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The Difference and Effectiveness of the Discovery Learning and Direct Learning Model on the Science Learning Outcomes

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Abstract: This research addresses several challenges in elementary school education, including a predominant focus on achieving curriculum targets, an emphasis on memorizing concepts over understanding them, limited opportunities for students to independently discover knowledge, teacher-dominated instruction, and reliance on lecture methods without the use of teaching aids, resulting in passive learning environments. The study aims to analyze the effectiveness of the Discovery Learning model compared to the direct instruction model on the science learning outcomes of fifth-grade students. This quasi-experimental research employs a non-equivalent control group design. Data were collected through observations and tests, and analyzed using the independent sample t-test. The results indicate that the Discovery Learning model is significantly more effective, with a t-test result showing a t-value of 2.235, which exceeds the critical value of 1.98373. The study concludes that the Discovery Learning model is more effective for teaching the Food Digestion topic to fifth-grade students at SD Gugus Amarta, Kragan District, Rembang Regency, compared to conventional teaching methods.

Keywords: Discovery learning, effectiveness, direct learning model

1. Introduction

Education plays a crucial role in addressing life's challenges, especially for individuals. It is not merely about transferring knowledge but also about shaping individuals with positive attitudes and personalities. This includes fostering competence, discipline, responsibility, mental resilience, honesty, trustworthiness, and rational thinking. According to Severiens and Wolff (2008), the quality of learning, which ultimately determines learning outcomes, is influenced by various internal and external factors. Internal factors include physiological and psychological elements such as intelligence, motivation, achievement, and cognitive ability. External factors encompass environmental and instrumental components, including teachers, curriculum, methods, and learning media.

Learning experiences are acquired through a series of activities that explore the environment via active interaction with peers, the environment, and other sources. To prepare a quality future generation at the basic education level, one essential effort is to instill literacy and a culture of reasoning and critical thinking in every school learning process (Prosser, M., & Sze, 2014; Tal, 2012).

Indonesia's participation in international assessments such as the Trends in International Mathematics and Science Study (TIMSS) and the Program for International Student Assessment (PISA) since 1999 has revealed that Indonesian students' achievements are not encouraging. These assessments often include material not covered in the Indonesian curriculum. In the 2015 PISA test, Indonesia ranked 69th out of 76 countries, highlighting the need for improvement in educational quality, particularly in science learning (Caponera & Losito, 2016).

The current learning process by many educators tends to focus on achieving curriculum targets, prioritizing memorization over understanding. Students are not trained to discover or understand knowledge independently, leading to quick forgetfulness of the taught material. This teacher-centered approach, using mainly lectures without teaching aids, results in passive learning and low student engagement. These issues are evident in the Amarta Group, Kragan District, Rembang Regency, where science learning remains teacher-centered, relying heavily on lecture and discussion methods. This approach only aims to meet curriculum demands without fostering students' learning abilities or personal development, leading to poor student performance.

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In the Amarta Cluster, Kragan District, Rembang Regency, the science learning process remains largely teacher-centered, with passive student participation. The lack of creativity in teaching methods and the absence of appropriate learning aids contribute to students' disinterest and low achievement in science. The average score of the Odd Semester Final Assessment for Grade V in the 2021/2022 academic year was only 48%, well below the Minimum Completeness Criteria (KKM) of 70. This issue is exacerbated by the transition from online to offline learning due to the COVID-19 pandemic.

To address these challenges, it is essential to implement a discovery learning model that can enhance students' interest in science. Discovery Learning helps students develop cognitive skills and processes by engaging them in active problem-solving and independent knowledge discovery (Mrazek & Howes, 2004). In this model, the teacher acts as a facilitator, guiding students in collecting information, analyzing data, and drawing conclusions (Hosnan, 2014).

The research conducted in the Amarta Cluster, Kragan District, Rembang Regency, revealed that the science learning process is still teacher-centered and passive. To optimize student learning outcomes, innovative teaching methods such as Discovery Learning and the Make a Match model should be implemented. These methods encourage active student participation and enhance understanding through interactive and investigative learning processes. The Make a Match model, in particular, fosters student motivation and comprehension by involving them in finding and discussing paired concepts (Helmi et al., 2018). This research aims to analyze the effectiveness of implementing the Discovery Learning and Make a Match models on the science learning outcomes of fifth-grade students at Gugus Amarta Elementary School, focusing on the topic of food digestion.

2. Methodology

This research is experimental in nature, utilizing a Quasi-Experimental Design to assess the effectiveness of a treatment on the sample. Specifically, a Nonequivalent Control Group Design was employed. According to Sugiyono (2016), experimental research designs include Pre-Experimental Design, True Experimental Design, Factorial Design, and Quasi-Experimental Design. The study population comprised fifth-grade students from six elementary schools in the Amarta Cluster, Kragan District, Rembang Regency, during the 2022/2023 academic year. Cluster Random Sampling was used to select the sample. Data were collected through observations and tests, and analyzed using the independent sample t-test. The study involved two classes: an experimental class and a control class.

