



The Effect of Discovery Learning Model on Improving Students' Motivation and Learning Outcomes in Class X on Chemical Bonding Material

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Abstract: The Effect Of Discovery Learning Model On Improving Student's Motivation and Learning Outcomes In Class X On Chemical Bonding Material. This study aims to determine the influence of the discovery learning model on increasing student motivation and learning outcomes in chemical bonding material. This study was conducted at SMA Swasta Gelora Pancasila Pegajahan, Pegajahan District, Serdang Bedagai Regency. The sample used was students of class X-2 as the experimental class or group and class X-1 as the control class. The instrument used in this study was a test instrument in the form of a multiple-choice objective test to see student learning outcomes obtained through a posttest and a questionnaire in the form of a statement to see student learning motivation. The results of the study showed that there was an influence of the discovery learning model on increasing student motivation and learning outcomes in chemical bonding material. This can be seen from the results of the posttest hypothesis test using the t-test obtained that $t_{count} > t_{table} = 5.77 > 1.671$. The results of student learning motivation using the t-test obtained that $t_{count} > t_{table} = 2.26 > 1.671$. The relationship between motivation and student learning outcomes shows that the correlation is 0.861 (very high correlation).

Keywords: Chemical Bonding, Discovery Learning.

Abstrak: Pengaruh Model Pembelajaran Discovery Learning Terhadap Peningkatan Motivasi dan Hasil Belajar Siswa Kelas X Pada Materi Ikatan Kimia. Penelitian ini bertujuan untuk mengkaji pengaruh model pembelajaran Discovery Learning terhadap motivasi dan hasil belajar siswa pada materi ikatan kimia. Penelitian ini menggunakan desain kuasi eksperimen dengan melibatkan dua kelompok siswa kelas X di SMA Swasta Gelora Pancasila. Kelompok eksperimen memperoleh pembelajaran menggunakan model Discovery Learning, sementara kelompok kontrol menggunakan metode konvensional. Pengumpulan data dilakukan melalui tes pilihan ganda untuk mengukur hasil belajar dan angket untuk menilai motivasi belajar siswa. Hasil penelitian menunjukkan bahwa penerapan model Discovery Learning mampu meningkatkan motivasi dan hasil belajar siswa secara signifikan. Temuan ini menunjukkan pentingnya penerapan model pembelajaran yang berpusat pada siswa guna meningkatkan keterlibatan aktif dan pemahaman konseptual dalam pembelajaran kimia.

Kata kunci: Ikatan Kimia, Discovery Learning, Hasil Belajar.

▪ INTRODUCTION

Good quality learning greatly influences the development of students' knowledge and skills, thus producing human resources who are ready to face global challenges. In addition, the use of innovative learning methods is an urgent need to continue to improve the quality of education, because this will create human resources who not only have knowledge, but also the ability to innovate and adapt in the world of work (Lestari & Nuryanti, 2022).

The challenges of learning in the 21st century are greatly influenced by technological advances and globalization that require students to have critical, analytical, and creative thinking skills. Traditional learning approaches, which tend to be passive, are often inadequate in meeting the needs of these skills. As a result, students' adaptability and competitiveness in facing global demands are less than optimal. This requires a change in the learning paradigm to be more dynamic and interactive, with a focus on developing high-level thinking skills (Absor, 2020).

The results of this study indicate that the application of the Discovery Learning model had a significant impact on students' learning outcomes and motivation in the topic of chemical bonding. This is evident from the increase in the average post-test score in the experimental class (78.17), compared to the control class (64.00). Similarly, the average learning motivation score in the experimental class (75.80) was also higher than that of the control class (64.63). These findings align with the study conducted by (Agustina dkk., 2024) in the *Jurnal Pendidikan dan Pembelajaran Kimia*, which found that Discovery Learning effectively enhanced student engagement and motivation by fostering independent exploration and active learning participation.

Furthermore, the findings of (Zuliana dkk., 2014), also published in the same journal, support the notion that activity-based and inquiry-driven instructional models such as Discovery Learning significantly improve students' conceptual understanding, especially in abstract topics like chemical bonding. In summary, the findings of this research not only reinforce previous studies but also highlight the potential of Discovery Learning as an effective instructional strategy for improving both cognitive and affective learning outcomes, particularly in the context of complex chemistry topics.

