



The Effect of the Discovery Learning Model on the Learning Outcomes of Fourth-Grade Students in Natural and Social Sciences

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ABSTRACT

This study examined the effect of the Discovery Learning model on the learning outcomes of fourth-grade students in Natural and Social Sciences at SD Negeri 060938 Medan Johor. A quantitative pre-experimental approach using a One-Group Pretest-Posttest Design was employed. The participants were 21 fourth-grade students selected through total sampling. Data were collected through achievement tests, a questionnaire, and documentation, and analyzed using descriptive statistics, the Shapiro-Wilk normality test, Pearson Product-Moment correlation, the coefficient of determination, and the t-test with IBM SPSS Statistics Version 25. The findings showed that the mean score increased from 52.76 on the pretest to 83.80 on the posttest. The data were normally distributed (Sig. = 0.413). Pearson correlation analysis revealed a very strong positive relationship between the Discovery Learning questionnaire score and learning outcomes ($r = 0.969$, $p < 0.001$). The coefficient of determination indicated that 93.9% of the variance in learning outcomes was explained by the implementation of Discovery Learning, while the t-test confirmed a significant positive effect ($t = 17.047$, $p < 0.001$). These findings indicate that Discovery Learning effectively improves students' learning outcomes in Natural and Social Sciences. This study contributes contextual evidence supporting the implementation of the Merdeka Curriculum by demonstrating the effectiveness of Discovery Learning in promoting student-centered learning at SD Negeri 060938 Medan Johor.

Introduction

Education plays a fundamental role in developing human potential by fostering knowledge, skills, attitudes, and values that enable individuals to participate effectively in society. High-quality education contributes significantly to the development of competent human resources capable of adapting to rapid technological and social changes. Consequently, improving students' learning outcomes has become one of the primary indicators of educational quality because it reflects the extent to which learning objectives have been achieved. In the context of twenty-first-century education, schools are expected not only to improve students' academic achievement but also to cultivate critical thinking, creativity, collaboration, and problem-solving skills through meaningful learning experiences (Rahmawati et al., 2024; Sari & Nugroho, 2025).

Teachers play a pivotal role in determining the success of the teaching and learning process. Beyond delivering instructional content, teachers are expected to facilitate active learning by designing learning environments that encourage students to construct knowledge independently. The implementation of the Merdeka Curriculum in Indonesia emphasizes student-centered learning, allowing students to develop their competencies according to their interests, abilities, and developmental characteristics. This educational philosophy is consistent with Ki Hadjar Dewantara's concept of educational freedom, which advocates providing learners with opportunities to develop their full potential through meaningful and autonomous learning experiences. Therefore, teachers are encouraged to employ innovative instructional models that actively engage students in learning rather than relying solely on conventional lecture-based approaches (Pratiwi, 2024).

Despite these curriculum reforms, learning practices in many elementary schools continue to be dominated by teacher-centered instruction. In such classrooms, students often become passive recipients of information with limited opportunities to participate in discussions, collaborative activities, or inquiry-based learning. This condition reduces students' motivation, curiosity, and conceptual understanding, ultimately leading to unsatisfactory learning outcomes. Recent educational studies have reported that conventional instructional practices remain one of the major factors contributing to low academic achievement, particularly in Natural and Social Sciences, where active exploration and problem-solving are essential (Yuliana, 2024; Kurniawan & Setiawan, 2025). This discrepancy between the expectations of the Merdeka Curriculum and actual classroom practices represents a significant research gap that deserves further investigation.

Learning outcomes represent the competencies acquired by students after participating in instructional activities and are commonly measured through various forms of assessment. These outcomes encompass cognitive, affective, and psychomotor domains, reflecting students' overall mastery of the learning objectives. Improving learning outcomes requires teachers to continuously evaluate instructional practices and implement learning models that accommodate students' developmental characteristics. According to Havighurst (as cited in Hayati et al., 2021), upper elementary school students are increasingly capable of independent learning, time management, teamwork, and social interaction. These developmental characteristics indicate that instructional approaches emphasizing exploration, collaboration, and active participation are particularly appropriate for students at this educational level.

Natural and Social Sciences is one of the core subjects implemented under the Merdeka Curriculum in Indonesian elementary schools. This subject integrates concepts from natural sciences and social sciences to enable students to understand the relationships among humans, society, and the natural environment. Natural and Social Sciences learning aims to develop students' scientific literacy, curiosity, critical thinking, and problem-solving abilities through contextual learning experiences. Consequently, instruction in Natural and Social Sciences should encourage students to observe, question, investigate, discuss, and discover scientific concepts independently rather than merely memorizing information. Such learning characteristics require instructional models that promote active student participation and meaningful knowledge construction (Cahayani et al., 2025).

Preliminary classroom observations conducted in Grade IV at SD Negeri 060938 Medan Johor revealed that Natural and Social Sciences instruction was still predominantly teacher-centered. Most students participated as passive listeners, while opportunities for collaboration, discussion, and inquiry activities were limited. As a result, many students experienced difficulties in understanding scientific and social concepts, which was reflected in their academic performance. Daily assessment data showed that out of 21 students, only four students (19.05%) achieved the "Highly Developed" category (scores 86–100), four students (19.05%) were categorized as "Developing" (scores 76–85), one student (4.76%) achieved the "Sufficiently Developed" category (scores 66–75), whereas twelve students (57.14%) remained in the "Needs Improvement" category (scores 0–65). These findings indicate that the majority of students have not yet achieved the expected learning outcomes, highlighting the need for more effective instructional strategies.

One instructional approach that has gained considerable attention is the Discovery Learning model. Discovery Learning encourages students to construct knowledge through investigation, observation, experimentation, and problem-solving while teachers function as facilitators rather than primary sources of information. According to Syamsidah et al. (2022), Discovery Learning creates an effective and enjoyable learning environment by actively involving students in planning, implementing, and evaluating learning activities. This instructional model enhances students' independence, curiosity, conceptual understanding, and higher-order thinking skills while making learning experiences more meaningful. These characteristics closely align with the principles of the Merdeka Curriculum, which emphasizes student autonomy and active participation in learning.

Previous empirical studies have consistently demonstrated the effectiveness of Discovery Learning in improving students' academic achievement. Maharani et al. (2025) reported that the implementation of Discovery Learning significantly improved elementary students' learning outcomes in Natural and Social Sciences, as evidenced by statistically significant differences between pretest and posttest scores. Similarly, Erita et al. (2022) found that Discovery Learning had a significant positive effect on students' achievement in Natural and Social Sciences, with hypothesis testing yielding a significance value below 0.05. Although these studies confirm the effectiveness of Discovery Learning, most were conducted in different educational settings with varying student characteristics. Limited empirical evidence is available regarding the implementation of Discovery Learning among fourth-grade students at SD Negeri 060938 Medan Johor under the Merdeka Curriculum. This contextual gap constitutes the novelty of the present study, which seeks to provide empirical evidence concerning the effectiveness of Discovery Learning in improving learning outcomes in Natural and Social Sciences in this particular educational setting.

