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The Application of Demonstrated Learning Methods to Increase Primary School Students' Science Learning Results

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Abstract: The paper aims to determine the difference in science learning outcomes of students who apply the demonstration method and the science learning outcomes of students who use conventional learning in class IV elementary school. The type of research that the author uses is experimental research. This research uses a group of research subjects from a certain population, then grouped randomly into two groups or classes, namely the experimental class and the control class. The experimental class was treated using the demonstration method and the control class used the conventional method, then both classes underwent the same post-test. The sampling technique used was non-probability sampling with proportional sampling. The same number of students and class average scores that are close to the same are class VA and class VB. After getting the sample class, the two classes were randomly drawn, then class VA was obtained as the experiment and class VB as the control. The results of this research can be seen from the results of the hypothesis test using the t-test which was carried out so that the value of t_count=0 and t_table= 2.02 was obtained. From the distributed table t, we get ttable = 2.02. So, it can be concluded that t_count > t_tabel, where 0 > 2.02, thus the working hypothesis H_1 is accepted, meaning there are significant differences in learning outcomes in the two samples. This research concluded that the science learning results of class IV students who used the demonstration learning method did not have a significant difference because the two sample classes got the same learning results, due to the limited time of the researcher who delivered the material to the experimental class

Keywords: Demonstration; Elementary School; Learning Results, Science

Introduction

Education in the digital era is education that must integrate Information and Communication Technology into all subjects. With the development of digital-era education, students can gain abundant knowledge quickly and easily (Huang et al., 2023). To tackle the difficulties posed by education in the digital age, educators and students alike must be capable of adapting to the changing times and communicating effectively. This includes the ability to keep up with the advancements in technology. As time progresses, it is expected that new challenges will arise, necessitating high-level problem-solving skills (Dwivedi et al., 2023). According to (Rajapathirana & Hui, 2018), In the 21st century, success requires a breadth of knowledge and skills. With globalization, economic growth, international competition, environmental issues, cultural dilemmas, and political difficulties all presenting challenges, it is crucial to be equipped to handle these complex issues.

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The essence of quality learning lies in the collaborative efforts of educational institutions and their students. The goal of this partnership is to facilitate a transformative experience that intentionally alters the student's behavior in line with specific educational objectives (Darling-Hammond et al., 2020). Students need to have the ability to think to be able to answer the problems they face and education must be able to facilitate developing this thinking ability (Haleem et al., 2022). In line with this, science learning is one solution. Science is learning that is directly related to nature and its various phenomena and problems (Ernawati et al., 2022; Wardani et al., 2023; Amala et al., 2023). By studying science, students not only practice skills, but also the ability to think. This thinking ability can help students solve the problems they will face in the future.

Based on a survey conducted on the rankings and achievement of the Program or International Student Assessment (PISA) scores, it shows that there has been an increase in the abilities of students in Indonesia in recent years. Indonesia's PISA ranking and achievement scores for 2015 rose from 71st in 2012 to 64th in 2015. This assessment is measured by 72 member countries of the Organization for Economic Cooperation and Development (OECD). The highest jump was in the field of science, namely from 327 points to 359 points. This increase in achievement is very encouraging and should receive more appreciation, but on the other hand, the results obtained cannot yet show that the learning carried out was completely good. Given these problems, the researcher wants to take action. Many efforts can be made to improve the quality of learning outcomes from science learning. One thing researcher want to do is to use the demonstration method.

Using the demonstration method should increase students' curiosity and curiosity about the material presented by the teacher because the demonstration method has advantages. The advantage of the demonstration method is that the learning is more interesting because the students do not only but also see the events that occur. With this interesting learning, students are more interested in learning so that it can improve student learning outcomes. Method of demonstrating a teaching method by demonstrating rules and sequences for carrying out an activity, directly, or by the use of educational supports relevant to the subject presented.

Based on the formulation of the research problem that has been stated, this research aims to determine the differences in science learning outcomes of students who apply the demonstration method and the science learning outcomes of students who use conventional learning in class IV elementary school.

Method

The paper employed experimental research (Siahaan et al., 2017) reveals that experimental research is a research method used to find the effect of certain treatments on others under controlled conditions. This research was conducted on two classes, namely the experimental class and the control class. The experimental class is a class that is treated using the demonstration method in the science learning process, and in the control class, the learning uses conventional methods in the learning process.

Research Design

The research design used in this study was Randomized Control Group Post-test Only Design. This research uses a group of research subjects from a certain population, then grouped randomly into two groups or classes, namely the experimental class and the control class. The experimental class was treated using the demonstration method and the control class used the conventional method, then both classes underwent the same post-test

Population

The population in this study was all fourth-grade students at SDN KP in the academic year, totaling 45 people**.**

Table 1. Total number of students

Sample	Number of Students
IVA	23
IVB	22
IVC	20
Total	65

Sample

For the problem being studied, two sample classes are needed, an experimental class and a control class. The sampling technique used was non-probability sampling with proportional sampling. Based on considerations, the number of students whose average scores are close to the same is taken as a sample. Determining the experimental class and control class was carried out using probability sampling with proportionate stratified random sampling.

