



The Influence of Discovery Learning Model on Improving Student Learning Outcomes on Reaction Rate Material in Grade XI of Senior High School

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Abstract: The Influence of Discovery Learning Model on Improving Student Learning Outcomes on Reaction Rate Material in Grade XI of Senior High School. This study aims to determine the effect of the Discovery Learning learning model on improving student learning outcomes in the reaction rate material. This study used two research samples selected by random sampling at SMA Negeri 1 Sidikalang and each numbered 36 students. The research design used in this study was the Pretest Posttest Control Group Design, which involved the control class and the experimental class. The test instrument used in this study was a multiple-choice student chemistry learning outcome test that had been validated by an expert validator. The results of the data analysis obtained an average increase in students' chemistry learning outcomes in the experimental class of 80% and for the control class of 70%. For hypothesis testing using the right-tailed t-test with the results of the study at a significant level of $\alpha = 0.05$ and db = 36 with a value of t count > t table, namely t count 23.43 > 2.03. So in this study Ha is accepted and H0 is rejected, which means that there is an influence of the Discovery Learning learning model on improving student learning outcomes in the reaction rate material.

Keywords: Discovery Learning, Learning Outcomes, Reaction Rate

Abstrak: Pengaruh Model Pembelajaran Discovery Learning terhadap Peningkatan Hasil Belajar Siswa pada Materi Laju Reaksi di Kelas XI SMA. Penelitian ini bertujuan untuk mengetahui pengaruh model pembelajaran Discovery Learning terhadap peningkatan hasil belajar siswa pada materi laju reaksi. Pada penelitian ini menggunakan dua sampel penelitian yang dipilih dengan random sampling di SMA Negeri 1 Sidikalang dan masing-masing berjumlah 36 siswa. Desain penelitian yang digunakan pada penelitian ini adalah Pretest Posttest Control Group Design, yang melibatkan kelas kontrol dan kelas eksperimen. Instrumen tes yang digunakan pada penelitian ini adalah tes hasil belajar kimia siswa yang berbentuk pilihan berganda yang telah divalidasi oleh validator ahli. Hasil analisis data yang diperoleh rata-rata peningkatan hasil belajar kimia siswa pada kelas eksperimen sebesar 80% dan untuk kelas kontrol sebesar 70%. Untuk uji hipotesis menggunakan uji t-pihak kanan dengan hasil penelitian pada taraf signifikan $\alpha = 0,05$ dan db=36 dengan nilai t_{hitung} > t_{tabel} yakni t_{hitung} 23,43 > 2,03. Sehingga dalam penelitian ini Ha diterima dan H₀ ditolak yang artinya terdapat pengaruh model pembelajaran Discovery Learning terhadap peningkatan hasil belajar siswa pada materi laju reaksi

Kata Kunci: Discovery Learning, Hasil Belajar, Laju Reaksi

150 Jurnal Pendidikan dan Pembelajaran Kimia, Vol. 14, No. 1 April 2025 Page 149-157

INTRODUCTION

Education is an effort made by each person to develop themselves according to their talents and abilities. With education, the potential of each individual can be maximized according to their natural characteristics, so that everyone can contribute to improving the quality of life better (Indy,2019). Education is a very important aspect in human life. The education process takes place from the womb until a person becomes an adult and elderly. Education acts as an enlightenment that helps humans find direction, purpose, and meaning in their lives (Nasution, 2014). Education consists of three main forms, namely guidance, teaching, and training. The goal of education is to develop all aspects of the student's personality in a comprehensive and integrated manner (Subhi, 2016).

Education requires interaction between teachers and students aimed at achieving learning objectives in the learning environment. Students have an important role that can influence all aspects needed to achieve their learning objectives (Wahid, 2021). By improving the quality of education in accordance with the times, the potential of students as the next generation of the nation can grow and develop according to their abilities through learning activities at school, so that learning objectives can be achieved. The role of teachers in this process is very crucial, because they function as conveyors of information, organizers, movers, motivators, guides, idea initiators, knowledge disseminators, facilitators, evaluators, and educators. In the entire teaching and learning process, the role of teachers cannot be ignored. Learning is an interaction between teachers and students that results in behavioral changes. In schools, teachers are one of the key factors in improving the quality of education. Therefore, the learning process needs to be well designed in order to achieve the desired learning achievements (Suwardi, 2018). Learning principles and methods need to be adjusted to the characteristics of students, the material being taught, and the environmental conditions where learning takes place. The quality of a method is influenced by several factors, such as learning objectives, student characteristics, situations and conditions, teacher abilities and personalities, and available facilities. In other words, the choice of teaching methods is influenced by various things that must be considered (Zein, 2016).