Based on the foregoing discussion, the research problem addressed in this study is whether the Discovery Learning model significantly influences the learning outcomes of fourth-grade students in Natural and Social Sciences at SD Negeri 060938 Medan Johor. Accordingly, the objective of this research is to examine the effect of the Discovery Learning model on students' learning outcomes in Natural and Social Sciences during the 2025/2026 academic year. The research hypothesis proposes that the implementation of the Discovery Learning model has a significant positive effect on students' learning outcomes in Natural

and Social Sciences. The findings of this study are expected to contribute theoretically by enriching the body of knowledge regarding student-centered learning models in elementary education and practically by providing teachers with empirical evidence supporting the implementation of Discovery Learning as an effective instructional strategy for improving students' achievement in Natural and Social Sciences. Therefore, this research is expected to strengthen the implementation of the Merdeka Curriculum through evidence-based instructional practices that promote meaningful and active learning in elementary schools.

Research Methods

Research Design

This study employed a quantitative research approach using a pre-experimental method with a One-Group Pretest–Posttest Design. A quantitative approach was selected because the primary objective of this research was to measure the effect of the Discovery Learning model on students' learning outcomes in Natural and Social Sciences through numerical data and statistical analysis. The pre-experimental design was considered appropriate because the study involved only one experimental group without a comparison group. Students' learning outcomes were measured before and after the implementation of the Discovery Learning model, allowing the researcher to determine whether a significant improvement occurred following the instructional intervention.

The research design can be illustrated as follows:

$O_1 - X - O_2$

Where:

O_1 = Pretest administered before the implementation of the Discovery Learning model.

X = Learning activities conducted using the Discovery Learning model.

O_2 = Posttest administered after the implementation of the Discovery Learning model.

The difference between the pretest and posttest scores was used to evaluate the effectiveness of the Discovery Learning model in improving students' learning outcomes.

Research Setting

The study was conducted at SD Negeri 060938 Medan Johor, located on Jalan Luku I, Kwala Bekala, Medan Johor District, Medan City, North Sumatra, Indonesia. This school was selected because it has implemented the Merdeka Curriculum, which encourages student-centered learning and supports the application of innovative instructional models such as Discovery Learning. Furthermore, the school administration granted permission for the researcher to conduct the study, and the fourth-grade class met the characteristics required for the research.

The research was carried out during the second semester of the 2025/2026 academic year. The research activities included obtaining research permission, developing and validating research instruments, administering the pretest, implementing the Discovery Learning model, conducting the posttest, analyzing the data, and preparing the research report.

Research Participants

Population

The population of this study consisted of all fourth-grade students enrolled at SD Negeri 060938 Medan Johor during the 2025/2026 academic year. The population represented the target group for investigating the effectiveness of the Discovery Learning model in improving learning outcomes in Natural and Social Sciences.

Sample and Sampling Technique

Because the research population was relatively small, the study employed total sampling (saturated sampling), in which every member of the population was included as the research sample. According to Sugiyono (2016), saturated sampling is appropriate when the population size is limited, allowing all individuals to participate in the study.

Consequently, the research sample consisted of 21 fourth-grade students. Using the entire population minimized sampling bias and ensured that the findings accurately reflected the characteristics of the participants involved in the study.

Research Instruments

Three research instruments were employed to collect the data: an achievement test, a questionnaire, and documentation.

Achievement Test

Students' learning outcomes were measured using a multiple-choice achievement test administered before and after the instructional treatment. The test initially consisted of 40 multiple-choice questions with four response options (A, B, C, and D). The items were developed based on the learning objectives of the topic "Roles and Responsibilities at School and in the Community" in the Natural and Social Sciences subject.

The test measured students' higher-order thinking skills across three cognitive levels based on Bloom's revised taxonomy: Application (C3), Analysis (C4), Evaluation (C5)

Following the validity testing process, 25 valid items were retained and used for both the pretest and posttest.

Questionnaire

A questionnaire was used to evaluate students' responses toward the implementation of the Discovery Learning model. Initially, the questionnaire consisted of 40 Likert-scale statements, representing the six stages of Discovery Learning: Stimulation, Problem Statement, Data Collection, Data Processing, Verification, Generalization. Each statement was rated using a five-point Likert scale ranging from Strongly Disagree (1) to Strongly Agree (5). After validity testing, 20 valid statements were retained for the final data collection.

Documentation

Documentation served as supporting evidence throughout the research process. The collected documents included students' assessment records, attendance lists, lesson plans, and photographs taken during the implementation of the Discovery Learning activities. These documents were used to strengthen the credibility of the research findings and provide additional information regarding the research context.

Instrument Validity and Reliability

Before the main data collection, all research instruments underwent validity and reliability testing to ensure that they accurately measured the intended variables.

Validity

Instrument validity was examined using the Pearson Product–Moment correlation coefficient. The validity test was conducted with 28 students outside the research sample. Test items with correlation coefficients greater than the critical value ($r\text{-calculated} \geq r\text{-table}$, $\alpha = 0.05$) were considered valid.

The results indicated that: 25 of the 40 achievement test items were valid and suitable for measuring students' learning outcomes. 20 of the 40 questionnaire statements met the validity criteria and were retained for the study.

Reliability

Instrument reliability was assessed using Cronbach's Alpha to determine the internal consistency of the instruments. The achievement test obtained a Cronbach's Alpha coefficient of 0.869, indicating excellent reliability. Similarly, the questionnaire achieved a Cronbach's Alpha coefficient of 0.920, demonstrating very high internal consistency. These findings indicate that both instruments were reliable and appropriate for use in the research.

Data Collection Procedures

Data collection was conducted in three sequential stages. During the preliminary stage, the researcher obtained permission from the school, prepared the instructional materials, and validated the research instruments.

During the implementation stage, students completed the pretest before participating in classroom learning using the Discovery Learning model. The instructional activities followed the six stages of Discovery Learning: stimulation, problem identification, data collection, data processing, verification, and generalization. After the instructional intervention was completed, students took the posttest and completed the questionnaire. Finally, during the final stage, all collected data were organized, coded, and entered into IBM SPSS Statistics Version 25 for statistical analysis.

Data Analysis Techniques

Data analysis was performed using IBM SPSS Statistics Version 25.

Descriptive Statistics

Descriptive statistical analysis was used to summarize students' learning outcomes by calculating the mean, standard deviation, minimum score, and maximum score for both the pretest and posttest.

Normality Test

Before hypothesis testing, the Shapiro–Wilk normality test was conducted because the sample size consisted of fewer than 50 participants. A significance value greater than 0.05 indicated that the data were normally distributed.

