant. Demonstrations cater to various learning styles, providing variety and allowing students to learn in ways that suit them best.

Based on this background, the study aims to determine the differences in the effect and effectiveness of using demonstration and experimental methods on science learning outcomes for fourth-grade elementary school students in the Gebog Kudus sub-district. The following hypotheses are proposed:

H1: There are differences in the effect of the demonstration and experimental methods on the science learning outcomes of fourth-grade elementary school students in the Gebog Kudus sub-district.

Ho: There are differences in the effectiveness of applying the demonstration and experimental methods to the science learning outcomes of fourth-grade elementary school students in the Gebog Kudus sub-district.

2. Literature Review

The demonstration method is a teaching strategy where instructors actively show students how to perform a task or understand a concept, which students observe with the intention to replicate. This method is particularly effective in teaching subjects that require practical skills and visual understanding, such as science and agricultural studies. The demonstration method has been found to significantly enhance student learning outcomes in science education. According to Umara (2022), this method helps in making abstract scientific concepts more concrete and understandable by providing visual and practical examples. Students are able to see the real-world applications of the concepts they are learning, which increases their engagement and retention of the material. The study highlights that many students initially find science difficult due to the abstract nature of the concepts, but the demonstration method alleviates this issue by offering clear, visual explanations. Daluba (2013) conducted a study comparing the demonstration method with traditional lecture-based teaching in agricultural science.

In the other hand, the experimental method engages students in active learning, which contrasts sharply with traditional lecture-based approaches. By involving students directly in the learning process, the experimental method helps them to not only understand theoretical concepts but also to apply these concepts in practical scenarios. According to Komorek and Duit (2004), the experimental method allows students to experience concepts firsthand, thereby facilitating a deeper comprehension and retention of knowledge . This active engagement is crucial for developing scientific skills such as observation, hypothesis formulation, data collection, and analysis. Experiments provide a platform for students to develop critical thinking and problem-solving skills. These skills are essential for scientific inquiry and are best cultivated through hands-on activities that require students to navigate challenges and find solutions. The study by Raja (2018) underscores that experiential learning methods, including experiments, significantly improve students' problem-solving abilities and decision-making skills . This is because experiments often present unpredictable results, compelling students to think critically and adapt their strategies accordingly.

Research consistently shows that the experimental method leads to better learning outcomes compared to traditional methods. In a study comparing traditional teaching methods with experiential learning, including experiments, Raja (2018) found that students in the experimental group performed significantly better in post-tests compared to those in the control group. The active involvement in experiments not only enhances understanding but also makes learning more enjoyable and relevant to real-world applications.

The experimental method also helps in developing scientific attitudes among students. It encourages curiosity, perseverance, and a systematic approach to problem-solving. By engaging in experiments, students learn to appreciate the scientific method and the importance of evidence-based conclusions. This was highlighted by Ariesta et al. (2019), who found that students who engaged in experimental learning demonstrated improved critical thinking skills and a greater appreciation for scientific inquiry.

3. Methodology

This research employs an experimental method. Experimental research is defined as the most comprehensive quantitative research approach, meeting all the requirements for examining causal relationships. According to Sugiyono (2013), the experimental research method is used to determine the effect of specific treatments on other variables under controlled conditions. This method plays a crucial role in student learning by involving students directly in the learning process through hands-on experiments.

By participating in experiments, students can experience concepts firsthand, which enhances their understanding beyond merely listening to information or theories. This method helps build a deeper comprehension of theoretical concepts by linking them to practical experiences. Experiments also aid in clarifying doubts and difficult concepts that might not be easily understood through theoretical approaches alone. Moreover, through experimental activities, students develop critical thinking, analytical, and problem-solving skills, which are valuable in everyday life. Both the demonstration and experimental methods play essential roles in the independent curriculum, facilitating independent learning processes. Research by Latifah (2018) has shown that these methods positively influence student learning outcomes.