The research was conducted on fifth-grade students from SDN Mojokerto, SDN Kendalagung, and SDN 1 Kragan. The results presented include pre-test and post-test data analyses of science learning outcomes. According to Sugiyono (2016), the population is a general area consisting of subjects or objects with specific qualities and characteristics defined by the researcher for study and conclusion drawing. This definition encompasses not only people but also objects and other natural phenomena. Opie (2019) describes the population as the totality of research subjects. In this study, the population included all fifth-grade elementary school students in the Amarta Cluster, Kragan District, Rembang Regency, during the 2022/2023 academic year.

3. Results and Discussion

The comparison of science learning outcomes on food digestion between the experimental class and the control class revealed a significant difference. The experimental class, which received the Discovery Learning model treatment, showed a higher average score than the control class. Specifically, the experimental class achieved an average score of 59.75, while the control class achieved an average score of 57.38. This indicates that the Discovery Learning model effectively enhances student learning outcomes in science.

The enthusiasm and engagement of students in the experimental class were noticeably higher, attributed to the implementation of Problem Statements (identifying problems) within the Discovery Learning model. This finding aligns with Novegitasari et al. (2018) assertion that discovery learning facilitates understanding concepts, meanings, and relationships through an intuitive process leading to conclusions.

The hypothesis test results, calculated using SPSS version 23, confirm these observations. The independent sample t-test results in the equal variances assumed column showed $t = 2.235$; $df = 101$; $p = 0.003$; mean difference = 5.323; 95% CI [0.450, 10.195]. Given that the t-count (2.235) is greater than the t-table value (1.98373) and the p-value (0.003) is less than 0.025, we reject the null hypothesis (H0) and accept the alternative hypothesis (Ha). This statistically supports the effectiveness of the Discovery Learning model over conventional teaching methods for improving science learning outcomes.

Hosnan (2014) states that the Discovery Learning model helps students embed knowledge more deeply because it requires them to actively seek and investigate information themselves. This is corroborated by Putri et al. (2018), who found that students using Discovery Learning show better enthusiasm and understanding compared to conventional models. The student-centered nature of Discovery Learning fosters real, creative, and critical experiences, promoting higher-level thinking and meaningful knowledge acquisition (Burhendi et al., 2019).

The data analysis reveals that the experimental class had better learning outcomes, as evidenced by higher post-test scores compared to the control class. The pretest and posttest data show that the highest scores in the control class were 75 and 95, respectively, while in the experimental class, the highest scores were 80 and 100. The lowest scores

were 40 in both classes for the pretest, but for the posttest, the control class had a lowest score of 50, whereas the experimental class had 60. The mean pretest score for the control class was 57.38, and the posttest mean was 70.83, indicating an increase of 13.45. In the experimental class, the mean pretest score was 59.75, and the posttest mean was 81.31, showing an increase of 21.56.

In conclusion, the application of the Discovery Learning model is effective in improving learning outcomes, particularly in the science subject of Food Digestion for fifth-grade students. This model encourages active learning and critical thinking, making it a valuable approach in educational settings. Studies by Hidayah et al. (2018) and Setyowati and Ranu (2017) further support the use of the Discovery Learning model to enhance student creativity and learning outcomes. Implementing Discovery Learning encourages student participation in problem identification, data collection, processing, and drawing conclusions, ultimately leading to improved learning outcomes and increased student creativity (Santi & Risan, 2023). The descriptive statistics comparison in Table 1 highlights the significant differences in learning outcomes between the control and experimental classes, underscoring the effectiveness of the Discovery Learning model. This model serves as a viable alternative for teaching science, particularly in topics like Food Digestion, to enhance student engagement and achievement.

Table 1: Descriptive statistics

No	Data	Class			
		Control		Experiment I	
		Pre	Post	Pre	Post
	Total students	**42**	**42**	**61**	**61**
1	Highest score	75	95	80	100
2	Lowest score	40	50	40	60
3	Average score	57.3810	70.8333	59.7541	81.3115
4	Standard deviation	9.0789	8.8585	11.6797	9.7047
5	Variance	84.4367	80.3862	138.6885	95.7514

The effectiveness of the Team Game Tournament (TGT) learning model on student learning outcomes was evaluated using a parametric statistical test (t-test) with the assistance of SPSS version 23, employing the independent sample t-test technique. The analysis steps in SPSS version 23 involved: Analyze → Compare Means → Independent Samples T Test. Decision-making criteria were based on the significance value ($p < 0.025$) and the comparison of t-count with the t-table (t-count > t-table). If these conditions were met, the null hypothesis (H0) was rejected and the alternative hypothesis (Ha) was accepted.

