



The Effect of Problem Based Learning Model on Learning Motivation and Student Learning Outcomes on Reaction Rate Material in Class XI SMA Pencawan Medan

Adelina Monica Sebayan*, Elfrida Ginting

Chemistry Education, Department of Chemistry, Faculty of Mathematics and Natural Sciences (FMIPA),
Universitas Negeri Medan.
Jalan Willem Iskandar Pasar V, Medan, Indonesia.

*Corresponding e-mail: adelinasebayang5@gmail.com

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Abstract: The Effect of Problem Based Learning Model on Learning Motivation and Student Learning Outcomes on Reaction Rate Material in Class XI SMA Pencawan Medan.

This study aims to determine the effect of the Problem Based Learning (PBL) learning model in increasing student learning motivation and learning outcomes on Reaction Rate material, as well as to determine the existence of a significant correlation between learning motivation and increased student learning outcomes in the PBL learning model. This research was conducted at SMA Pencawan Medan. The samples used were class XI-1 as the experimental class and class XI-2 as the control class. The research method used in this study was an experimental method, which compared the results between the experimental class and the control class with different treatments. The instruments used in this study were test instruments in the form of multiple choice objective tests to see students' initial abilities obtained through pretests and student learning outcomes obtained through posttests. The results of the study indicate that the Problem-Based Learning model has an effect on increasing student motivation and learning outcomes. This can be seen from the results of the posttest hypothesis test, which obtained a Sig. (2-tailed) value of $0.001 \leq \alpha (0.05)$. Based on the results obtained, there is a significant correlation between learning motivation and increased student learning outcomes in the Problem-Based Learning model. The relationship between motivation and student learning outcomes shows that the correlation is 0.968.

Keywords: Reaction rate, problem based learning learning motivation

Abstrak: Pengaruh Model Pembelajaran Problem Based Learning Terhadap Motivasi Belajar dan Hasil Belajar Siswa Pada Materi Laju Reaksi Di Kelas XI SMA Pencawan Medan.

Penelitian ini bertujuan untuk mengetahui pengaruh model pembelajaran Problem Based Learning (PBL) dalam meningkatkan motivasi belajar dan hasil belajar siswa pada materi Laju Reaksi, serta untuk mengetahui adanya korelasi yang signifikan antara motivasi belajar dengan peningkatan hasil belajar siswa pada model pembelajaran PBL. Penelitian ini dilakukan di SMA Pencawan Medan. Sampel yang digunakan adalah kelas XI-1 sebagai kelas eksperimen dan kelas XI-2 sebagai kelas kontrol. Metode penelitian yang dilakukan dalam penelitian ini adalah metode eksperimen, yaitu dengan membandingkan hasil antara kelas eksperimen dan kelas kontrol dengan perlakuan yang berbeda. Instrumen yang digunakan pada penelitian ini adalah instrumen tes berupa tes objektif pilihan berganda untuk melihat kemampuan awal siswa yang didapat melalui pretest dan hasil belajar siswa yang didapat melalui posttest. Hasil penelitian menunjukkan bahwa terdapat pengaruh model pembelajaran Problem Based Learning dalam meningkatkan motivasi dan hasil belajar siswa. Hal ini dapat dilihat dari hasil uji hipotesis

posttest yang diperoleh nilai Sig. (2-tailed) sebesar $0,001 \leq \alpha (0,05)$. Berdasarkan hasil yang diperoleh, terdapat korelasi yang signifikan antara motivasi belajar dengan peningkatan hasil belajar siswa pada model pembelajaran Problem Based Learning. Hubungan antara motivasi dengan hasil belajar siswa menunjukkan bahwa korelasinya sebesar 0,968.

Kata kunci: *Laju reaksi, problem based learning, motivasi belajar*

■ INTRODUCTION

Learning is a process where there is interaction between learners and educators and learning resources in an educational environment. This process is a form of assistance provided by educators to enable learners to acquire knowledge and knowledge, master skills and habits, and form attitudes and beliefs. In other words, learning is an effort to help students to learn optimally (Ubabuddin, 2019). Success in achieving learning objectives is influenced by many factors, including the role of teachers in the teaching and learning process. Teachers have a direct influence in shaping, developing, and improving students' intelligence and skills. Therefore, it is expected that teachers have effective teaching approaches and models, and are able to choose learning methods that are in accordance with the concepts and materials being taught (Ramadhani, et al., 2024).