Pearson Correlation Analysis

The Pearson Product–Moment correlation coefficient was calculated to determine the strength of the relationship between the implementation of the Discovery Learning model and students' learning outcomes in Natural and Social Sciences.

Coefficient of Determination

The coefficient of determination (R^2) was calculated to determine the proportion of variance in students' learning outcomes explained by the implementation of the Discovery Learning model.

Hypothesis Testing

The research hypothesis was tested using the Paired-Samples t-test, which compares students' pretest and posttest scores obtained from the same participants. Statistical significance was determined at the 0.05 significance level. The research hypotheses were formulated as follows:

H_0 : The Discovery Learning model has no significant effect on students' learning outcomes in Natural and Social Sciences.

H_1 : The Discovery Learning model has a significant positive effect on students' learning outcomes in Natural and Social Sciences.

The null hypothesis was rejected when the probability value ($p < 0.05$), indicating that the Discovery Learning model significantly improved students' learning outcomes.

Findings

Pretest Results of Fourth-Grade Students

Prior to the implementation of the Discovery Learning model, a pretest was administered to all 21 fourth-grade students at SD Negeri 060938 Medan Johor. The purpose of the pretest was to determine the students' initial knowledge and understanding of the Natural and Social Sciences material before they received the instructional treatment. The pretest results served as baseline data to evaluate the effectiveness of the Discovery Learning model by comparing students' learning achievement before and after the intervention.

The distribution of students' pretest scores is presented in Table 1.

Table 1. Frequency Distribution of Fourth-Grade Students' Pretest Scores

Score (X)	Frequency (F)	FX	$X - \bar{X}$	$(X - \bar{X})^2$	$F(X - \bar{X})^2$
24	1	24	-28.76	827.14	827.14
28	3	84	-24.76	613.06	1,839.18
36	2	72	-16.76	280.90	561.80
40	2	80	-12.76	162.82	325.64
44	1	44	-8.76	76.74	76.74
52	1	52	-0.76	0.58	0.58
60	3	180	7.24	52.42	157.26
64	1	64	11.24	126.34	126.34
68	2	136	15.24	232.26	464.52
72	2	144	19.24	370.18	740.36
76	3	228	23.24	540.10	1,620.30
Total	21	1,108		3,282.54	6,739.86

Table 1 shows that the pretest scores of the 21 students varied considerably, ranging from 24 to 76. The score of 28 was obtained by three students (14.29%), while the score of 60 was also obtained by three students (14.29%). Similarly, three students achieved a score of 76, indicating that only a small proportion of the class demonstrated relatively good prior knowledge before the implementation of the Discovery Learning model. Most students obtained scores in the lower and middle score ranges, suggesting that their initial understanding of the Natural and Social Sciences concepts was still limited.

To provide a clearer description of students' initial achievement, descriptive statistical measures including the mean, standard deviation, and standard error were calculated. Table 1 indicates that the average pretest score of the students was 52.76, which reflects a relatively low level of initial understanding of the Natural and Social Sciences material. Furthermore, the standard deviation of 18.35 demonstrates considerable variability among students' prior knowledge. The standard error of 4.00 suggests that the sample mean reliably represents the population mean. To further illustrate the distribution of students' pretest scores, the scores were grouped into score intervals, as presented in Table 2.

Table 2. Percentage Distribution of Fourth-Grade Students' Pretest Scores

Score Interval	Frequency	Percentage
20–29	4	19.05%
30–39	2	9.52%
40–49	3	14.29%
50–59	1	4.76%
60–69	6	28.57%
70–79	5	23.81%
Total	21	100%

Table 2 reveals that the largest proportion of students (28.57%) obtained scores within the 60–69 interval, followed by 23.81% of students who scored between 70 and 79. Meanwhile, four students (19.05%) achieved scores ranging from 20 to 29, indicating very limited mastery of the learning material. Only one student (4.76%) obtained a score within the 50–59 interval. Overall, the distribution demonstrates that students' initial achievement was concentrated in the middle score categories, although a substantial number of students still performed at a relatively low level.

The percentage distribution of the pretest scores is illustrated in Figure 1.

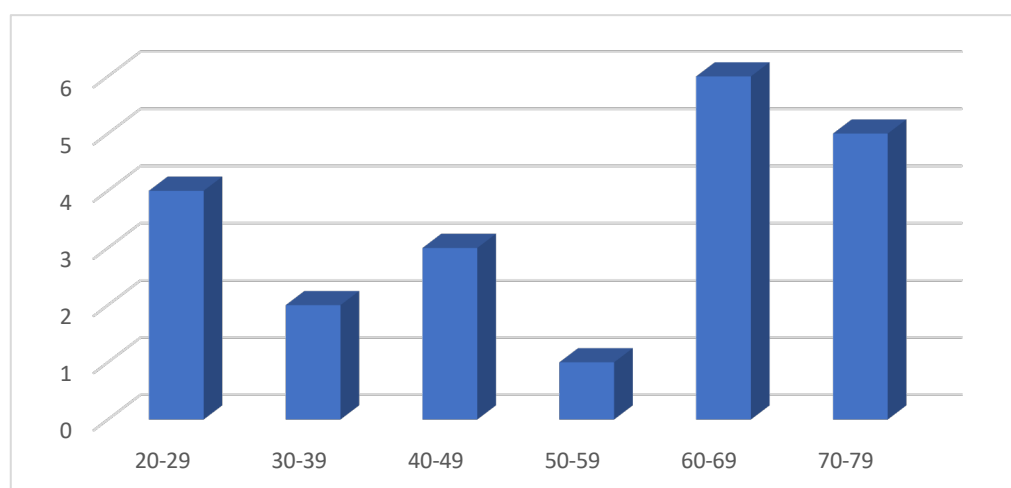


Figure 1. Distribution of Fourth-Grade Students' Pretest Scores

Figure 1 visually illustrates the distribution of students' pretest scores before the implementation of the Discovery Learning model. The figure shows that the 60–69 score interval contains the highest number of students (6 students; 28.57%), followed by the 70–79 interval with 5 students (23.81%). Conversely, the 50–59 interval includes only one student (4.76%), representing the smallest proportion of participants.

The figure also indicates that nine students (42.86%) scored below 50, suggesting that nearly half of the participants had insufficient prior knowledge of the Natural and Social Sciences concepts. Although five students achieved scores between 70 and 79, the overall class average remained 52.76, indicating that students' initial learning achievement was still below the expected level before the instructional intervention.

Posttest Results of Fourth-Grade Students

Following the completion of the instructional activities using the Discovery Learning model, a posttest was administered to all 21 fourth-grade students at SD Negeri 060938 Medan Johor. The posttest was designed to measure students' learning achievement after they had participated in the learning process using the Discovery Learning model. By comparing the posttest scores with the pretest scores, the researcher was able to determine the effectiveness of the Discovery Learning model in improving students' learning outcomes in Natural and Social Sciences. The distribution of students' posttest scores is presented in Table 3.

