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The Influence of the Guided Discovery Learning Model Using a Scientific Approach to Cube Material at Tatengesan 17 Christian Middle School

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Abstrak

Penelitian ini bertujuan untuk mengetahui perbedaan hasil belajar siswa menggunakan model *guided discovery learning* (GDL) dengan pendekatan *scientific* dan model pembelajaran langsung pada materi Kubus. Subjek penelitian yaitu kelas VIIIB sebagai kelas eksperimen menggunakan model GDL dengan pendekatan *scientific* dan kelas VIIIA sebagai kelas kontrol menggunakan model pembelajaran langsung. Desain penelitian yaitu *posttest only control group design*. Sampel penelitian yaitu kelas eksperimen sejumlah 22 siswa dan kelas kontrol sejumlah 23 siswa. Hasil analisis prasyarat menunjukan sampel berasal dari populasi yang terdistribusi normal dan homogen. Hasil uji *t student 1 tailed right* menunjukan nilai t_{hitung} 1,8645 dan nilai t_{tabel} 1,6811 sehingga $t_{hitung} > t_{tabel}$. Interval batas bawah rata – rata penerimaan berada pada 76,3153 dimana lebih tinggi dari nilai rata – rata hasil belajar siswa dengan model pembelajaran langsung yaitu 72,1739. P value berada pada angka 0,0345 dan lebih kecil dari batas kritis penelitian 0,05 maka disimpulkan perbedaan hasil belajar siswa dengan model GDL dengan pendekatan *scientific* dan hasil belajar siswa dengan model pembelajaran langsung pada taraf signifikan.

Kata kunci: *Guided Discovery Learning, Hasil Belajar, Kubus, Pendekatan Scientific*

Abstract

This study aims to determine differences in student learning outcomes using the guided discovery learning (GDL) model with a scientific approach and direct learning models on cube material. The research subjects were class VIIIB as the experimental class using the GDL model with a scientific approach and class VIIIA as the control class using the direct learning model. The research design is a posttest-only control group design. The research sample consisted of 22 students in the experimental class and 23 students in the control class. The prerequisite analysis results show that the sample comes from a normally distributed and homogeneous population. The student 1-tailed suitable t-test results show a t_{count} value of 1.8645 and a t_{table} value of 1.6811, so that $t_{count} > t_{table}$. The lower limit interval for the average acceptance is 76.3153, higher than the average value of student learning outcomes with the direct learning model, namely 72.1739. The P value is at 0.0345 and is smaller than the critical research limit of 0.05, so it can be concluded that the differences in student learning outcomes with the GDL model with a scientific approach and student learning outcomes with the direct learning model are at a significant level.

Keywords: *Guided Discovery Learning, Learning Outcomes, Cube, Scientific Approach*

INTRODUCTION

The objectives of national education in Indonesia are derived from the diverse cultural foundations of the Indonesian population, as outlined in Law No. 20 of 2003 on the National Education System. This legislation asserts that the primary aim of national education is to foster the growth of students' potential, enabling them to embody qualities such as faith in a higher power, virtuous character, physical well-being, intellectual proficiency, creativity, self-reliance, and the ability to function as democratic and responsible members of society.

Learning mathematics is essential for students, so it needs to be developed from an early age. Mathematical concepts can be applied to everyday life (Pramita, 2015; Bakhtiyar, 2017). In addition, understanding and developing good mathematical concepts will train students to be more creative and innovative in developing ideas to be more competitive in the current global era (Bornok et al., 2014; Rambe, 2020).

A learning model that encourages students' activeness by finding their way is a learning model that shows students' independence but also cannot be separated from the educator as a facilitator to direct students to student discoveries in learning activities. This model pays more attention to differences in the initial knowledge of each student in obtaining learning achievement (Dewi, 2014; Rahman, 2016). With learning that directs students to explore new knowledge, this learning model is closely related to the scientific approach (Rusman, 2015; Diana, 2022).

The scientific approach is a learning approach by applying the stages of scientific study. The stages of scientific studies are Observing, Questioning, Experimenting, Associating, Concluding, and Networking (Ekawati, 2020; Rustam, 2021). Learning with a scientific approach builds students' thinking patterns to compile concepts from received learning (Hosnan, 2014; Suciarsy, 2018). Using a learning model that stimulates students to gain new knowledge, combined with the implementation of learning with a scientific approach and the educator's ability to relate the material taught to everyday events can have a positive influence on student learning outcomes (Sugiyono, 2014; Nuzlia et al. 2015).

