

Improving Students' Cognitive Learning Outcomes through Discovery Learning and Inquiry Models on the Human Skeleton and Its Functions Material

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Abstract

This research is motivated by the tendency of students' learning outcomes to be low in the topic of the human skeleton and its functions. As a teacher, there is often a feeling of not having maximized the potential learning outcomes of students, leading to a tendency for students to be more passive. The researcher offers a solution through Discovery Learning and inquiry-based learning. The purpose of this study is to determine the effect of implementing Discovery Learning and inquiry-based learning on the learning outcomes of Grade IV students at UPTD SD Negeri 6 Peusangan Selatan on the topic of the human skeleton and its functions. The population in this study consists of all Grade IV students at UPTD SD Negeri 6 Peusangan Selatan, totaling 30 students across two classes. The sample includes all students from Class IVA, consisting of 15 students, and Class IVB, also consisting of 15 students. Class IVA was designated as the experimental class taught using Discovery Learning, while Class IVB served as the control class taught using inquiry-based learning. Data collection was conducted using tests, and data analysis employed t-test analysis. The results of the study on Grade IV students at UPTD SD Negeri 6 Peusangan Selatan, which examined the use of Discovery Learning and inquiry-based learning models and their impact on students' learning outcomes, indicate that the hypothesis results show that $t_{calculated}$ is greater than t_{table} at a significance level of 0.05 (1.701). Mathematically, 2.407 more than 1.701, indicating that the application of Discovery Learning and inquiry-based learning significantly affects the learning outcomes of Grade IV students at UPTD SD Negeri 6 Peusangan Selatan in the topic of the human skeleton and its functions.

Keywords – Discovery Learning; Inquiry-Based Learning; Cognitive Learning Outcomes: Human Skeleton And Its Functions



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1. Introduction

Learning is the process of interaction between students and their environment, leading to behavioral changes in a positive direction. This interaction can be described as the teaching and learning process, which involves activities between teachers and students with reciprocal communication that occurs in an educational setting to achieve learning objectives. The achievement of learning objectives is closely related to the learning outcomes obtained by students. According to Jihad and Haris (2012), "Learning outcomes are the tangible changes in students' behavior after the teaching and learning process aligned with the learning objectives has taken place."

A good learning process is one that is not teacher-centered but student-centered. Teacher-centered learning tends to yield lower-level thinking skills, as students are primarily engaged in memorizing, recalling, recognizing, and explaining facts. On the other hand, student-centered learning fosters critical thinking and problem-solving skills, encouraging students to become independent learners. This approach results in deeper understanding and retention of concepts.

Based on interviews with the science teacher for Grade IV, the average test score of students on the topic of the human skeleton and its functions was 71.30. This score is the lowest compared to other topics and does not meet the minimum passing grade (KKM) of 75. Additionally, it was revealed that the use of inquiry-based methods, such as lectures and question-and-answer sessions, was less effective in helping students discover and understand concepts, which impacted their learning outcomes. Therefore, an appropriate learning model is needed to encourage students to independently discover and understand concepts. Learning models that support this include the Discovery Learning model and the Inquiry Learning model.

The Discovery Learning model is a method aimed at fostering active learning in students by allowing them to discover and investigate independently. This approach leads to longer retention of knowledge, as students are less likely

to forget what they have learned. Discovery Learning is considered an effective method where students are active, and the teacher guides them in forming concepts, principles, generalizations, or theories (Lestari, Budiyo, and Isnandar, 2015). According to Widiadnyana, Sadia, and Suastra (2014), the Discovery Learning model involves several stages, including: Stimulation, Problem Statement, Data Collection, Data Processing, Verification, and Generalization.

Research conducted by Widiadnyana, Sadia, and Suastra (2014) revealed that the Discovery Learning model positively impacts students' understanding of science concepts and scientific attitudes. The study found a significant difference in the understanding of science concepts and scientific attitudes between students who used the Discovery Learning model and those who engaged in direct instruction.