Based on the results of interviews and observations that have been conducted on several students of class X IPA of SMA Swasta Gelora Pancasila, there are still students who have not been able to understand the material on Chemical Bonding as seen from the data on student test results. The students seemed bored while studying, which was caused by the use of conventional learning models by the teacher. As a result, students obtained low learning outcomes with an average student score of 70 with a KKM value of 75. The average score results came from assignments or tests. Conventional learning (such as lectures) tends to rely only on teacher activity and ability, while students just sit still receiving the material presented. As a result, the learning process becomes boring and students become passive, so that the subject matter presented by the teacher cannot be understood properly by students. This situation contributes to their low learning outcomes.

Choosing the right model is important to attract students' attention and increase learning effectiveness. In an effort to improve student learning outcomes, a fun learning process is needed, which can stimulate students' activeness and enthusiasm to be actively and creatively involved during learning. To overcome this problem, it is necessary to

apply the right learning model so that learning outcomes can improve. One of the models that is suitable for use is the Discovery Learning Learning Model.

The Discovery Learning learning model is an approach that encourages students to find knowledge through independent exploration and investigation. This concept places students as active learning subjects seeking solutions to problems given by educators, not just passively receiving information. Discovery Learning is designed to develop deep understanding through direct learning experiences, where students are given the opportunity to hypothesize and test their own conclusions (Ardhini, et al., 2021).

This model emphasizes the process of independent exploration by students to discover concepts, which is expected to improve understanding, active involvement, and learning creativity (Strauning, 2023). This model also helps students develop deep understanding through active exploration, which also improves critical thinking skills and interest in science (Syarifah & Ami, 2021).

Learning motivation is an internal and external drive that drives a person to participate in the learning process, maintain their efforts, and achieve learning goals (Darniyanti & Saputra, 2021).

Low learning outcomes are inseparable from low learning motivation. The learning process will not run well if students' motivation is lacking. This knowledge should be obtained through observation, experience, and independent investigation, by utilizing available facilities. Therefore, students who actively participate with a high level of learning motivation in the learning process can develop learning methods, as well as improve their ability to plan, implement, and assess the learning process itself. The discovery learning model is one of the best solutions that can be used to improve students' learning outcomes and learning motivation in chemical bonding material.

▪ METHOD

Research Design

This study followed the quasi-experimental pretest-posttest control group design commonly adopted in educational research (Halidjah, 2020). The purpose of this design was to assess the effect of the Discovery Learning model on students' motivation and learning outcomes in chemical bonding material. Two classes were selected as the research samples: one class served as the experimental group, which received the Discovery Learning model, while the other class served as the control group, which was taught using conventional teaching methods.

Research Location and Time

The research was conducted at SMA Swasta Gelora Pancasila, located at Jl. Dusun Harapan, RT 0/RW 0, Pegajahan District, Serdang Bedagai Regency, North Sumatra Province. The study was carried out during the even semester of the 2024/2025 academic year.

Population and Sample

The population of this study included all students of Grade X IPA at SMA Swasta Gelora Pancasila Pegajahan, which consisted of four classes (X IPA 1 to X IPA 4), each comprising 30 students. Two classes were selected as samples using purposive sampling,

with one class designated as the experimental group and the other as the control group, considering accessibility and data collection efficiency.

Data Collection Techniques

There are 2 data collection techniques used in this study, namely test and non-test data collection techniques. The test data used are in the form of multiple choice questions with a total of 30 questions covering cognitive aspects with 5 choices (a, b, c, d, e) to measure the improvement of learning outcomes. Test data is carried out 2 times, namely at the beginning of learning (pretest) and at the end of learning (post-test). The result were processed using the established criteria.