The independent sample t-test results are summarized in Table 2. In the column for equal variances assumed, the t-value is 2.235; degrees of freedom (df) = 101; Sig. (2-tailed) = 0.003; mean difference = 5.323; 95% confidence interval (CI) for the difference: lower bound = 0.450, upper bound = 10.195. For the column of equal variances not assumed, the t-value is 2.235; df = 53.514; significance (2-tailed) = 0.03; mean difference = 5.323; 95% CI: lower bound = 0.438, upper bound = 10.207. Given that the data is homogeneous, the equal variances assumed column is used for hypothesis testing. The results show that t-count (2.235) is greater than t-table (1.98373) and the significance value (0.003) is less than 0.025, leading to the rejection of H0 and acceptance of Ha.

Table 2: The results of the t-test analysis of the effectiveness of the Discovery Learning model on science learning outcomes for fifth grade elementary school students

		t-test for Equality of Means						
		t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
							Lower	Upper
Value	Equal variances assumed	2.235	101	.003	-5.323	2.436	10.195	.450
	Equal variances not assumed	2.235	100.324	.003	-5.323	2.436	10.207	.438

Thus, the study concludes that the Discovery Learning model in the experimental class is more effective for improving students' science learning outcomes compared to conventional teaching methods used in the control class. This finding is supported by the statistical evidence indicating that the Discovery Learning model significantly

enhances student performance. In summary, the parametric statistical analysis using SPSS version 23 demonstrated that the Discovery Learning model is a more effective instructional strategy for science education compared to traditional methods. The t-test results clearly support the superiority of the Discovery Learning model in promoting better learning outcomes among students.

The data on learning outcomes for fifth-grade students in science learning on Food Digestion showed significant differences between the experimental class and the control class. The experimental class, which used a combination of the Discovery Learning model and the Make a Match model, demonstrated an average score of 86.61 after the intervention, compared to 66.61 in the control class, which did not receive the treatment. This indicates that the experimental class had a higher average increase in learning outcomes, highlighting the effectiveness of the Discovery Learning and Make a Match models in teaching science.

The hypothesis test results, calculated using SPSS version 23, confirm these findings. The independent sample t-test results in the equal variances assumed column show $t = 7.226$, $df = 101$, $p < 0.000$, mean difference = 21.45, with a 95% confidence interval ranging from 15.81 to 27.09. Similarly, the equal variances not assumed column shows $t = 7.226$, $df = 59.676$, $p < 0.000$, mean difference = 21.45, with a 95% confidence interval ranging from 15.81 to 27.09.

Since the data is homogeneous, the equal variances assumed column is used for hypothesis testing. The t-test results show that t-count (7.226) is greater than the t-table value (1.98373) and the significance value (0.000) is less than 0.025, leading to the rejection of H0 and acceptance of Ha. Thus, the study concludes that the Discovery Learning model and the Make a Match model are more effective in improving students' science learning outcomes compared to conventional teaching methods.

Hosnan (2014) outlines the benefits of the Discovery Learning model, including improving cognitive processes and problem-solving abilities, fostering student-centered learning, enhancing self-concept, better understanding of basic concepts, motivating reasoning and hypothesis formulation, stimulating initiative, and encouraging active participation. These benefits align with the findings of this study, where the Discovery Learning model provided a real, creative, and critical learning experience, fostering high-level thinking and meaningful knowledge acquisition (Prasetya et al., 2022).

By actively engaging in the learning process through the Discovery Learning model, students retain knowledge more effectively, as they are required to search and investigate information independently. This aligns with constructivist theory, which emphasizes contextual learning processes where students build knowledge through active exploration (Ulfa & Octaviana, 2021). The use of audiovisual media further clarifies the material, making it easier for students to remember and apply their knowledge.

The steps of the Discovery Learning model, which include responding to stimuli, conducting discussions, collecting data, and communicating findings, reinforce constructivist principles. This approach provides varied and meaningful learning experiences, allowing students to construct their knowledge actively and independently. Consequently, the Discovery Learning model, combined with the Make a Match model, proves to be an effective strategy for enhancing science learning outcomes in the Food Digestion topic for fifth-grade students. In conclusion, the implementation of the Discovery Learning and Make a Match models significantly improves student learning outcomes in science. These models encourage active learning, critical thinking, and independent knowledge construction, making them valuable tools in educational settings. The study's findings support the continued use and further exploration of these models to enhance science education and overall student achievement.

4. Conclusion

The study concludes that the current teacher-centered approach in science education, relying heavily on lectures and discussions, fails to engage students effectively. This approach does not foster active learning or develop students' abilities and interests in the subject matter, leading to boredom and low participation. The lack of creative teaching methods and appropriate learning media further exacerbates this issue, resulting in subpar student outcomes that do not meet the school's Minimum Completeness Criteria (KKM). The Discovery Learning model, on the other hand, has proven to be significantly more effective in improving student engagement and learning outcomes in science, particularly on the topic of Food Digestion. This model encourages active participation, critical thinking, and independent knowledge discovery, making learning more meaningful and enjoyable for students. Therefore, implementing the Discovery Learning model in science education is recommended to enhance student learning experiences and outcomes.

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