Table 1. Research design methods

Class	Pretest	Treatment	Postest
E	O_1	X	O_2
K	O_3	Y	O_3

(Source: Arikunto, 2014).

Description:

E = Experiment
K = control
O_1 dan O_3 = *Pretest*
O_2 dan O_4 = *Posttest*
X = demonstration method
Y = experiment method

The population for this study includes all fourth-grade elementary school students in Gebog District, Kudus Regency. The samples were selected as follows: 1) Experimental Class: Fourth-grade students at SD 3 Padurenan (13 students) and SD 1 Padurenan (26 students); and 2) Control Class: Fourth-grade students at SD 1 Klumpit (26 students) and SD 2 Getassrabi (13 students). This experimental research was conducted in the second semester of the 2022/2023 school year.

The data analysis technique involves the following steps: 1) Prerequisite Tests: These are conducted if parametric analysis is used. The data must meet two requirements: normal distribution and homogeneity; 2) t-test: This test determines the level of influence and differences between the experimental and control variables; and 3) N-Gain Test: This test assesses the effectiveness of the experimental and demonstration methods by measuring the increase in student learning outcomes from the initial to the final learning sessions. The N-Gain analysis is used to evaluate the difference between post-test and pre-test scores (Widhiarso, 2011). The gain index level criteria (normalized gain) can be seen in Table 2.

Table 2. Normalized gain criteria

Clasification	Criteria
$(g) \geq 0.70$	N-gain high
$0.30 \leq (g) < 0.70$	N-gain midle
$(g) < 0.30$	N-gain low

4. Results and Discussion

The results of this study are presented through the analysis of prerequisite tests and research data on the effect of the experimental model and process skills approach on student learning outcomes. The findings from the validity, reliability, difficulty level, and differential power tests are as follows: 1) Validity Test: Based on the results using SPSS version 20, twenty questions were found to be valid with a significance value of less than 0.05; 2) Reliability Test: The reliability test using SPSS version 20 indicated that the questions were reliable, with a Cronbach's Alpha value of 0.885, which is greater than the threshold of 0.60; 3) Difficulty Level Test: The difficulty level analysis of the 20 questions using SPSS version 20 showed good results, with the questions meeting the criteria: 20% difficult, 60% moderate, and 20% easy; and 4) Differential Power Test: The differential power test using SPSS version 20 demonstrated that the questions had good differential power, with values greater than 0.41.

Data on students' science learning outcomes were obtained from pretests and posttests administered to both the experimental and control classes. The key findings are summarized as follows: 1) Pretest Scores: Experimental class (using the experimental learning method): Mean value of 68.92, and Control class (using the demonstration learning method): Mean value of 67.96; and 2) Posttest Scores: Experimental class (using the experimental learning method): Mean value of 81.38, and Control class (using the demonstration learning method): Mean value of 71.96. Based on these results, it can be concluded that the application of the experimental method led to a significant increase in student learning outcomes, with an improvement of 12.46 points from pretest to posttest. In contrast, the application of the demonstration method resulted in a smaller increase of 4 points. These findings suggest that the experimental method is more effective in enhancing students' science learning outcomes compared to the demonstration method. The descriptive statistics can be seen in Table 3.

Table 3. Pretest and posttest scores of science learning outcomes for experiment class and control class students

Descriptive Statistics							
	N	Range	Min	Max	Sum	Mean	Std. Deviation
Pre-experiment	26	30.00	55.00	85.00	1792.00	68.9231	7.50958
Post-experiment	26	36.00	60.00	96.00	2116.00	81.3846	7.25577
Pre-Control	26	30.00	50.00	80.00	1767.00	67.9615	9.43390
Post-Control	26	35.00	50.00	85.00	1871.00	71.9615	9.11474
Valid N (listwise)	26						

Based on the normality and homogeneity tests, the data was found to be normally distributed and homogeneous. Therefore, the hypothesis was tested using an independent sample t-test with the help of SPSS version 20. The results of the normality test can be seen in Table 4.