The same number of students and class average scores that are close to the same are class VA and class VB. After getting the sample class, the two classes were randomly drawn, then class VA was obtained as the experiment and class VB as the control.

Result and Discussion

Based on data analysis of student learning outcomes scores in the sample classes, the average, standard deviation, and variance of the two sample classes were calculated as shown in the figure 1.

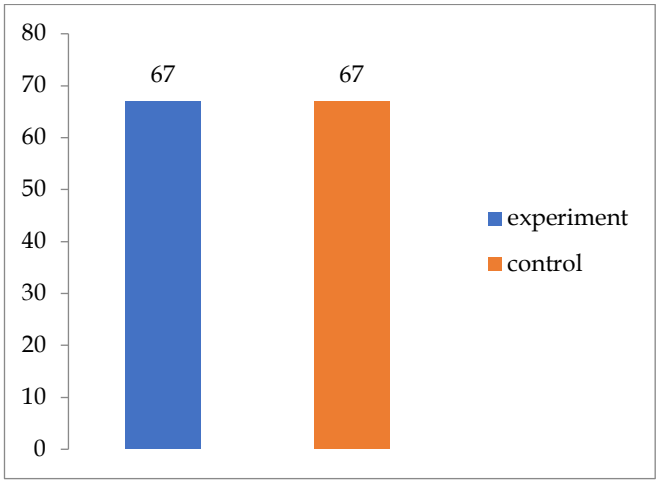

Figure 1. Calculation of Mean, Standard Deviation, and Variance

The average academic performance of the experimental class using the demonstration method was 67.00, and the academic performance of the control class using conventional learning was 67.00. Therefore, the average academic performance of the two sample classes was 67.00. Based on the minimum completeness criteria (KKM) at SDN KP for science learning is 75.

Validity

The technique used to calculate the validity of the questions in this research is to look for the validity of the question items from the test results of the questions in this study using the product moment correlation formula. As stated in the following table 2.

Table 2. Validity Results of Trial Tests

Validity Coefficient	Category	Total Number
0.80-1.00	Very High	0
0.60-0.79	High	5
0.40-0.59	Enough	15
0.20-0.39	Low	9
0.00-0.19	Very Low	11
	Total	40

Question Item Difficulty Index

Based on the results of the test questions carried out, the difficulty level of the questions is calculated. In this research, the difficulty levels of the questions were classified as easy, medium, and difficult. As stated in the following figure 2.

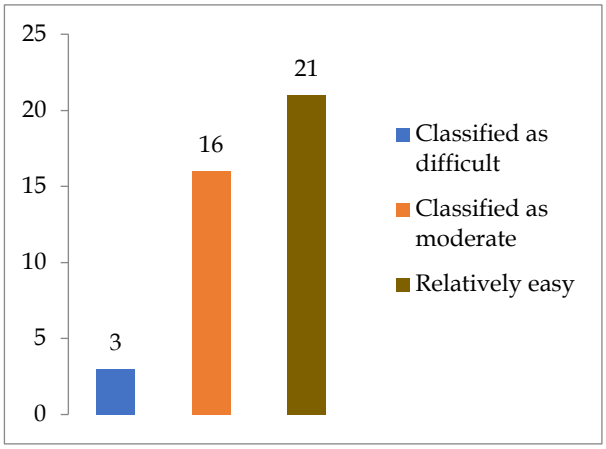

Figure 2. Results of Question Difficulty Index Analysis

Question Differentiating Power

Based on the results of the test questions carried out, an analysis of the question items was carried out by calculating the differentiating power of the questions. Based on the test of the differentiating power of the questions, the author got the differentiating power of the questions which were classified as bad, fair, good, and very good. As stated in the following Figure 3.