Based on the results of observing the learning process in class in mathematics at SMP Kristen 17 Tatengesan, it is known that students' ability to receive material while learning mathematics in class could be more optimal. This can be seen from the learning outcomes of students based on the acquisition of an average score of the odd midterm exam results of 61. The average score has yet to reach the Minimum Completeness Criteria (KKM) set by the school, which is 75. According to the results of interviews with mathematics teachers at that school, students were reluctant to ask questions regarding the material during the lesson, so it took a lot of work for the teacher to determine how much material students had absorbed at the end. Based on student interviews, one of the problematic materials was the material about cubes. In this material, students need help understanding the concepts being taught because the teacher only provides learning based on material in the form of formulas and calculations presented in the learning book. Observations during the learning process show that the presentation of material by the teacher uses a direct learning model and tends to be dominated by the teacher. At the same time, students need to be more involved in responding to the lesson.

Seeing these problems, applying a learning model that can stimulate student participation in learning activities is necessary. One learning model that actively involves the role of students is the Guided Discovery Learning Model with a scientific approach (Maya, 2019). In this learning model, students are encouraged to learn to be responsible in solving problems given by educators through the active involvement of individual students (Trianingsih, 2019; Mustakim, 2020). Educators also play a role in guiding students, but guidance from educators is limited to directing the necessary work procedures (Wulandari & Jannah, 2019; Nugraha et al., 2020). In addition, applying the Guided Discovery Learning model is closely related to the scientific approach, so it is hoped that students can further deepen the material being taught based on conditions often found in everyday environments (Nuzlia et al., 2015).

Research conducted by Doni Widianto (2014) shows that the Guided Discovery Learning model can improve students' reasoning abilities during teaching and learning. This conclusion is reinforced by the results of research published in a research journal by Diana Putri (2022) that the application of the Guided Discovery Learning model significantly impacts the ability of high school students to solve math problems. Supporting this opinion is based on a research journal by Rustam Simamora (2021), which applies the Guided Discovery Learning model with a practical scientific approach to learning mathematics.

By looking at the background of the problem as previously described, this research was carried out with the topic of the Guided Discovery Learning model using a scientific approach.

METHOD

This study employs an experimental design with two distinct treatments: the Guided Discovery Learning model with a scientific approach, which serves as the experimental treatment, and the direct learning model, previously employed by the teacher, which serves as the control treatment. These treatments are being investigated as potential alternative solutions to the identified problems.

The investigation was conducted at Tatengesan 17 Christian Middle School, located in the Pusomaen District. The investigation was conducted during the fall semester of the 2022-2023 school year. The participants in this research comprised Grade VIII students at SMP Kristen 17 Tatengesan during the school year 2022/2023. The sample for this study was selected by assigning two classes, specifically class VIIIB as the experimental group and class VIIIA as the control group. This study posits the assumption that both classes possess equivalent average abilities.

This study aims to conduct a comparative analysis of the learning results between two distinct classes. The experimental class will be exposed to the Guided Discovery Learning model, which incorporates a scientific approach. On the other hand, the control class will be subjected to the direct learning model.

The data collection tool employed in this study consisted of a written test presented in the format of a descriptive assessment. The written test comprises questions that encompass various cognitive levels, serving as a posttest for both the control and experimental classes. The employed validation technique is content validity, which has been consulted with supervisors and subject teachers. The essay examination comprises a set of five inquiries, collectively accounting for a cumulative score of 100 points.

RESULT

The Guided Discovery Learning model, implemented with a scientific approach, was employed in the experimental class consisting of 22 students in class VIIIB. In contrast, the control class, comprising 23 students in class VIIIA, received instruction on cube content using the Direct Learning model. Upon the conclusion of the study, the researcher administered the post-test to both groups. The objective of this study is to examine the learning outcomes of students who have utilized the Guided Discovery Learning model, as well as to compare the learning outcomes between students who have employed the Guided Discovery Learning model and those who have utilized the direct learning model.

Table 1. Statistical Summary of Posttest Research Values

No	Statistics	Posttest score	
		GDL	DI
1.	Total	1770	1660
2.	Maximum Score	100	100
3.	Minimum Score	55	45
4.	Average	80,4545	72,1739
5.	Standard	13,5321	16,0840
6.	Variance	183,1169	258,6957

Student learning outcomes as seen from the posttest after the learning process was carried out on class VIIIB as an experiment with treatment using the Guided Discovery

Learning model with a scientific approach and class VIIIA as class VIIIA as a control class with treatment using a direct learning model. Based on the results of the posttest, the average value of the experimental class was 80.45, with a maximum value of 100 and a minimum of 55. In the control class, the average posttest was 72.17, with a maximum value of 100 and a minimum of 45.