Table 3. Frequency Distribution of Fourth-Grade Students' Posttest Scores

Score (X)	Frequency (F)	FX	$X - \bar{X}$	$(X - \bar{X})^2$	$F(X - \bar{X})^2$
68	2	136	-15.43	238.08	476.16
72	2	144	-11.43	130.64	261.28
76	3	228	-7.43	55.20	165.60
80	2	160	-3.43	11.76	23.52
84	3	252	0.57	0.32	0.96
88	3	264	4.57	20.88	62.64
92	2	184	8.57	73.44	146.88

Score (X)	Frequency (F)	FX	$X - \bar{X}$	$(X - \bar{X})^2$	$F(X - \bar{X})^2$
96	2	192	12.57	158.00	316.00
100	2	200	16.57	274.56	549.12
Total	21	1,760		962.88	2,002.16

Table 3. demonstrates that students' posttest scores ranged from 68 to 100, indicating a substantial improvement compared with the pretest scores, which ranged from 24 to 76. The highest score (100) was achieved by two students, while three students each obtained scores of 76, 84, and 88, respectively. Overall, the score distribution shifted toward the higher score categories, suggesting that students developed a better understanding of the learning material after participating in Discovery Learning activities.

To provide a comprehensive description of students' learning achievement, descriptive statistical analyses were conducted by calculating the mean, standard deviation, and standard error. As presented in Table 3, the mean posttest score reached 83.80, indicating that students achieved a considerably higher level of understanding after the instructional treatment. Furthermore, the lower standard deviation (10.00) compared with the pretest (18.35) suggests that students' achievement became more consistent across the class. The reduced standard error (2.18) also indicates greater precision in estimating the population mean.

To further illustrate the distribution of students' posttest scores, the scores were grouped into score intervals as shown in Table 4.

Table 4. Percentage Distribution of Fourth-Grade Students' Posttest Scores

Score Interval	Frequency	Percentage
60–69	2	9.52%
70–79	5	23.81%
80–89	8	38.10%
90–100	6	28.57%
Total	21	100%

Table 4 shows that the largest proportion of students (38.10%) achieved scores between 80 and 89, followed by 28.57% of students who scored between 90 and 100. Only 9.52% of students remained within the 60–69 score interval. These findings indicate that the majority of students achieved high levels of academic performance after participating in Discovery Learning.

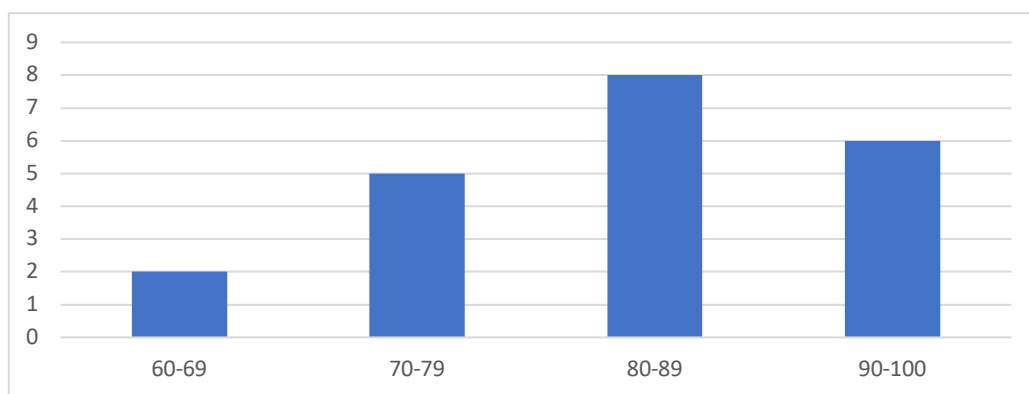


Figure 2. Distribution of Fourth-Grade Students' Posttest Scores

Figure 2 illustrates a clear shift in students' achievement toward the higher score categories after the implementation of the Discovery Learning model. The highest concentration of students is found in the 80–89 score interval, which includes eight students (38.10%), followed by the 90–100 interval with six students (28.57%). In contrast, only two students (9.52%) obtained scores between 60 and 69, and no students scored below 60.

Compared with the pretest distribution, the posttest results reveal a substantial improvement in students' learning achievement. During the pretest, many students were concentrated in the lower score intervals, whereas after the instructional intervention, most students moved into the higher achievement categories. This shift demonstrates that students developed a stronger conceptual understanding of the Natural and Social Sciences content after participating in Discovery Learning activities.

Comparison Between Pretest and Posttest Results

To provide a clearer overview of students' learning improvement, the descriptive statistics of the pretest and posttest are compared in Table 5.

Table 5. Comparison of Pretest and Posttest Descriptive Statistics

Statistic	Pretest	Posttest	Improvement
Number of Students	21	21	—
Mean	52.76	83.80	+31.04
Standard Deviation	18.35	10.00	–8.35
Standard Error	4.00	2.18	–1.82
Lowest Score	24	68	+44
Highest Score	76	100	+24

Table 5 indicates that the average score increased by 31.04 points, from 52.76 on the pretest to 83.80 on the posttest. Additionally, the decrease in the standard deviation from 18.35 to 10.00 suggests that students' achievement became more evenly distributed after the intervention. These findings indicate that Discovery Learning not only improved students' academic performance but also reduced disparities in learning achievement among students.

Interpretation Based on School Achievement Criteria. To facilitate the interpretation of students' learning achievement, the school assessment criteria are presented in Table 6.

Table 6. School Achievement Categories

Score Range	Achievement Category
86–100	Highly Developed
76–85	Developing
66–75	Sufficiently Developed
0–65	Needs Improvement

Based on the achievement criteria presented in Table 6, the average pretest score of 52.76 falls within the Needs Improvement category, indicating that students had not yet achieved the expected learning objectives before the instructional intervention. After implementing the Discovery Learning model, the average posttest score increased to 83.80, placing students in the Developing category. This improvement demonstrates that the majority of students successfully achieved the expected learning outcomes.

Students' Questionnaire Results on the Implementation of the Discovery Learning Model

Following the completion of the learning activities and the administration of the posttest, the researcher distributed a student questionnaire to evaluate the implementation of the Discovery Learning model during the teaching and learning process. Unlike the pretest and posttest, which measured students' cognitive achievement, the questionnaire was designed to measure students' perceptions of the implementation of the Discovery Learning model, including the teacher's instructional practices and students' learning experiences throughout the lesson.

The questionnaire consisted of 20 valid statements representing the six stages of the Discovery Learning model, namely stimulation, problem identification, data collection, data processing, verification, and generalization. Students responded to each statement using a five-point Likert scale. The results of the questionnaire are presented in Table 7.