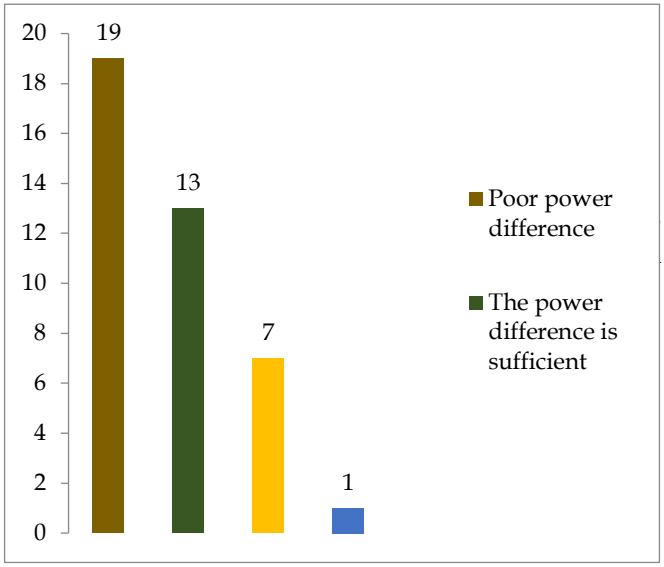

Figure 3. Results of Differentiating Power of Questions

Normality test

The normality test aims to determine whether the data for the two sample classes are normally distributed or not. The normality test was carried out using the Lilifors test formula which was carried out on both sample classes. From the normality test carried out, the value L_0 < L_table at the real level α = 0.05 is obtained as in the following table 3.

Table 3. Final Class Sample Normality Test Results

Class	Number of Students	L_{count}	L_{table}	description
Experiment	21	0.12	0.19	Normal
Control	22	0.12	0.18	Normal

From the table 3 it can be seen that the L_count value is smaller than L_table so it can be concluded that the data for the two sample classes are normally distributed.

Homogeneity Test

The homogeneity test aims to find out whether the learning outcome data for the two classes has homogeneous variance or not. Inhomogeneity testing, the F test is used. The homogeneity test can be seen in the following Figure below:

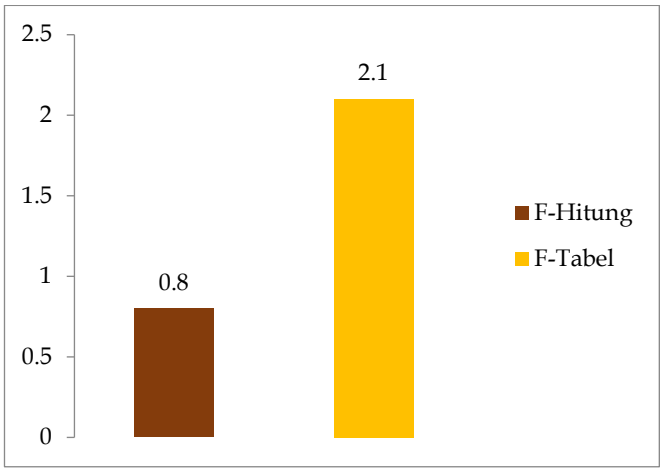

Figure 4. Sample Class Homogeneity Test Results

For F_table at a significance level of 0.05 with dk in the numerator 20 and dk in the denominator 21 is 2.10. So we get F_count < F_table, namely 0.80 < 2.10. The data for both sample classes have homogeneous variance.

Hypothesis testing

After carrying out the normality test and homogeneity test, it can be concluded that the two sample classes are normally distributed and have homogeneous variances. The hypothesis test used is the t-test. Hypothesis testing can be seen in the following table 5.

Table 5. Sample Class t-test results

Class			t_{table}	Description
Experiment and Control class	17.43	0	2.02	H_1 accepted and H_0 rejected

The results of the hypothesis test using the t-test were carried out, the values obtained were t_count=0 and t_table= 2.020. From the distributed table t, we get ttable = 2.020. So, it can be concluded that t_count > t_tabel, where 0 > 2.019, thus the working hypothesis H_1 is accepted, meaning there are significant differences in learning outcomes in the two samples.

Discussion

Education is a human effort to broaden the horizons of knowledge to form values, attitudes, and behavior. As efforts that not only produce great benefits, education too is one of the basic human needs that is often not felt to meet expectations. Considering that the quality of our education is far behind Neighboring countries, especially when compared with developed countries. From various analyses, it can be seen that one of the causes of the low quality of education in Indonesia is our education system emphasizes results and pays less attention to the learning process of education itself. Ideally, learning activities must be balanced between learning processes and outcomes.

The learning process by applying the demonstration method emphasizes students' learning. So they are the ones who must actively develop knowledge based on concrete experience. The advantages of the demonstration method are that students will get a clearer picture of the process of something that has been demonstrated, students' attention will be more easily focused on the important things being discussed, thus allowing for an optimal learning process for children, and can reduce misunderstandings between children and teachers when compared to lectures and questions and answers, because with demonstrations students will be able to observe for themselves the process of something, and will be able to provide opportunities for students to discuss what has been demonstrated or can also practice mastery or certain skills as a follow-up to the demonstration (Bälter et al., 2018).