Data on the value of student learning outcomes is a general description of the learning outcomes of the experimental class and control class. Recapitulation of student learning outcomes in the treatment and control classes can be seen in the appendix. Next, it will carry out statistical tests on learning outcomes between the experimental class and the control class to test hypotheses and draw conclusions regarding the results of the research that has been done. Statistical tests were carried out with several stages of testing as follows:

1. Prerequisite Test

a. Normality test

Before carrying out the normality test on the posttest results data, the researcher formulates the thesis and antithesis to be tested as well as the area of rejection as the basis for concluding the normality test as follows:

H_0: The sample comes from a normally distributed population.

H_1: The sample comes from a population that is not normally distributed.

The rejection area is:

$L_{count} < L_{table}$ then H_0 is accepted and H_1 is rejected, and

$L_{count} > L_{table}$, then H_0 is rejected and accepts H_1.

The mechanism for calculating the normality test using the Lilliefors formula with the help of Microsoft Excel software can be seen in the attachment. Based on the results of the normality test on the posttest values of the experimental class, it is known that the L_{count} is 0.1162 with L_{table} is 0.1889. This figure shows that $L_{count} < L_{table}$ in the posttest results of the practical course so that H_0 is accepted and H_1 is rejected. Based on the results of the normality test on the posttest value of the control class, it is known that the L_{count} is 0.0899 with L_{table} is 0.1849. This figure shows that $L_{count} < L_{table}$ in the posttest results of the control class so that H_0 is accepted and H1 is rejected.

Table 2. Data Statistics on the Normality Test

	GDL		DI
L_{count}	0,1162		0,0899
Critical Limit		0,05	
L_{table}	0,1889		0,1847
Conclusion	Normal		Normal

Based on the normality test results, it can be concluded that the two samples in the experimental class and the control class are samples from normally distributed populations.

b. Homogeneity test

The thesis and antithesis to be tested, as well as the area of rejection as the basis for concluding the normality test, are as follows:

H0: Homogeneous data variance

H1: The variance of the data is not homogeneous.

The rejection area is:

$F_{count} < F_{table}$ then H_0 is accepted and H_1 is rejected, and

$F_{count} > F_{table}$, then H_0 is rejected and accepts H_1.

After proving the normality of the data for the experimental and control class values, it is continued with a homogeneity test for the experimental and control class values. The mechanism for calculating the homogeneity test using the Fisher F formula assisted by Microsoft Excel software can be seen in the attachment. Based on the results of the homogeneity test on the posttest values of the experimental and control classes, it is known that the F_{count} is 1.4127 with F_{table} is 2.0733. This figure shows that $F_{count} < F_{table}$ on the posttest results of the experimental and control classes so that H0 is accepted and H_1 is rejected.

Table 3. Data Statistics on Homogeneity Test

	GDL	DI
Total Data	22	23
Degrees of freedom 1	22	
Degrees of freedom 2	21	
Critical limit	0,05	
F_{count}	1,4127	
F_{table}	2,0733	
Conclusion	Homogenous	

Based on the results of the homogeneity test, it can be concluded that the two samples in the experimental and control classes are homogeneous.

c. Test the Research Hypothesis

The thesis and antithesis to be tested, as well as the area of rejection as the basis for concluding the normality test, are as follows:

H_0: There is no difference in learning outcomes between the GDL and DI models.
H_1: There are differences in learning outcomes with the GDL model against DI.
The rejection area is:
$t_{count} < t_{table}$ then H_0 is accepted and H_1 is rejected, and
$t_{count} > t_{table}$ then H_0 is rejected and accepts H_1.

Hypothesis testing was carried out to determine the learning outcomes of experimental class students with the control class student learning outcomes after each class was given a different treatment. Testing the hypothesis in this test uses the right-side t 1 test. The calculation mechanism using the right-side t 1 test formula assisted by Microsoft Excel software can be seen in the attachment. Based on the t-test results on the right side of the posttest values of the experimental and control classes, it is known that the t_{count} is 1.8645 with a t_{table} of 1.6811. This figure shows that $t_{count} > t_{table}$ on the posttest results of the experimental and control classes so that H0 is rejected and H_1 is accepted.