Discovery Learning is highly recommended due to its advantages, as highlighted by Illahi (2012):

- a. Engagement with Direct Activities and Experiences: Discovery Learning uses activities and direct experiences to present material, which captures students' attention and fosters the formation of meaningful abstract concepts.
- b. Realistic and Meaningful Learning: Students work directly with real-world examples, making the learning process more relatable and meaningful.
- c. Problem-Solving Approach: Students directly apply principles and initial steps to solve problems.
- d. Ease of Knowledge Transfer: The hands-on activities in Discovery Learning facilitate better absorption of knowledge related to specific learning contexts.
- e. Active Student Participation: The model provides ample opportunities for students to actively engage in learning activities.

Inquiry-based learning, on the other hand, is a model designed to instill the foundations of scientific thinking in students. It emphasizes independent learning, creativity, concept understanding, and problem-solving (Komalasari,

2015). According to Ahmadi, Amir, Ari, and Elisah (2011), "The Inquiry Learning model is a learning activity that maximally involves all of the students' abilities to investigate objects, people, or events systematically, critically, logically, and analytically, allowing them to formulate findings confidently."

Trianto (2014) describes the stages of implementing the Inquiry model as follows:

- a. Posing questions or problems.
- b. Formulating hypotheses.
- c. Collecting data.
- d. Analyzing data.
- e. Drawing conclusions.

Research by Dewi, Dantes, and Sadia (2013) indicates that the Guided Inquiry Learning model influences scientific attitudes and science learning outcomes. The study found significant differences in scientific attitudes and learning outcomes between students using the Guided Inquiry Learning model and those employing a general Inquiry model.

Inquiry-Based Learning is highly recommended due to its numerous advantages. According to Trianto (2014), these advantages include:

- a. This approach emphasizes the balanced development of cognitive, affective, and psychomotor aspects, making the learning process significantly more meaningful.
- b. It allows students to learn according to their individual learning styles.
- c. Inquiry-Based Learning aligns with modern educational psychology, which views learning as a process of behavioral change resulting from experience.
- d. It accommodates the needs of students with above-average abilities, ensuring that high-achieving students are not hindered by those who may struggle with learning.

2. Method

The research employed a quantitative approach. A research design encompasses all the processes required for planning and conducting a study. In a narrower sense, it pertains specifically to data collection and analysis. According to Sugiyono (2016), "The non-equivalent control group design is almost identical to the pretest-posttest control group design, except that in this design, neither the experimental class nor the control class is randomly selected".

According to Arikunto (2016:174), a sample is a portion or representative of a population being studied. In this research, the researcher employed simple random sampling. As explained by Sugiyono (2017:82), Simple Random Sampling is the selection of sample members from a population done randomly without considering any strata within the population. The experimental class consisted of Class IV_A with 15 students taught using the discovery learning model, while Class IV_B, also with 15 students, was taught using the inquiry model.

This study is a quantitative research. According to Sugiyono (2014:2), quantitative research is a type of research that generates findings achieved using statistical procedures or other quantitative methods (measurements). A quantitative approach focuses on phenomena with specific characteristics in human life, referred to as variables. The essence of relationships between these variables is analyzed using objective theory. To assist in data analysis, tools like the SPSS software version 21.0 were used.

The Paired Sample t-Test is a test for the difference between two paired samples. Paired samples are the same subjects experiencing different treatments. This test is used to analyze research models before and after treatment. According to Widiyanto (2013:35), the paired sample t-test is a method used to examine the effectiveness of treatments, marked by differences between the average values before and after the treatment. The paired t-test is applied as a comparative or difference test when the data scale of both variables is quantitative (interval or ratio). It is also referred to as a paired t-test, designed to

compare the means of two paired groups, meaning that the data source comes from the same subjects.