Table 7. Frequency Distribution of Students' Questionnaire Scores on the Discovery Learning Model

Score (X)	Frequency (F)	FX	$X - \bar{X}$	$(X - \bar{X})^2$	$F(X - \bar{X})^2$
70	1	70	-14.52	210.83	210.83
73	1	73	-11.52	132.71	132.71
74	1	74	-10.52	110.67	110.67
75	1	75	-9.52	90.63	90.63
76	1	76	-8.52	72.59	72.59
78	1	78	-6.52	42.51	42.51
79	1	79	-5.52	30.47	30.47
81	1	81	-3.52	12.39	12.39
82	1	82	-2.52	6.35	6.35
84	1	84	-0.52	0.27	0.27
85	1	85	0.48	0.23	0.23
86	1	86	1.48	2.19	2.19

Score (X)	Frequency (F)	FX	$X - \bar{X}$	$(X - \bar{X})^2$	$F(X - \bar{X})^2$
87	1	87	2.48	6.15	6.15
88	1	88	3.48	12.11	12.11
90	1	90	5.48	30.03	30.03
91	1	91	6.48	41.99	41.99
92	1	92	7.48	55.95	55.95
94	1	94	9.48	89.87	89.87
95	1	95	10.48	109.83	109.83
97	1	97	12.48	155.75	155.75
98	1	98	13.48	181.71	181.71
Total	21	1,775			1,491.99

As presented in Table 7, the questionnaire scores ranged from 70 to 98, indicating that students generally expressed positive perceptions regarding the implementation of the Discovery Learning model. The relatively high distribution of scores suggests that students actively participated in classroom activities and perceived the learning process as engaging and meaningful.

To obtain a comprehensive description of students' responses, descriptive statistical analyses, including the mean, standard deviation, and standard error, were calculated. Table 7 shows that the average questionnaire score reached 84.52, indicating a high level of student agreement regarding the implementation of the Discovery Learning model. The relatively small standard deviation (8.63) suggests that students shared similar opinions about the learning process. Likewise, the low standard error (1.88) indicates that the sample mean provides a reliable estimate of the population mean.

To further describe the distribution of questionnaire scores, the results were grouped into score intervals as presented in Table 8.

Table 8. Percentage Distribution of Students' Questionnaire Scores

Score Interval	Frequency	Percentage
70–74	3	14.29%
75–79	4	19.05%
80–84	3	14.29%
85–89	4	19.05%
90–94	4	19.05%
95–99	3	14.29%
Total	21	100%

Table 8, demonstrates that the questionnaire scores were distributed relatively evenly across all score intervals. The largest percentages (19.05%) were observed in the 75–79, 85–89, and 90–94 intervals, each consisting of four students. Meanwhile, three students (14.29%) were found in each of the 70–74, 80–84, and 95–99 intervals. This balanced

distribution indicates that almost all students gave positive evaluations of the Discovery Learning implementation, with no concentration of responses in the lower score categories.

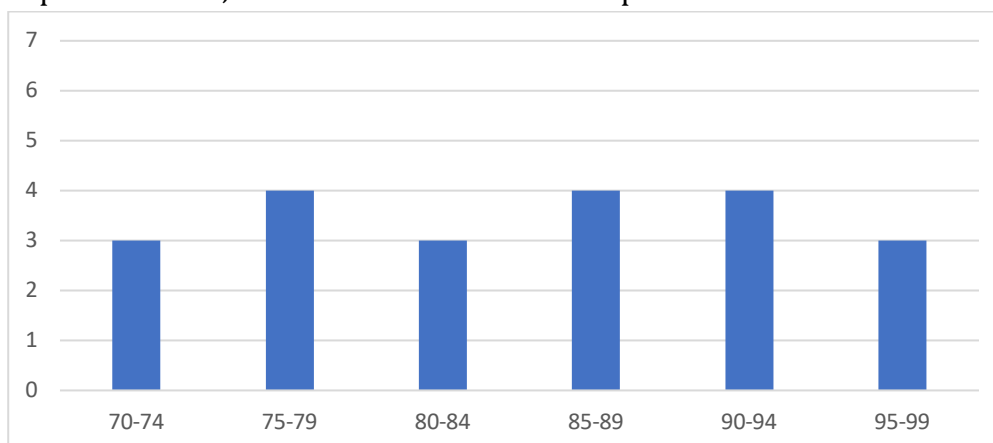


Figure 3. Distribution of Students' Questionnaire Scores on the Discovery Learning Model

Figure 3 provides a graphical representation of students' perceptions regarding the implementation of the Discovery Learning model. The figure shows that the questionnaire scores ranged from 70 to 98, with no students obtaining scores below 70. The highest concentration of responses appears in the 75–79, 85–89, and 90–94 score intervals, each representing 19.05% of the participants. This distribution indicates that the majority of students rated the implementation of the Discovery Learning model positively.

Furthermore, the relatively symmetrical distribution of scores suggests that students shared similar perceptions of the learning process. The absence of extremely low scores demonstrates that the instructional activities were consistently perceived as effective across the class. Students reported that the Discovery Learning model encouraged them to participate actively, discuss ideas with peers, investigate learning materials independently, and draw conclusions based on evidence obtained during classroom activities.

Data Assumption Testing

Before conducting hypothesis testing, it was necessary to verify whether the research data satisfied the assumptions required for parametric statistical analysis. One of the most important assumptions is that the data are normally distributed. Since this study employed the Pearson Product-Moment correlation test to examine the relationship between the implementation of the Discovery Learning model and students' learning outcomes, the normality of the data was first assessed. Ensuring that the data follow a normal distribution increases the validity and reliability of the statistical conclusions drawn from the analysis.

Normality Test

The normality test was conducted to determine whether the posttest scores of fourth-grade students at SD Negeri 060938 Medan Johor were normally distributed. In this study, the Shapiro–Wilk test was employed because it is considered one of the most appropriate methods for testing normality when the sample size is relatively small (less than 50 participants). According to Ghasemi and Zahediasl (2012), the Shapiro–Wilk test provides high statistical power in detecting deviations from normality for small samples.

The statistical analysis was performed using IBM SPSS Statistics Version 25, while Microsoft Excel was used to verify the descriptive calculations. The level of significance (α)

was set at 0.05. The decision criteria were established as follows: If the significance value (Sig.) is greater than 0.05, the data are considered normally distributed. If the significance value (Sig.) is less than 0.05, the data are considered not normally distributed. The results of the Shapiro–Wilk normality test are presented in Table 9.

Table 9. Normality Test of Students' Learning Outcomes

Variable	Test	Statistic	df	Sig.	Interpretation
Learning Outcomes	Shapiro–Wilk	0.955	21	0.413	Normally Distributed

Table 9. indicates that the Shapiro–Wilk statistic for students' learning outcomes is 0.955, with a significance value (Sig.) of 0.413. Since the obtained significance value (0.413) is greater than the significance level of 0.05, the null hypothesis stating that the data are normally distributed cannot be rejected.