Chemistry is one of the main subjects in senior high school (SMA). Chemistry subject matter has characteristics that include abstract theories, various chemical properties, and elements of very diverse compounds, and involves chemical calculations. This is the reason why many students do not like chemistry. Chemistry lessons aim to help students develop logical, analytical, systematic, critical, and creative thinking skills. Based on Permendiknas No. 22 of 2006, chemistry aims to improve competence in the fields of science and technology and encourage critical, creative, and independent scientific thinking. Therefore, students should be able to master chemistry lessons. However, in reality, many students still have low learning achievement in this subject. This low achievement is influenced by various factors in the learning process, both from the students themselves (internal factors) and from the surrounding environment (external factors) (Kristin, 2016).

Based on the results of observations that I have conducted on chemistry teachers at SMAN 1 Sidikalang, the use of conventional learning models with lecture methods is still found during the learning process. With the use of conventional learning models with lecture methods, students are not directly involved in the teaching and learning process. In addition, teachers are still the center of attention and the media used during the learning process are only textbooks. So that the learning process without involving students will

reduce their learning outcomes, as is known that the material on reaction rates is material that is considered difficult by students because of the many uses of formulas. This causes student learning outcomes, especially in the material on reaction rates, to be quite low (Haeruman, 2017).

These problems need to be addressed with more innovative learning so as to encourage students to learn optimally both in the learning process in the classroom and independently (Fatmawati, 2021). So the improvements that need to be made are to pay attention to the right learning models and learning resources, because these learning models and resources play an important role in improving student learning outcomes. Where the quality of learning has a direct relationship with learning outcomes, which means that the learning outcomes obtained are better in relation to the quality of learning (Kusuma, 2020).

Learning models, learning motivation, student interest and attention are factors that influence student learning outcomes in the world of education. The constructivist approach can be used as an effective learning model for students. This is because constructivism is a learning approach that emphasizes student activities in finding their own knowledge. Through the constructivist approach, students can seek their knowledge independently so that the knowledge possessed by students can increase and the talents and skills possessed by the students themselves can develop. Based on this, one of the important components in the constructivist approach is the use of the Discovery Learning learning model (Setyawati, 2019). The Discovery Learning model is a discovery with a teaching method that emphasizes individual teaching, object manipulation and others, before reaching the generalization stage. In this discovery learning activity, the teacher only acts as a facilitator and learning activities are focused on students (Junaedi, 2020). So that the teacher does not immediately draw conclusions from the learning process but gives students the opportunity to investigate, find out and solve existing problems themselves. With that opportunity, students will certainly be encouraged because of the curiosity possessed by each student. Through the learning process using the discovery learning model, it is believed that it can improve student learning outcomes. This statement is based on previous research which states that the discovery learning model can arouse students' enthusiasm in learning, so that students can contribute actively and analytically which will then have an impact on student learning outcomes (Abdjul, 2022). The discovery learning model has been studied, including (Widiadnyana, 2014) stating that there is a significant difference in the average value of students' understanding of concepts and scientific attitudes between groups of students who learn with the discovery learning model and students who learn with the direct teaching model. Students gave a positive response to the application of the discovery learning model (Ismawati, 2015).

METHOD

This research is a type of experimental research using a quantitative approach. Experimental research is a research conducted to determine the effect of giving a treatment or treatment to the research subject, or also research that aims to determine whether or not there is an effect of something imposed on the research subject. This research will be conducted in class XI MIA SMAN 1 Sidikalang which is located at Jl. F.L Tobing, Sidikalang City, Dairi Regency, North Sumatra Province 22218. The research time was carried out in the odd semester of the 2024/2025 school year, namely in November - January 2025 which consisted of 8 classes where the number of students was

152 Jurnal Pendidikan dan Pembelajaran Kimia, Vol. 14, No. 1 April 2025 Page 149-157

240 students from 8 classes for science majors. The technique of determining the selection of samples used in this study is the random sampling technique. The test instrument used in this study is a test of student chemistry learning outcomes, namely pretest and posttest. The pretest was given to the sample before the treatment was carried out which aims to determine the homogeneity and normality or initial abilities of students. Then the posttest was given after the treatment was completed with the aim of determining student learning outcomes. The form of the learning outcome test used was multiple choice consisting of 20 questions about reaction rates with five answer choices, namely A, B, C, D and E.