The test was conducted at a 0.05 significance level ($\alpha=5\%$) between the independent and dependent variables. The decision to accept or reject H_0 (null hypothesis) is based on the following criteria:

- a. If the significance value > 0.05 , H_0 is accepted, and H_a is rejected (no significant difference).
- b. If the significance value < 0.05 , H_0 is rejected, and H_a is accepted (significant difference).

For hypothesis testing, the Independent Sample T-Test was used. This method compares the mean values of two different samples (independent). The Independent Sample T-Test aims to determine whether there is a mean difference between two populations by comparing their sample means. Before performing the Independent Sample T-Test, the data must meet the following initial requirements:

- a. Data must be in interval or ratio form.
- b. Sample data must originate from a normally distributed population.
- c. The variances between the two compared samples must not differ significantly (homogeneous).
- d. Data must originate from two different samples.

3. Result and Discussion

This section discusses the research results and analysis of the thesis titled "The Application of Discovery Learning and Inquiry Learning on the Learning Outcomes of Fourth-Grade Students at UPTD SD Negeri 6 Peusangan Selatan on the Human Skeleton and Its Functions".

In this research variable X represents the teaching methods: Discovery Learning, Inquiry Learning, and conventional teaching, variable Y represents the students' learning outcomes. The data collected in this study comprise the science

(IPA) learning outcomes of Class IV.A students at UPTD SD Negeri 6 Peusangan Selatan after the learning process using the Discovery Learning method on the topic of the human skeleton and its functions.

During the research, both classes involved in the study (experimental and control) followed the learning process to completion and completed the post-test provided. The pre-test and post-test scores are summarized in Figure 1, which illustrates the recap of results for the experimental class.

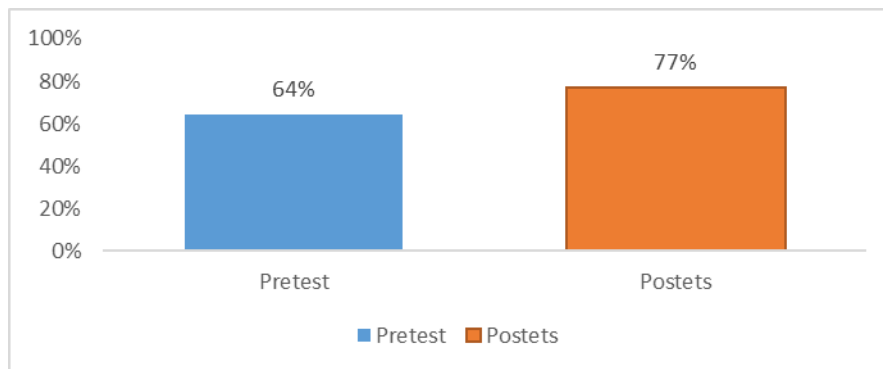


Figure 1. Summary of Experimental Class Results

Based on the diagram above, it is shown that the average score for Class IVA is 64 for the pre-test and 77 for the post-test. These results indicate an improvement in student learning outcomes for the experimental class. In this study, the data collected for Class IV.B students at UPTD SD Negeri 6 Peusangan Selatan pertain to their science (IPA) learning outcomes after the learning process using Discovery Learning and Inquiry Learning methods on the topic of the human skeleton and its functions. The summary of results for the control class can be observed in Figure 2 below:

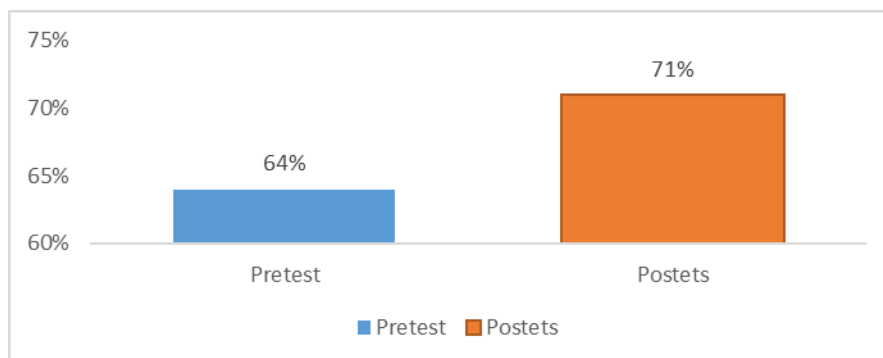


Figure 2. Summary of Control Class Results

Based on the diagram above, it is shown that the average score for Class IVA is 64 for the pre-test and 71 for the post-test. These results indicate an improvement in student learning outcomes for the control class. The data processing was conducted using SPSS 21.0 for Windows, which provided the maximum score, minimum score, mean, and standard deviation for each class. These details are presented in Table 1 below.

Table 1. Maximum Score, Minimum Score, Mean, and Standard Deviation of Pre-Test for Experimental and Control Classes

	N	Min	Max	Mean	Std. Deviation
Pretest control	15	40	80	64	12,37
Pretest exsperiment	15	40	80	64	12,37

Based on the table above, the minimum score is 40, the maximum score is 80, the mean is 64.33, and the standard deviation is 12.37. Meanwhile, the post-test scores for the experimental and control classes are presented as follows:

Table 2. Maximum Score, Minimum Score, Mean, and Standard Deviation of Post-Test for Experimental and Control Classes

	N	Min	Max	Mean	Std. Deviation
Postest control	15	50	100	71	11,22
postest exsperimet	15	50	100	77	12,87

Based on the table above, the minimum score for the control class is 50, the maximum score is 100, the mean is 71, and the standard deviation is 11.22. For the experimental class, the mean is 77, and the standard deviation is 12.87.

The normality test for the control and experimental classes aims to determine whether the obtained data follows a normal distribution with a significance level of 0.05. The normality test for both classes was conducted using the Shapiro-Wilk test, and the output results are presented in Table 3 below.

Table 3. Normality Distribution of Experimental and Control Classes

		Tests of Normality		
		Shapiro-Wilk		
	Group	Statistic	df	Sig.
Pretest	Exeperiment	,883	15	,052
	control	,898	15	,090
Posttest	Exeperiment	,951	15	,535
	control	,935	15	,321

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

Based on the output of the normality variance test using the Shapiro-Wilk test, the probability value in the significance column for the post-test scores is 0.535 for the experimental class and 0.321 for the control class. Since the probability values for both groups are greater than 0.05, it can be concluded that the control and experimental classes are normally distributed.

The homogeneity test for the two variances between the control and experimental classes was conducted using the Levene's Test with a significance level of 0.05. After processing the data, the output results are presented in Table 4 below:

Table 4. Homogeneity Test of Pre-Test Scores for Experimental and Control Classes

<i>Test of Homogeneity of Variances</i>				
	<i>Levene Statistic</i>	df1	df2	Sig.
Pretest	,038	1	28	,847
Posttest	,196	1	28	,661

Based on the output of the homogeneity variance test using Levene's Test, the probability values in the significance column for the pre-test are 0.847 and for the post-test are 0.661. Since the significance probability values are greater than 0.05, it can be concluded that the students in the control and experimental classes come from populations with equal variances, indicating that both classes are homogeneous.