These findings indicate that the posttest scores follow a normal distribution and therefore satisfy one of the primary assumptions required for parametric statistical analysis. The normality of the data suggests that the distribution of students' learning outcomes adequately represents the characteristics of the study population and does not exhibit significant deviations from normality.

Furthermore, the relatively high significance value indicates that the observed distribution closely approximates a normal curve. Consequently, the data are considered appropriate for further inferential statistical analyses, particularly the Pearson Product-Moment correlation test, which requires normally distributed variables.

Based on the results of the normality test, it can be concluded that the learning outcome data of fourth-grade students at SD Negeri 060938 Medan Johor satisfy the assumption of normality. Therefore, the researcher proceeded with the hypothesis testing using parametric statistical techniques.

Data Analysis Technique

After confirming that the data met the assumption of normality, the next stage involved testing the research hypothesis. The purpose of this analysis was to determine whether there was a statistically significant relationship between the Discovery Learning model (independent variable) and students' learning outcomes in Natural and Social Sciences (dependent variable).

The relationship between the two variables was analyzed using the Pearson Product-Moment correlation coefficient, which measures both the strength and direction of the linear relationship between variables. The correlation coefficient (r) ranges from -1 to $+1$, where values approaching $+1$ indicate a very strong positive relationship, values approaching -1 indicate a very strong negative relationship, and values close to 0 indicate little or no relationship. The correlation analysis was performed using IBM SPSS Statistics Version 25, while Microsoft Excel was utilized to verify the calculations.

Pearson Product-Moment Correlation Test

The Pearson Product-Moment correlation analysis was conducted to determine whether the implementation of the Discovery Learning model significantly influenced students' learning outcomes in Natural and Social Sciences.

The hypotheses of the study were formulated as follows:

Null Hypothesis (H_0): There is no significant relationship between the implementation of the Discovery Learning model and students' learning outcomes in Natural and Social Sciences.

Alternative Hypothesis (H_1): There is a significant relationship between the implementation of the Discovery Learning model and students' learning outcomes in Natural and Social Sciences. The correlation analysis produced the results presented in Table 10.

Table 10. Pearson Product-Moment Correlation Analysis Discovery Learning Model and Learning Outcomes

Variable	Discovery Learning Model	Learning Outcomes
Discovery Learning Model	1.000	0.969 **
Sig. (2-tailed)	—	0.000
N	21	21
Learning Outcomes	0.969 **	1.000
Sig. (2-tailed)	0.000	—
N	21	21

As shown in Table 10, the Pearson correlation coefficient between the Discovery Learning model and students' learning outcomes is 0.969. This coefficient indicates a very strong positive relationship between the two variables.

The significance value obtained from the analysis is 0.000, which is substantially lower than the significance level of 0.05. Therefore, the correlation between the Discovery Learning model and students' learning outcomes is statistically significant.

To further verify the statistical findings, the obtained correlation coefficient ($r_{\text{calculated}}$) was compared with the critical value from the Pearson correlation table 10 (r_{table}). With a sample size of 21 students ($N = 21$) and a significance level of 5%, the critical value is 0.433. Since [$r_{\text{calculated}} = 0.969 > r_{\text{table}} = 0.433$], the alternative hypothesis (H_1) is accepted, while the null hypothesis (H_0) is rejected.

These findings demonstrate that there is a statistically significant relationship between the implementation of the Discovery Learning model and students' learning outcomes in Natural and Social Sciences. Moreover, the coefficient value of 0.969 indicates that the relationship is not only statistically significant but also exceptionally strong. This finding suggests that effective implementation of the Discovery Learning model is closely associated with higher student achievement. To facilitate interpretation of the correlation coefficient, the relationship strength was classified according to Sugiyono (2016), as presented in Table 11.

Table 11. Interpretation of Pearson Correlation Coefficients

Correlation Coefficient	Relationship Strength
0.00–0.199	Very Low
0.20–0.399	Low
0.40–0.599	Moderate

Correlation Coefficient	Relationship Strength
0.60–0.799	Strong
0.80–1.00	Very Strong

Based on the classification shown in Table 11, the obtained correlation coefficient of 0.969 falls within the 0.80–1.00 interval, indicating a very strong positive relationship between the Discovery Learning model and students' learning outcomes.

Coefficient of Determination (R^2)

The coefficient of determination (R^2) was calculated to determine the proportion of variance in students' learning outcomes that could be explained by the implementation of the Discovery Learning model. In other words, this analysis measures the contribution of the independent variable (Discovery Learning model) to the dependent variable (students' learning outcomes).

The manual calculation indicates that the coefficient of determination is 93.9%. This result means that 93.9% of the variation in students' learning outcomes can be explained by the implementation of the Discovery Learning model, whereas the remaining 6.1% is attributable to other variables that were not included in this study.

These external variables may include differences in students' learning motivation, prior knowledge, learning styles, family support, classroom environment, teacher characteristics, and other psychological or environmental factors that were beyond the scope of this research. To verify the manual calculation, the coefficient of determination was also analyzed using IBM SPSS Statistics Version 25. The results are presented in Table 12.

Table 12. Model Summary (Coefficient of Determination Analysis)

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	0.969	0.939	0.935	2.541

Table 12 shows that the correlation coefficient (R) is 0.969, indicating a very strong positive relationship between the Discovery Learning model and students' learning outcomes. Furthermore, the R Square (R^2) value is 0.939, indicating that 93.9% of the variance in students' learning outcomes is explained by the implementation of the Discovery Learning model.

The Adjusted R Square value of 0.935 suggests that after adjusting for sample size, the explanatory power of the model remains very high (93.5%). This finding indicates that the regression model is stable and provides a reliable explanation of students' learning outcomes.

In addition, the Standard Error of the Estimate (2.541) is relatively small, indicating that the regression model predicts students' learning outcomes with a high level of accuracy.

Hypothesis Testing (t-Test)

After verifying that the research data were normally distributed and met the assumptions required for parametric analysis, the research hypothesis was tested using the t-test. The t-test was employed to determine whether the Discovery Learning model had a statistically significant influence on students' learning outcomes in Natural and Social Sciences.

The hypotheses of the study were formulated as follows:

Alternative Hypothesis (H_1): There is a significant positive effect of the Discovery Learning model on the learning outcomes of fourth-grade students in Natural and Social Sciences at SD Negeri 060938 Medan Johor. Null Hypothesis (H_0): There is no significant effect of the Discovery Learning model on the learning outcomes of fourth-grade students in Natural and Social Sciences at SD Negeri 060938 Medan Johor.

The decision criteria for hypothesis testing were established as follows: If t -calculated $>$ t -table or Sig. $<$ 0.05, the null hypothesis (H_0) is rejected and the alternative hypothesis (H_1) is accepted. If t -calculated $\leq$ t -table or Sig. $\geq$ 0.05, the null hypothesis (H_0) is accepted.