Table 4. Data Statistics on Hypothesis Testing

Statistic	Result
t_{count}	1,8645
P value	0,0345
t_{table}	1,6811
Accepted Interval	76,3153 - 84,5938
Conclusion	Rejected H_0, AcceptedH_1
Significant	Significant

DISCUSSION

The application of the Guided Discovery Learning model, coupled with a scientific approach, in the context of mathematics education using cube materials, has the potential to yield superior learning outcomes as compared to the direct learning model. The results obtained from comparing the average learning outcomes of the experimental and control classes, using the same assessment instrument, indicate that the implementation of the Guided Discovery Learning model, coupled with a scientific approach, leads to a significant improvement in the average student learning outcomes. The mean value of student learning outcomes instructed by the Guided Discovery Learning paradigm utilizing the scientific method

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is 80.4545. The attainment of this mean score meets the minimum passing threshold established by the educational institution, which is set at 75. Nevertheless, there are still several pupils within the experimental class who have yet to achieve the minimum passing grade (KKM). Based on empirical evidence, the utilization of the Guided Discovery Learning model with a scientific approach resulted in a participation rate of 4 out of 22 students in the experimental class. The mean value of student learning outcomes instructed by the direct learning model is 72.1739. The attainment of this mean score has not yet met the minimum passing grade (KKM) set by the educational institution, which is 75. Based on empirical evidence, it was observed that out of a total of 23 students in the control class, 11 students did not achieve the minimum competency level (KKM) despite being exposed to the direct learning paradigm.

The findings derived from the examination of data in both the experimental and control groups indicate notable disparities in student learning outcomes when comparing the Guided Discovery Learning model with the scientific approach to the direct learning model. This result is derived by applying the hypothesis specification and evaluating the t_{count} against the t_{table} criteria. Based on the data calculations, it is observed that the t_{count} value is 1.8645, whereas the t_{table} value is 1.6811. Consequently, the condition $t_{count} > t_{table}$ is satisfied. From a statistical standpoint, this criterion serves to highlight the disparities in student learning outcomes when comparing the Guided Discovery Learning model, implemented with a scientific approach, to the direct learning model. Based on the observation that the t_{count} value is greater than zero, it can be inferred that the effect under consideration exhibits a positive influence. The Guided Discovery Learning methodology, when compared to the direct learning model, demonstrates greater student learning outcomes with a scientific approach.

To establish the validity of this finding, the investigator conducted a comparative analysis between the mean range of statistical test result turnaround times, ranging from 76.3153 (lower bound) to 84.5938 (upper bound), and the mean value of student learning outcomes achieved by the direct learning approach, specifically 72.1739. When comparing the average acceptance rate interval to the average value of student learning outcomes using the direct learning model, it is seen that the average discrepancy between the acceptance rate (either the upper or lower limit) is greater than the average value of student learning outcomes with the direct learning model.

Based on the obtained p-value of 0.0345, which falls below the predetermined research critical threshold of 0.05, it can be inferred that there are significant differences in student learning outcomes between the Guided Discovery Learning model with a scientific approach and the direct learning model.

The collected research findings indicate that students who are exposed to the Guided Discovery Learning model with a scientific approach exhibit superior learning outcomes compared to students who are exposed to direct learning methods when studying cube-related content. This outcome is consistent with the study conducted by Riftakhul (2017), which demonstrates that the utilization of the Guided Discovery Learning model, incorporating a scientific approach, has a good impact on the acquisition of mathematical ideas. The Guided Discovery Learning model, when combined with the scientific method, offers superior advantages. This is due to the systematic steps inherent in the Guided Discovery Learning model, which effectively guide students towards the discovery of mathematical concepts. Consequently, students are empowered to independently explore the application of their learning.

The utilization of the Guided Discovery Learning model, which incorporates a scientific approach, facilitates the active engagement of students in the process of discovery. This perspective aligns with the findings of Doni (2014), whose research demonstrates that pupils instructed through the guided discovery method exhibit superior reasoning ability compared to those taught through standard learning approaches.

CONCLUSION

The data calculations show that the t_{count} value is 1.8645 and the t_{table} value is 1.6811, so the criteria fulfilled is $t_{count} > t_{table}$. The t_{count} value indicates a number more than zero, so it can be concluded that the effect is a positive influence. The average interval for receiving statistical test results is 75.9774 (lower limit) – 84.9317 (upper limit), with the average value of student learning outcomes with the direct learning model of 72.1739. Judging from the probability value (p-value), the analysis results show that the p-value is at 0.0345, below the research critical limit, namely at 0.05. So, it can be concluded that there is a significant positive difference in the learning outcomes of students taught by the Guided Discovery Learning model with a scientific approach compared to the learning outcomes of students taught by the direct learning model.

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