After confirming that both classes are normally distributed and have homogeneous variances, the next step is to perform a two-sample mean comparison test using the Independent Sample T-Test with the assumption of equal variances (equal variances assumed) at a significance level of 0.05. After processing the data, the output results are presented in Table 5 below:

Table 5. T-Test of Pre-Test Scores for Experimental and Control Classes

		Independent Samples Test								
		Levene's Test for Equality of Variances		t-test for Equality of Means					95% Confidence Interval of the Difference	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
Pretest	Equal variances assumed	,038	,847	,000	28	1,000	,000	4,596	-9,415	9,415
	Equal variances not assumed			,000	27,996	1,000	,000	4,596	-9,415	9,415

In the table above, it can be seen that the probability value (sig. 2-tailed) from the t-test is 1.000. Since the probability value is greater than 0.05, H0 is accepted, indicating that the learning outcomes of students in both classes do not differ significantly. Meanwhile, the post-test results can be seen in Table 4.8 below:

Table 6. T-Test of Post-Test Scores for Experimental and Control Classes

		Independent Samples Test								
		Levene's Test for Equality of Variances		t-test for Equality of Means					95% Confidence Interval of the Difference	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
Posttest	Equal variances assumed	,196	,661	2,407	28	,017	6,000	4,263	-2,733	14,733
	Equal variances not assumed			2,407	28	,017	6,000	4,263	-2,733	14,733

In Table 6, it shows that the probability value (sig. 2-tailed) from the t-test is 0.017. Since the probability value is less than 0.05, H_a is accepted, indicating that the implementation of Discovery Learning and inquiry-based learning affects the learning outcomes of students in class IV at UPTD SD Negeri 6 Peusangan Selatan, specifically on the topic of the human skeleton and its functions. Based on the hypothesis testing results, it can be concluded that $t_{\text{count}} > t_{\text{table}}$ at a significance level of 0.05, which is 1.701. Mathematically, it is written as $2.407 > 1.701$, which concludes that the implementation of Discovery Learning and inquiry-based learning has an effect on the learning outcomes of students in class IV at UPTD SD Negeri 6 Peusangan Selatan on the topic of the human skeleton and its functions.

4. Conclusion

Based on the results of the study conducted in class IV at UPTD SD Negeri 6 Peusangan Selatan, which examined the use of problem-based instruction models and student learning outcomes, it can be concluded that the implementation of Discovery Learning and inquiry-based learning affects the learning outcomes of students in class IV at UPTD SD Negeri 6 Peusangan Selatan, specifically on the topic of the human skeleton and its functions.

Reference

- Ahmadi, Lif Khairu, Amir, Sofan, Ari, Hendro S., dan Elisah, Tatik. 2011. *Strategi Pembelajaran Berorientasi KTSP*. Jakarta: Protasi Pustaka.
- Arikunto, S. 2016. *Prosedur Penelitian Suatu Pendekatan Praktik*. Jakarta: Rineka Cipta.
- Dewi, Narni L., Dantes, Nyoman dan Sadia., I Wayan 2013. *Pengaruh Model Pembelajaran Inkuiri Terbimbing Terhadap Sikap Ilmiah dan Hasil Belajar IPA*. (Online). Jurnal Program Pascasarjana Universitas Pendidikan Ganesha. 3. (http://119.252.161.254/e-journal/index.php/jurnal_pendas/article/view/512, diakses pada 9 Oktober 2015).
- Fatra, M., Darmayanti, R., & Dhakal, A. (2023). A study that uses Card based learning media to help students' mathematical literacy. *Delta-Phi: Jurnal Pendidikan Matematika*, 1(2), 91-98.