The formula for calculating the final score (post-test) for learning outcomes.

$$Mark = \frac{\text{and au}}{\text{aiu au}} 100\%$$

For non-test data collection techniques, observations were conducted using a questionnaire containing 20 statements with a Likert scale (scale 5), namely Strongly Agree (SS), Agree (S), Disagree (KS), Disagree (TS) and Strongly Disagree (STS). These results are processed using the following calculations:

$$Mark = \frac{\text{and au}}{\text{aiu a}} 100\%$$

Table 1. Level of learning motivation

Percentage of Student Learning Motivation	Interpretations
<20,00	Motivation is very low
21,00 - 40,00	Low Motivation
41,00 - 60,00	Enough Motivation
61,00 - 80,00	High Motivation
81,00 - 100	Very High Motivation

▪ RESULT AND DISCUSSION

The data in this study were collected through research activation at SMAS Gelora Pancasila Pegajahan using two different classes, namely one class an experimental class taught using discovery learning model and another class as a control class taught using conventional methods. Before learning using different learning models in each class, a pre-test was first conducted to determine students' initial abilities in the subject of chemical bonding. The result of this study obtained an a average pre-test value of the experimental class, namely 38,00 and average pre-test value of the control class namely 39,33. After knowing how the students' initial abilities were, different learning was

carried out. At the end of learning, students were given a post-test and filled out a student learning motivations questionnaire to determine the learning outcomes and motivation of the two group of students after being treated. The results of the study obtained an average post-test value of the experimental class, namely the class that used discovery learning models was 78,17 and an average post-test value of the control class used conventional model was 64,00. The average motivation to learn chemistry of student in the experimental class is 75,80 and the average value of motivation to learn chemistry of students in the control class is 64,63. Furthermore, before conducting a hypothesis test to determine whether or not there is an influence of discovery learning model, a data pre-requisite test is first conducted.

1. Normality Test

Data normality test was carried out using the chi-square test, it was obtained that the post-test values of both sample groups had normal data or χ^2 count $<$ χ^2 table at a significance level of 0,05 for the experimental class and the control class, then it can be started that the data is normally distributed as shown in table 4.2 below.

Table 2. Post-test Data Normality Test

NO	Data	χ^2 count	χ^2 table	Conclusion
1.	Post- Test Experimental Class	4,00	7,815	Normal
1.	Post – Test Control Class	4,63	7,815	Normal

2. N-Gain Test Result of Student Learning Outcome Data

The Purpose of this study was to conducted an n-gain analysis to measure the improvement of student performance in learning by comparing the scores from the pre-test and post-test of students in the experimental and control classes. In the experimental class, there was an increase in learning outcomes of 0.65 (65%). In the control class, there was an increase in student achievement of 0.41 (41%).

Table 3. N-Gain Calculation of Experimental Class

Pre - Test	Post - Test	N	Gain	Interpretation
38,00	78,17	30	0,65	Sedang

Table 4. N-Gain Calculation of Control Class

Pre - Test	Post - Test	N	Gain	Interpretensi
39,33	64,33	30	0,41	Sedang

3. Homogeneity Test

The calculation results for the homogeneity test for the posttest data of the two experimental and control classes by comparing $F_{\text{count}} < F_{\text{table}}$ at a significance level =

0.05 can be seen in table 5 below.

Table 5. Sample Homogeneity Test

Data Source	Class	S ²	F _{count}	F _{table}	Information
Post-test	Experimen	62,09	1,74	1,86	Homogenous
	Control	108,16			Homogenous

S² = Sample Variance; $F_{\text{Table}} = \text{db } (n_1 - 1), (n_2 - 1) (\alpha = 0.05)$. For the post-test value of the experimental class and the control class based on the value table for the F distribution with a real level = 0.05 and numerator db 29 and denominator db 29 so that $F_{\text{table } 0.05 (29.29)} = 1.86$ Because the F_{count} value $< F_{\text{table}}$, it can be concluded that the post-test data of the two classes are homogeneous.

4. Hypothesis Test 1

After the data is known to be normally distributed and homogeneous, a hypothesis test can be carried out using a statistical test, namely the right-hand t-test using Microsoft Excel 2013. This test is to determine whether the hypothesis in this study is accepted or rejected, the test criteria if $t_{\text{count}} < t_{\text{table}}$ then H_0 is accepted, with degrees of freedom (db) = $n - k$ and = 0.05. Hypothesis test data can be seen in table 6 below.