The t -test was performed using IBM SPSS Statistics Version 25, and the results are presented in Table 13.

Table 13. Results of the t -Test

Model	Unstandardized Coefficients (B)	Std. Error	Standardized Coefficients (Beta)	t	Sig.
Constant	-14.215	5.777	—	-2.461	0.024
Discovery Learning Questionnaire	1.160	0.068	0.969	17.047	0.000

Table 13 reveals that the regression coefficient (B) for the Discovery Learning model is 1.160, indicating that every one-unit increase in the implementation score of the Discovery Learning model is associated with an increase of 1.160 points in students' learning outcomes.

The standardized regression coefficient (Beta) is 0.969, indicating a very strong positive influence of the Discovery Learning model on students' learning outcomes.

Furthermore, the calculated t -value (17.047) is substantially greater than the critical t -table value (2.086) for $N = 21$ at the 5% significance level. Because [$t_{\text{calculated}}=17.047 > t_{\text{table}}=2.086$] and [Sig.=0.000<0.05,] the null hypothesis (H_0) is rejected, while the alternative hypothesis (H_1) is accepted. These findings indicate that the Discovery Learning model has a positive and statistically significant effect on students' learning outcomes in Natural and Social Sciences.

The extremely high t -value demonstrates that the influence of the Discovery Learning model is not due to chance but reflects a genuine improvement in students' academic achievement following the instructional intervention. Moreover, the standardized coefficient (Beta = 0.969) indicates that the Discovery Learning model is a highly influential predictor of students' learning outcomes.

The findings of the hypothesis test are consistent with the descriptive analyses presented in the previous sections. The mean learning outcome increased substantially from 52.76 in the pretest to 83.80 in the posttest, representing an improvement of 31.04 points. Additionally, the coefficient of determination analysis showed that 93.9% of the variance in students' learning outcomes could be explained by the Discovery Learning model.

Discussion

This study was conducted at SD Negeri 060938 Medan Johor involving 21 fourth-grade students as the research participants. The primary objective of this study was to examine the effect of the Discovery Learning model on students' learning outcomes in Natural and Social Sciences during the 2025/2026 academic year. The findings provide comprehensive evidence regarding the implementation of the Discovery Learning model, students' learning achievement, students' perceptions of the instructional model, and the statistical relationship between the implementation of Discovery Learning and students' learning outcomes.

The implementation of the Discovery Learning model during the research was carried out successfully according to the six instructional phases proposed by Bruner, namely stimulation, problem identification, data collection, data processing, verification, and generalization. Throughout the learning process, students actively participated in observing learning materials, discussing ideas within their groups, collecting information from various sources, analyzing evidence, presenting their findings, and drawing conclusions collaboratively. Rather than functioning as the primary source of information, the teacher acted as a facilitator who guided students throughout each stage of the learning activities. This learner-centered approach encouraged students to construct their own understanding through direct experience and collaborative inquiry.

The active participation demonstrated by the students indicates that the Discovery Learning model is well suited to the developmental characteristics of elementary school learners. Fourth-grade students generally possess a high level of curiosity, enjoy exploring new ideas, and are enthusiastic about collaborative learning activities. These characteristics were clearly observed during the implementation of the research. Students showed strong engagement when observing pictures, discussing authentic problems, exchanging ideas with their peers, asking questions, and presenting the results of their group discussions before the class. Consequently, the Discovery Learning model successfully accommodated students' cognitive and social characteristics, making the learning process more meaningful and interactive.

These findings support the view of Leuwol. (2023), who argued that a learning model serves not only as a framework for organizing classroom instruction but also as a strategy for facilitating students' acquisition of knowledge, skills, and conceptual understanding. According to their perspective, an effective instructional model should encourage students to become active participants in constructing knowledge rather than passive recipients of information. In the present study, the teacher provided guidance and scaffolding, while students independently explored learning resources, collaborated with classmates, formulated explanations, and presented their conclusions. Such learning experiences are consistent with the constructivist principles underlying Discovery Learning.

The analysis of the pretest results revealed that students' initial understanding of the Natural and Social Sciences content was relatively low. Before the implementation of the Discovery Learning model, the average pretest score was 52.76, which was classified as Needs Improvement according to the school's learning achievement criteria. The highest score obtained by students was 76, while the lowest score was 24. Furthermore, the

standard deviation of 18.35 and the standard error of 4.00 indicated considerable variation in students' prior knowledge.

Only five students (23.81%) successfully achieved the school's minimum learning achievement criteria, whereas sixteen students (76.19%) failed to meet the expected level of competency. These findings indicate that most students experienced difficulties in understanding the concepts presented in the Natural and Social Sciences subject before receiving the instructional intervention. The descriptive statistics therefore confirmed the necessity of implementing a more student-centered instructional approach capable of improving students' conceptual understanding and academic achievement.

After students participated in classroom instruction using the Discovery Learning model, a posttest was administered to evaluate the effectiveness of the instructional treatment. The posttest results demonstrated a substantial improvement in students' learning outcomes. The average score increased from 52.76 to 83.80, representing an improvement of 31.04 points. Moreover, the highest score increased from 76 to 100, while the lowest score improved from 24 to 68. In addition, the standard deviation decreased from 18.35 during the pretest to 10.00 in the posttest, indicating that students' achievement became more homogeneous following the implementation of the Discovery Learning model.

The improvement in students' learning achievement suggests that Discovery Learning effectively facilitated conceptual understanding by encouraging students to investigate problems, analyze information, collaborate with peers, and formulate conclusions independently. Rather than memorizing factual information, students developed deeper conceptual knowledge through meaningful learning experiences. These findings demonstrate that Discovery Learning not only enhanced students' academic performance but also reduced differences in achievement among students.

The improvement observed in this study is consistent with the theoretical perspective proposed by Maskuri (2021), who defined learning outcomes as changes in learners' cognitive, affective, and psychomotor competencies resulting from meaningful learning experiences. According to this perspective, successful learning is reflected in students' increased understanding, improved attitudes, and enhanced skills after participating in instructional activities. The significant increase between the pretest and posttest mean scores observed in the present study indicates that students experienced meaningful cognitive development after participating in Discovery Learning activities. During the initial implementation, however, several challenges emerged, including students' limited confidence in expressing their ideas and presenting the results of group discussions, while collaborative activities occasionally became noisy as students adapted to an active learning environment. These challenges gradually decreased through continuous teacher guidance, clear learning instructions, and structured group facilitation, enabling students to participate more confidently and collaboratively. This finding suggests that although the implementation of Discovery Learning requires an adjustment period for both students and teachers, it ultimately creates meaningful learning experiences that contribute not only to improved academic achievement but also to the development of students' communication, collaboration, and active learning skills.