Data collection techniques are methods that can be done by researchers with the aim of obtaining data as research results. The data collection technique used in this study is a learning outcome test consisting of a pre-test and post-test. The questions are validated by the relevant Expert Validator, then tested on students to calculate the validity and reliability of the questions used. The test is used in the form of a pretest and posttest using the same questions. The implementation of this test is used with the aim of measuring student learning outcomes before and after being given treatment with the Discovery Learning and Conventional learning models with reaction rate material.

The procedures in this study are conducting a pretest to the experimental class and control class with the aim of determining students' initial abilities in the material taught before being given treatment, managing the pretest results to see the initial abilities, normality and homogeneity of the sample before being given treatment, providing treatment to the experimental class by implementing learning with the Discovery Learning learning model and providing treatment to the conventional learning model and after the learning process given in the experimental class is complete, the next stage is to provide a post-test to both classes to measure learning outcomes.

From the results obtained, then the data processing of the increase in learning outcomes (N-Gain) was analyzed statistically with the right-sided t-test (one-sided). Then before the hypothesis test was carried out, the prerequisites were first carried out, namely the normality test and the homogeneity test. And then the hypothesis test was carried out to determine whether there was an influence of the discovery learning model on improving student learning outcomes.

RESULT AND DISCUSSION

This study consists of independent variables, namely the Discovery Learning (DL) learning model and the dependent variable is the improvement of chemistry learning outcomes of class XI students on the Reaction Rate material. The research data were processed using Microsoft Excel. The improvement in learning outcomes was measured using a question instrument consisting of 20 multiple choice questions about the reaction rate. Analysis of research data that has been conducted at SMA Negeri 1 Sidikalang using Microsoft Excel. There are 4 types of tests that will be carried out, namely the N-Gain test, Normality Test, Homogeneity Test and Hypothesis Test.

1. N-Gain Test

The N-Gain test aims to measure the level of understanding possessed by students after the pretest and posttest (Wigati,2015). The results of this N-Gain are used as a comparison between before and after learning.

Table 1. N-gain test data			
Data	Statistics	Control	Experiment
Pretest	Minimum Value	15	25
	Maximum Value	45	60
	Average	32,63	47,91
	Variance	47,83	77,83
	Standard Deviation	6,91	8,82
Postest	Minimum Value	60	70
	Maximum Value	90	90
	Average	76,25	85,69
	Variance	53,39	43,07
	Standard Deviation	7,30	6,91

Based on the table above, the difference in the average pretest and posttest scores for the control and experimental classes can be described in the following graph:



Based on the image above, it can be seen that the pretest and posttest values in the control class and the experimental class are different. The pretest and posttest values in the experimental class that was taught using the discovery learning model were higher than the control class.

Table 2. Average Improvement in Learning Outcomes				
Class	Criteria	Gain	%Gain	Keterangan
Control class	G<0,3= Low	0,70	70%	Medium
Experiment	$0,3 \leq G \leq 0,7$	0,80	80%	High
class	=Medium			
	G > 0,7 = High			

Based on the table above, it can be seen that the increase (gain) in learning outcomes in the experimental class was higher than in the control class.

2. Normality Test

The normality test is used to see whether the increase data to be analyzed is normally distributed or not. The normality test used in this study is the Chi Square test. If the obtained X^2 count $< X^2$ table then the data is declared normal, and vice versa if the obtained X^2 count $> X^2$ table then the data is declared abnormal (Puspalita, 2017).

154 Jurnal Pendidikan dan Pembelajaran Kimia, Vol. 14, No. 1 April 2025 Page 149-157

Table 5. Normanty Test Results				
Kelas	Data	X ² hitung	X ² tabel	Information
Control	Pretest	4,76	11,07	Normally Distributed
Class	Postest	9,26	11,07	Normally Distributed
Experiment	Pretest	6,23	11,07	Normally Distributed
Class	Postest	10,07	11,07	Normally Distributed
				2

Table 3. Normality Test Results

So it can be concluded that the calculated X^2 value $< X^2$ table, where the X^2 table value at the significance level $\alpha = 0.05$ with db = 5 is 11.07.