Table 6. Post-Test Data Hypothesis Test

Class Data	t _{count}	t _{table}	Information
Experimen			
Post - Test			
$\bar{x} = 78,17$			
$S = 7,88$			
$S^2 = 62,09$			
Control	5,77	1,671	Ha accapted, H0 rejected
Post - Test			
	<u>$\bar{x} = 64,33$</u>		
$S = 10,40$			
$S^2 = 108,16$			

From the t distribution data, $t_{table} = 1.671$ was obtained, while based on the calculation, the calculated t value was obtained = 5.77, meaning that H_0 was rejected and H_a was accepted. Based on this analysis, it means that there is an influence on the chemistry learning outcomes of students who are taught using the discovery learning model on the topic of chemical bonds.

5. Hypothesis II

Correlation analysis is used to measure how close the relationship is between motivation and student learning outcomes using a simple correlation test (r_{xy}) using product moments. This test is conducted to determine whether the hypothesis in this study is accepted or rejected. The test criteria if $r_{hit} > r_{table}$ then H_0 is rejected, so H_a is accepted which means the correlation coefficient tested is significant. The correlation test data can be seen in table 7 below.

Table 7. Correlation Test of Student Motivation to Learning Outcomes

Class	Class Data	r_{count}	r_{table}	Information
Experimen	$\sum X^2 = 174034$ $(\sum X)^2 = 5171076$ $\sum Y^2 = 183700$ $(\sum Y)^2 = 5475600$ $\sum X\sum Y = 5321160$ $\sum XY = 178580$	0,861	0,361	H_a accapted, H_0 rejected
Class	Class Data	r_{count}	r_{table}	Information
Control	$\sum X^2 = 127595$ $(\sum X)^2 = 3759721$ $\sum Y^2 = 127300$ $(\sum Y)^2 = 3724900$ $\sum X\sum Y = 3742270$ $\sum XY = 127255$	0,941	0,361	H_a accapted, H_0 rejected

Based on table 7 in the control class, $r_{count} = 0.941$ was obtained while r_{table} at $\alpha = 0.05$ ($N = 30$) was 0.361. Because $r_{count} > r_{table}$, H_0 is rejected, which means H_a is accepted, meaning there is also a positive and significant correlation between learning motivation and learning outcomes with conventional learning. Based on the coefficient, the r_{count} obtained is 0.941, so the correlation meaning is very high. While in the experimental class, $r_{count} = 0.861$ was obtained and r_{table} at $\alpha = 0.05$ ($N = 30$) was 0.361. Because $r_{count} > r_{table}$, H_0 is rejected, which means H_a is accepted, meaning there is a positive and significant correlation between learning motivation and learning outcomes using the Discovery Learning learning model.

Based on the coefficient, the r count obtained is 0.861, so the correlation meaning is very high.

6. Student Motivation Calculation

The calculation results can be directly searched from the average value of learning motivation obtained by students for each class (experimental class and control class). The presentation of the data can be seen in table 8 below.

Table 8. Average Student Motivation Score

Realm	Class	Average
Motivation	Experimen	75, 80
	Control	64, 63

Based on the results presented above, it is evident that the Discovery Learning model has a significant positive impact on students' learning outcomes and motivation in the topic of chemical bonding. The increase in post-test scores and the higher average motivation score in the experimental class support this conclusion. These findings are in line with the study by Agustina, Sabtiawan, and Mujiyanto (2024) in the *Jurnal Pendidikan dan Pembelajaran Kimia*, which found that the Discovery Learning model effectively enhances students' active engagement and motivation by encouraging independent exploration and participatory learning. Moreover, Darniyanti and Saputra (2021) emphasized the critical role of learning motivation in academic success, stating that motivated students are more likely to stay focused, persistent, and achieve better learning outcomes. Therefore, the results of this study reinforce existing research and confirm that Discovery Learning is an effective instructional model not only for improving cognitive achievement but also for fostering students' motivation in learning chemistry.

▪ CONCLUSION

The implementation of the Discovery Learning model has proven to significantly improve both students' motivation and learning outcomes in the topic of chemical bonding. This finding highlights the importance of employing active learning approaches that promote independent discovery and student engagement. Discovery Learning not only enhances conceptual understanding but also encourages students to take ownership of their learning process. Therefore, this model can serve as an effective alternative teaching strategy for improving the quality of chemistry education at the senior high school level.

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