The findings are also supported by Firdaus et al. (2024), who emphasized that learning outcomes represent students' mastery of knowledge and behavioral changes acquired through active participation in the learning process. Their findings suggest that

students achieve better learning outcomes when instructional activities provide opportunities to investigate problems independently and construct knowledge through authentic experiences. Similarly, the present study found that the implementation of Discovery Learning increased the number of students who achieved the expected learning objectives. During the early stages of implementation, however, some students were hesitant to express their ideas, and group discussions occasionally became noisy as students adapted to collaborative learning. With continuous teacher guidance and structured facilitation, students gradually became more confident, actively participated in discussions, and worked more effectively with their peers. These experiences indicate that although Discovery Learning presents initial implementation challenges, it ultimately creates a more engaging learning environment that supports both academic achievement and the development of students' communication and collaboration skills.

Besides measuring students' cognitive achievement through achievement tests, this study also investigated students' perceptions of the Discovery Learning model through a structured questionnaire. The analysis revealed an average questionnaire score of 84.52, with scores ranging from 70 to 98. These results indicate that students responded positively to the implementation of the Discovery Learning model throughout the learning process.

Students' positive responses were reflected in their increased willingness to express opinions, collaborate with classmates, ask questions, solve problems, and complete learning tasks enthusiastically. During classroom observations, students demonstrated greater confidence in communicating their ideas and actively participated in group discussions. Such findings indicate that the Discovery Learning model successfully created an engaging learning environment that encouraged active participation and collaborative learning.

These findings support the opinion of Syamsidah et al. (2022), who stated that Discovery Learning is an instructional model that emphasizes students' active participation in constructing meaningful learning experiences. Rather than receiving information passively from teachers, students are encouraged to explore learning materials independently, formulate hypotheses, analyze evidence, and develop conceptual understanding through inquiry. The positive questionnaire responses obtained in this study further confirm that students perceived Discovery Learning as an enjoyable, motivating, and effective instructional approach. Nevertheless, the implementation was not without challenges. At the beginning of the learning process, some students lacked confidence in expressing their ideas, and group discussions occasionally became noisy as students adapted to collaborative learning activities. Through continuous teacher guidance, clear group organization, and encouragement for equal participation, students gradually became more confident and actively engaged in discussions. These findings indicate that although Discovery Learning requires an initial adjustment period, it effectively promotes meaningful learning while enhancing students' participation, collaboration, and confidence.

During the implementation of the research, several strengths of the Discovery Learning model were observed. First, the model significantly increased students' classroom participation by encouraging them to ask questions, investigate problems, and express their ideas confidently. Second, collaborative learning activities enhanced students' communication and teamwork skills, enabling them to exchange ideas and solve problems collectively. Third, the instructional model promoted students' self-confidence because they were given opportunities to present their findings and defend their arguments before their

classmates. Finally, Discovery Learning encouraged students to develop critical thinking skills by requiring them to analyze evidence and formulate conclusions independently.

Despite these strengths, several challenges were also encountered during the instructional process. Group discussions occasionally created a relatively noisy classroom environment because all groups conducted discussions simultaneously. Furthermore, several students initially lacked confidence when presenting their opinions before the class. To address these challenges, the teacher established clear discussion rules, allocated appropriate time for each instructional stage, provided continuous guidance to groups experiencing difficulties, and encouraged less confident students through positive reinforcement and constructive feedback. These strategies contributed to maintaining an effective and supportive learning environment throughout the implementation of the Discovery Learning model.

Prior to hypothesis testing, the normality of the research data was examined using the Shapiro-Wilk test with the assistance of IBM SPSS Statistics Version 25. The analysis produced a significance value of 0.413, which exceeded the predetermined significance level of 0.05. Therefore, the data were considered normally distributed and met the assumptions required for parametric statistical analysis.

Following the normality test, the relationship between the Discovery Learning model and students' learning outcomes was analyzed using the Pearson Product-Moment correlation coefficient. The analysis yielded a correlation coefficient (r) of 0.969, whereas the critical value (r -table) for $N = 21$ at the 5% significance level was 0.433. Since $0.969 > 0.433$, the relationship between the two variables was classified as very strong. This result indicates that improvements in the implementation quality of the Discovery Learning model were associated with corresponding improvements in students' learning outcomes.

The coefficient of determination analysis further demonstrated that the Discovery Learning model explained 93.9% of the variance in students' learning outcomes. Consequently, only 6.1% of the variance could be attributed to other variables not investigated in the present study, such as students' individual learning motivation, family educational support, classroom environment, prior academic ability, learning styles, and other contextual factors. This exceptionally high coefficient of determination indicates that Discovery Learning served as the dominant factor influencing students' academic achievement in this research.

Finally, the research hypothesis was tested using the t-test. The analysis revealed a calculated t-value of 17.047, which substantially exceeded the critical t-table value of 2.086. Moreover, the significance value ($p = 0.000$) was considerably lower than the significance level of 0.05. Therefore, the null hypothesis (H_0) was rejected, while the alternative hypothesis (H_1) was accepted.

These findings provide strong statistical evidence that the Discovery Learning model has a positive and statistically significant effect on fourth-grade students' learning outcomes in Natural and Social Sciences, particularly on the topic "My Roles and Responsibilities in the School and Community Environment." The exceptionally high correlation coefficient, large coefficient of determination, and highly significant t-test collectively demonstrate that the

implementation of Discovery Learning substantially enhanced students' academic performance.

Conclusion

This study concludes that the implementation of the Discovery Learning model has a positive and significant effect on the learning outcomes of fourth-grade students in Natural and Social Sciences at SD Negeri 060938 Medan Johor during the 2025/2026 academic year. The findings revealed a substantial improvement in students' academic achievement after the application of the Discovery Learning model. The mean pretest score increased from 52.76 to a mean posttest score of 83.80, representing an improvement of 31.04 points. Students also demonstrated positive responses toward the learning process, as indicated by the questionnaire mean score of 84.52, suggesting that Discovery Learning successfully promoted active participation, collaboration, confidence, and meaningful learning experiences.

The inferential statistical analyses further confirmed the effectiveness of the Discovery Learning model. The data were normally distributed based on the Shapiro-Wilk test ($\text{Sig.} = 0.413 > 0.05$). Pearson correlation analysis revealed a very strong positive relationship between the Discovery Learning model and students' learning outcomes ($r = 0.969$), while the coefficient of determination ($R^2 = 93.9\%$) indicated that the model explained most of the variance in students' achievement. Furthermore, the hypothesis testing produced a t-value of 17.047, which was greater than the critical t-table value of 2.086 ($p < 0.001$), confirming that the Discovery Learning model significantly improved students' learning outcomes in Natural and Social Sciences. Therefore, the Discovery Learning model can be recommended as an effective learner-centered instructional approach for improving academic achievement in elementary school classrooms.

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