Using the demonstration method in science learning can achieve optimal student learning outcomes, because by using the demonstration method in science learning (Basheer et al., 2016). As teachers, we can see students' activeness and ability to understand the learning concepts presented. Based on research data, it can be seen that the average is 67.00. Meanwhile, in the control class, the average was 67.00. These results indicate that the average score obtained by students who were treated using the demonstration method in science learning has the same average score as conventional learning. The similarity in learning outcomes between the experimental class and the control class is due to the two sample classes being given

different learning treatments (Ningsih, 2019; Haelermans, 2022).

This shows that with the demonstration method in the experiment, learning results were obtained which should be better than the control class using conventional methods. The demonstration method is suitable for use in science learning because science material is material that shows a lot of processes. The obstacles that researchers experienced during the research were that demonstration activities required careful planning as well as requiring quite a long time, which may have forced them to take up other time or class hours. Apart from that, the obstacles that researchers experience during research are that adequate facilities such as equipment, space, and costs are not always available properly.

The researcher has tried to overcome various obstacles that the researcher experienced during this research by preparing and trying out demonstration activities first before carrying out the demonstration activity at school so that when the activity is carried out in the learning process, the activity runs according to the activity plan that has been prepared so that the lesson time is different. not used, then the researchers must first prepare and condition the facilities, equipment, place, and costs, because if there are no facilities then the demonstration activity will not run smoothly.

Science learning in elementary schools is known as Natural Science (IPA) learning. The concept of science in elementary school is a concept that is still integrated because it has not been separated separately, such as the subjects of chemistry, biology, and physics (Kang, 2019). Science learning in elementary schools is carried out with simple investigations rather than memorizing a collection of science concepts (Markula & Aksela, 2022). Activities in science learning will involve direct experience through observation, discussion, and simple investigations. Science is not only mastery of a collection of knowledge in the form of facts, concepts, or principles, but it is also a process of discovery (Sandopa et al., 2022; Matthews, 2022; Pedaste et al., 2015; De Ramos-Samala, 2018). It is hoped that science education in schools can be a vehicle for students to learn about themselves and the natural world around them, and can provide further development in applying it in everyday life, which is based on the scientific method (Grassini, 2023; Faisal & Martin, 2019). Science learning emphasizes direct experience to develop competencies so that students can understand the natural surroundings through the process of finding out and applying it this will help students to gain a deeper understanding (Fauziah & Kuswanto, 2020).

Science lessons in elementary school contain material about natural knowledge that is close to the lives of elementary school students. In the course of their daily lives, students are expected to possess the ability to recognize and understand natural knowledge. Science is a crucial area of study because the knowledge it imparts has direct applications in society. There are several reasons why science subjects hold a significant weightage, including the fact that it is useful for children's future lives or careers, they form an integral part of national culture, and they teach young minds to think critically and analytically.

Lastly, science has educational value, as it has the potential to shape the child's personality as a whole (Chafouleas & Iovino, 2021; Oeschger et al., 2022; Li & Qiu, 2018; Payne & Costas, 2021). Science education should be implemented well in the learning process at school considering the importance of this lesson as stated above (Oliveira & Bonito, 2023; Hadzigeorgiou & Schulz, 2019; Santos Garduño et al., 2021). Science learning is considered successful if all predetermined learning objectives can be achieved, which are revealed outcomes of science learning. However, in reality, some schools are still weak in science learning because they do not have the predetermined completion standards (Nadeem et al., 2023).

Based on observations made by researchers in class IV elementary school, during the learning process teachers tend to use lecture and question-and-answer methods, so the learning process is less enjoyable. This has an impact on the condition of students who easily feel bored in learning. During the learning process, there is a lack of student motivation and activeness towards science learning, as a result, it has an impact on student learning outcomes. This is because class IV A students prefer to pay attention to their teacher with the existing material or media, but the teacher only explains the lessons in the handbook so that students do not understand the lesson. Meanwhile, in class IV B, the students were more active in asking about the teaching material explained by the teacher.

Conclusion

It can be deemed that the science learning results of class IV students who used the demonstration learning method did not have a significant difference because the two sample classes got the same learning results, due to the limited time of researchers who delivered material to the experimental class, so there were still many students who do not understand the material being taught. learning by using the demonstration method, students can work together with their groups and students gain direct learning experience, both seeing, hearing, and carrying out activities in science learning. To achieve science learning goals and mutually improve

the quality of science education, the most important factor is an interactive learning process. Teaching is not just telling or imparting learning material to students. The learning process will be active if students are directly involved in solving all the problems given by the teacher.

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Author Contribution
Conceptualization, G. P., P., L. J., B. P., S., N. C. L., N. E.; methodology, G. P., P, L. J.; software, B. P.; validation, S.; formal analysis, N. C. L.; investigation, N. E.; resources, G. P.; data curation, P., L. J.; writing-original draft preparation, B. P., S., N. C. L.; writing-review and editing, N. E. and G. P.

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Conflicts of Interest
The authors declare no conflict of interest.

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