Table 4. Normality test

	Class	Kolmogorov-Smirnova			Shapiro-Wilk		
		Statistic	df	Sig.	Statistic	df	Sig.
Outcomes learning	Pre-test Exeriment	.172	26	.055	.951	26	.241
	Post-test Experiment	.152	26	.124	.929	26	.074
	Pretest Control	.162	26	.076	.923	26	.052
	Postest Control	.131	26	.200*	.946	26	.185

*. This is a lower bound of the true significance.
a. Lilliefors Significance Correction

Table 5 shows the significance value (Sig.) is greater than 0.05, the data is declared to be normally distributed. The table above shows that the significance value is 0.227 at the $\alpha = 0.05$ significance level. Since the calculated score is greater than $\alpha = 0.05$, this indicates that the experimental class and the control class come from the same or homogeneous variance class.

Table 5. Homogeneity test results of student learning outcomes

Levene Statistic	df1	df2	Sig.
1.471	3	100	.227

Based on Table 6, there is a difference in the average application of the demonstration method and the experimental method, with the control group (demonstration) having an average value of 71.96 and the experimental group having an average value of 81.38. According to the Independent Samples Test output, the significance value (2-tailed) is 0.000, which is less than 0.05. This indicates a significant difference in student learning outcomes between the experimental class using the experimental method and the control class using the demonstration method.

Table 6. T Test result

	Class	N	Mean	Std. Deviation	Std. Error Mean
Learning Outcomes	Postcontrol	26	71.96	9.115	1.788
	Posteksperimen	26	81.38	7.256	1.423

The gain score test was conducted to determine the difference between the pretest and posttest values. This test was performed after all prerequisite tests, including the normality and homogeneity tests, were satisfied. Table 7 shows that the N-gain in the experimental class was 41.35% (0.4135) and in the control class was 11.78% (0.1178). The N-gain classification is as follows: $g < 0.30$ = low, $0.30 < g < 0.70$ = moderate, $g > 0.70$ = high. The results indicate that the N-gain for the experimental class, at 41.35% (0.4135), falls into the moderately effective category. In contrast, the N-gain for the control class, at 11.78% (0.1178), falls into the low category. Thus, the gain test results demonstrate that the learning outcomes in the experimental class were significantly better than those in the control class.

Tabel 7. Hasil uji gain scor**e**

Experiment Class	Control Class

Sample	N Gain Percent	Sample	N Gain Percent
Mean	41.3452	Mean	11.7835
Minimum	8.57	Minimum	-47.06
Maximum	73.33	Maximum	40

Based on the Independent Samples Test output, with a significance value (2-tailed) of 0.000 (<0.05), it can be concluded that there is a significant difference in student learning outcomes between the experimental class using the experimental learning model and the control class using the demonstration method. The use of demonstration and experimental methods shows significant differences in the context of Natural Sciences (IPA) subjects at the elementary school level.

In the demonstration method, the teacher actively demonstrates scientific concepts, processes, or phenomena to students, who act as observers. This method aims to help students visualize concepts or phenomena that are difficult to understand verbally or textually. Teachers use tools, models, or visual media to support the presentation, allowing students to observe firsthand. While interaction and questions are possible, students are not directly involved in conducting experiments or collecting data. This method is effective for introducing new concepts or phenomena, describing their characteristics, and providing students with an overview. Demonstrations help students understand concepts by seeing them firsthand, though their practical experience may be more limited than with experimental methods. The experimental method involves active student participation in planning, carrying out, and observing experiments. Students act as the main actors in the learning process, discovering scientific concepts or principles through direct experience. They are involved in the entire experimental process, including planning, conducting, data collection, and result analysis, which encourages deeper understanding. This method emphasizes developing scientific skills such as observing, formulating hypotheses, collecting data, and drawing conclusions based on evidence. Experiments allow students to understand concepts more deeply by engaging in scientific processes, thereby strengthening their understanding through practical experience.