3. Homogenity Test

If the normality test obtains normally distributed data, then the homogeneity test will be carried out (Sukestiyarno,2017). The homogeneity test is used to test whether the distribution of data from two or more variants comes from a homogeneous population or not, namely by comparing two or more variants. If Fcount <Ftable with a level of $\alpha = 0.05$, then H₀ is accepted or the data is homogeneous (Silitonga, 2014). In the homogeneity test, if Fcount > Ftable, then the data is homogeneous.

Table 4. Homogeneity Test Results				
Data	Kelas	Fhitung	Ftabel	Information
Pretest	Control Class	1,68	1,74	Homogeneous Data
	Experiment Class			
Postest	Control Class	0,57	1,74	Homogeneous Data
	Experiment Class			

Based on table 4, it can be seen that the pretest and posttest data are homogeneous, therefore this data can be used to conduct hypothesis testing.

4. Hypothesis Test

Hypothesis testing is used to test whether the truth can be accepted or rejected by using a one-sided t-test (right side). The decision-making criteria are carried out in hypothesis testing "If the t-count value is in the critical area (H0 rejection area) then the decision taken is to reject H_0 and accept H_a (Farisi,2017).

Та	ble 5. Hypothe	esis Test Resul	lts
Data	Thitung	T _{tabel}	Information
Pretest-Postest	23,43	2,03	Ho ditolak, Ha diterima

Based on the results of the hypothesis test above, it was obtained that tcount> ttable, which is 23.43. So it can be concluded that Ho is rejected and Ha is accepted. This means that there is an influence of the Discovery Learning learning model on improving students' chemistry learning outcomes on the reaction rate material.

The increase in learning outcomes in the experimental class was higher compared to the control class. This difference is caused by the mechanism of learning implementation in both classes. In the experimental class with the discovery learning model with the aim of learning emphasizing learning activities through student work activities. In accordance with the Regulation of the Minister of Education and Culture of the Republic of Indonesia number 22 of 2016, the learning process in educational units is carried out interactively, inspiringly, fun, innovatively, motivatingly, challengingly, calmly and actively participating. By actively participating in learning, students are able to find knowledge optimally. If the learning model used in teaching a subject matter is appropriate, then student learning outcomes also tend to be better. The results of the researcher's observations during the study showed that the enthusiasm and understanding of students taught with the Discovery Learning learning model were better when compared to students taught using conventional learning models. The difference can be seen from the results of student learning and student activity during the learning process (Kadri, M, & Rahmawati, 2015).

Based on the description above, the results of this study indicate that there is a difference between the discovery learning model and conventional learning on student learning outcomes in the reaction rate material. The significant difference in learning outcomes between the experimental class and the control class is caused by the use of the discovery learning model in the experimental class. The discovery learning model has syntax or phases in learning that are not owned by conventional learning. The discovery learning model emphasizes the process of full student involvement in order to find the material being studied and relate it to real life situations so as to encourage students to be able to apply it in everyday life, in the discovery learning process students do not only act as recipients of lessons through verbal teacher explanations, but students play a role in finding the core of the subject matter themselves.

Student activity in learning using the discovery learning model is a process that begins with the stimulation stage, problem identification, data collection, data processing, verification and generalization. These learning steps encourage students to be more active in the classroom. Learning outcomes with the discovery learning model are better than conventional models. This is in accordance with Bruner's opinion (in Hosnan, 2014:281) that discovery learning is a model for developing active student learning methods by finding information themselves so that the results obtained are not easily forgotten by students. The discovery learning model makes students more active in learning, because with this model, the knowledge and skills obtained by students are expected not to be the result of remembering a set of facts, but the result of finding them themselves. With this model, students can also work together in groups. The level of understanding obtained by students is deeper because students are directly involved in the process of finding answers to existing problems and directly practicing them so that the learning process is more effective and efficient.

This study is also supported by Putrayasa (2014) who stated that the Discovery model can improve the learning outcomes of students who have high learning interests. Based on the results of this study, it is stated that the application of Discovery Learning to improve student learning outcomes is running well, students look more enthusiastic and interested in following lessons, and can increase student activity which is shown through cooperation in groups using teaching aids, presentations, and asking questions also increases.

CONCLUSION

Based on the results of the research and data obtained that have been carried out, it can be concluded that there is an influence of the Discovery Learning learning model on improving students' chemistry learning outcomes on the reaction rate material with a significant level of $\alpha = 0.05$ with tcount > ttable, namely 23.43> 2.03, which means that H_a is accepted and H₀ is rejected.

156 Jurnal Pendidikan dan Pembelajaran Kimia, Vol. 14, No. 1 April 2025 Page 149-157

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