- Gnidovec, T., Žemlja, M., Dolenc, A., & Torkar, G. (2020). Using augmented reality and the structure–behavior–function model to teach lower secondary school students about the human circulatory system. *Journal of Science Education and Technology, 29*, 774-784.
- Hutasuhut, S., Aditia, R., & Putri, F. R. (2022). The Effectiveness of the Hybrid Learning Materials with the Application of Problem Based Learning Model (Hybrid-PBL) to Improve Learning Outcomes during the COVID-19 Pandemic. *IJORER: International Journal of Recent Educational Research, 3*(1), 124-134.
- Illahi, M. Takdir. 2012. *Pembelajaran Discovery Strategy dan Mental Vocational Skill*. Yogyakarta: DIVA press.
- Ismail, I. A., Jhora, F. U., Qadriati, Q., & Insani, M. (2024). Enhancing science learning activities through the implementation of discovery learning and teaching at the right level method. *Jurnal Penelitian Pendidikan IPA, 10*(4), 1886-1895.
- Jihad, Asep dan Haris, Abdul. 2012. *Evaluasi Pembelajaran*. Yogyakarta: Multi Pressindo.
- Komalasari, Kokom. 2015. *Pembelajaran Kontekstual (Konsep dan Aplikasi)*. Bandung: Refika ADITAMA.
- Lestari, Shanti I., Budiyono dan Isnandar. 2015. *Eksperimentasi Model Pembelajaran Problem Based Learning (PBL), Discovery Learning (DL), dan Problem Possing (PP) Ditinjau Dari Kecerdasan Majemuk Siswa Pada Materi Kubus Dan Balok SMP Negeri Kabupaten Demaktahun Ajaran 2014/2015*. (Online). *Jurnal Elektronik Pembelajaran IPA. 3* (8): 811-823. (<http://www.jurnal.fkip.uns.ac.id/index.php/s2math/article/view/6650>, diakses pada 13 Desember 2015).
- Nurjali, N., Munip, A., Maimunah, M., & Aprianto, I. (2024). The Discovery Learning Method: An Islamic Religious Education Instructor's Strategy for Character Development. *Zabags International Journal of Islamic Studies, 1*(1), 7-14.
- Ristanto, R., Sabrina, A., & Komala, R. (2022). Critical thinking skills of environmental changes: A biological instruction using guided discovery learning-argument mapping (gdl-am). *Participatory Educational Research, 9*(1), 173-191.
- Safitri, R., Wahyuri, A. S., & Ockta, Y. (2024). The Impacts of the Project-Based Learning and Problem-Based Learning Models with Self-Confidence on Students' Learning Outcomes. *Indonesian Research Journal in Education | IRJE |*, 8(1), 269-283.
- Senisum, M., Susilo, H., Suwono, H., & Ibrohim. (2022). GIRESiMCo: A learning model to scaffold students' science process skills and biology cognitive learning outcomes. *Education Sciences, 12*(4), 228.
- Subagja, S., & Rubini, B. (2023). Analysis of Student Learning Styles Using Fleming's VARK Model in Science Subject. *JURNAL PEMBELAJARAN DAN BIOLOGI NUKLEUS (JPBN), 9*(1), 31-39.

-
- Sugiyono. 2014. *Metode Penelitian Pendidikan Pendekatan Kuantitatif, Kualitatif, dan R&D*. Bandung: Alfabeta.
- Sulisworo, D., Erviana, V. Y., Robiin, B., Sepriansyah, Y., & Soleh, A. (2022). The feasibility of enhancing environmental awareness using virtual reality 3D in the primary education. *Education Research International*, 2022(1), 4811544.
- Sutiani, A., Situmorang, M., & Silalahi, A. (2021). Implementation of an inquiry learning model with science literacy to improve student critical thinking skills. *International Journal of Instruction*, 14(2), 117-138.
- Trianto. 2009. *Mendesain Model Pembelajaran Inovatif Progresif*. Surabaya: Kencana.
- Widiadnyana, I.W., Sadia I W dan Suastra I W. 2014. *Pengaruh Model Discovery Learning Terhadap Pemahaman Konsep IPA dan Sikap Ilmiah Siswa SMP*. (Online). Jurnal Pascasarjana Universitas Pendidikan Ganesha. 4. (http://119.252.161.254/e-journal/index.php/jurnal_ipa/article/view/1344, diakses pada 9 Oktober 2015).
- Widiyanto. 2013. *Statistika Terapan. Konsep dan Aplikasi dalam Penelitian Bidang Pendidikan, Psikologi dan Ilmu Sosial Lainnya*. Jakarta: PT Elex Media Komputindo.