In the context of elementary school science subjects, both methods have significant value. The demonstration method effectively provides an overview of complex concepts or phenomena that students cannot directly observe. Conversely, the experimental method helps students understand scientific concepts through practical experience, building scientific skills and stimulating curiosity. Teachers should choose the method that best suits the learning objectives and student characteristics. Combining these methods can provide diverse and comprehensive learning experiences for students in understanding the scientific world. This study supports previous research by Wijayanto et al. (2021), which stated that there are differences in learning outcomes between the use of demonstration and experimental methods. However, it contradicts Latifah's research (2018), which found no difference in the effect of using these methods on science learning outcomes.

5. Conclusion

Based on the findings, it can be concluded that both the demonstration and experimental learning methods positively impact students' science learning outcomes in elementary schools in the Gebog Kudus sub-district. However, there is a significant difference in the effectiveness of these methods, with the experimental method being more effective than the demonstration method.

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Conflict of Interest

The authors declare no conflicts of interest.

References

Ariesta, F. W. (2019). Effectiveness of e-learning media to improve learning outcomes natural science in primary schools. *Journal of Education Research and Evaluation*, *3*(2), 88-95. https://doi.org/10.23887/jere.v3i2.17203

Daluba, N. E. (2013). Effect of Demonstration Method of Teaching on Students' Achievement in Agricultural Science. *World journal of Education*, *3*(6), 1-7. https://doi.org/10.5430/wje.v3n6p1

Friedman, A. J., Cosby, R., Boyko, S., Hatton-Bauer, J., & Turnbull, G. (2011). Effective teaching strategies and methods of delivery for patient education: a systematic review and practice guideline recommendations. *Journal of Cancer Education*, *26*, 12-21. https://doi.org/10.1007/s13187-010-0183-x

Komorek, M., & Duit, R. (2004). The teaching experiment as a powerful method to develop and evaluate teaching and learning sequences in the domain of non-linear systems. *International Journal of Science Education*, *26*(5), 619-633. https://doi.org/10.1080/09500690310001614717

Latifah, S. S. (2018). Pengaruh Metode Pembelajaran Demonstrasi Dan Eksperimen Terhadap Hasil Belajar Ipa. *Basic Education*, *7*(35), 3-509.

Mustamir, A. (2019). Application of demonstration methods to improve learning achievement in cultural arts subject and skills of filter art graphic materials in class IX E students of SMP Negeri 3 Surabaya. *Indonesian Journal of Contemporary Education*, *1*(1), 15-17. https://doi.org/10.33122/ijoce.v1i1.4

Raja, F. U. (2018). Comparing traditional teaching method and experiential teaching method using experimental research. *Journal of Education and Educational Development*, *5*(2), 276-288.

Rumini, S., Purwanto, E., Purwandari, M. S., Suharmini, T., Si, M., & Ayriza, Y. (2003). Belajar dan Faktor-faktor yang Mempengaruhinya. *Jakarta: PT Rineka Cipta*.

Sulistiyowati, S., & Fajrie, N. (2023). Efektivitas media canva terhadap minat dan hasil belajar IPA siswa kelas V SDN Bakaran Wetan 03 Pati. *Journal on Education*, *5*(3), 5883-5891. https://doi.org/10.31004/joe.v5i3.1351

Sugiyono, D. (2013). Metode penelitian pendidikan pendekatan kuantitatif, kualitatif dan R&D. Bandung: Alfabeta.

Umara, R. (2022). The effectiveness of the demonstration method to improve student learning outcomes. *East Asian Journal of Multidisciplinary Research*, *1*(9), 1997-2006. https://doi.org/10.55927/eajmr.v1i9.1513

Wijayanto, S., Asrul, A., & Tiro, A. R. (2021). Pengaruh Metode Demonstrasi terhadap Hasil Belajar IPA Kelas V MI-AL Ma'arif Kota Sorong. *Jurnal Papeda: Jurnal Publikasi Pendidikan Dasar*, *3*(1), 62-68.