Reaction rate material is one of the difficult material topics with concepts and calculations that cause students to be lazy to take part in chemistry learning, thus causing student learning outcomes in taking chemistry lessons to be low (Solehah, et al., 2024). Although the reaction rate is close to our daily lives, there are still many students who have difficulty in learning it and have low learning outcomes. This is because the reaction rate is a complex material because of the combination of abstract knowledge in the form of reaction rate equations, reaction orders, factors that affect reaction rates, and collision theory (Basi, et al., 2023).

Based on the results of observations and interviews with teachers and grade XI students at SMA Pencawan Medan, it was found that the school has implemented the Merdeka Curriculum and uses teaching materials in the form of printed books from the Ministry of Education and Culture. In the chemistry learning process, the teacher has tried to apply the Discovery Learning model, but its application is still rare due to the lack of student participation. Most of the learning uses more lecture methods and teacher-centered learning, accompanied by discussions and questions and answers. This condition causes student participation in the class to be low so that student understanding of the material becomes less than optimal.

In addition, based on interviews with several students, the problem of low interest in learning chemistry subjects, especially in reaction rate material, was found. This is influenced by limited learning facilities and infrastructure, where the media used are only power point (PPT) and school handbooks. As a result, the learning atmosphere becomes passive so that students are easily bored, less interested, and even sleepy during the learning process.

Based on the problems at school, one of the appropriate learning models according to the above problems is a learning model that involves students actively and helps students' analytical processes and understanding, and orientates students in the problem so as to increase students' interest and learning outcomes. One of the appropriate learning models to be applied is the Problem Based Learning model. The Problem Based Learning model is a teaching method that emerged from the practice of collaborative problem

solving. Students are given challenges from the beginning of learning so that learners constantly use the knowledge gained in addition, and the teacher only becomes a facilitator for students (Santika, et al., 2024).

■ METHOD

Research Location and Time

This research was conducted at Pencawan Medan High School, Jalan Bunga Ncole No 50, Kemenangan Tani, Medan Tuntungan, Medan City, North Sumatra 20136, Indonesia. The research time was carried out in the span of December-March 2025 in class XI even semester of the 2024/2025 academic year.

Research Subjects and Objects

The population in this study were all 11th grade students of Pencawan High School consisting of 2 classes, namely XI-1, XI-2. With a total of 70 students. The sample in this study is class XI-1 which will be the experimental class and class XI-2 which will be the control class and is the total sample in this study.

Type and Design of Research

This study used two classes, namely the eksperimental class and the control class. Both classes were given treatment in the form of a pre-test to measure the initial conditions between the two classes before being given treatment. Both classes were also given treatment in the form of a post-test to determine the final condition after being given treatment using the Problem Based Learning (Silitonga, 2014).

Data Collection Techniques

There are 2 data collection techniques used in this study, namely test and non-test data collection techniques. Test data used in the form of multiple choice questions with a total of 40 questions covering cognitive aspects with 5 choices (a, b, c, d, e) to measure the improvement of learning outcomes. The test data was conducted twice, namely at the beginning of learning (pretest) and at the end of learning (post-test). The results are processed by calculating the average value of pretests and posttests from each class

For non-test data collection techniques used to measure student learning motivation, a questionnaire containing statements with a Likert scale, namely with the choice of STS: 1, TS: 2, S: 3, and SS: 4 (Miranda 2019).

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 activities at SMA Pecawan Medan using two different classes, where one class was used as an experimental class and one control class. The experimental class was taught using the Problem Based Learning learning model, while the control class used conventional methods. before the learning began, students were given a pretest first to measure the initial ability of students before learning. The results of this study obtained the average value of the experimental class pretest of 34.00 and the average value of the control class pretest of 33.43. After knowing the initial ability of students, different learning is carried out. At the end of the learning, students were given a post-test and filled out a student learning motivation questionnaire to find out the learning outcomes and motivation of the two groups of students after being treated. the results of this study obtained the average post-test score in the experimental class of 87.20 and the average post-test in the control class of 79.91. The average motivation of students learning chemistry in the experimental class is 94.14 and the average value of student learning motivation in the control class is 86.40. next, before conducting hypothesis testing to determine whether or not there is an effect of the Problem Based Learning learning model, the data prerequisite test is first carried out.

1. Normality Test

Normality tests were conducted to determine whether the data obtained was normally distributed or not. Normality testing was performed using IBM SPSS 21 For Windows software with Shapiro Wilk at a significance level of 0.05. Based on the test results, data was considered normal if the sig value was > 0.05 and vice versa, if the sig value was ≤ 0.05 , then the data was not normal.

The significance value of student learning motivation after learning in the experimental and control classes is both greater than 0.05, indicating that the data is normally distributed. as shown in table 3 below.

Table 2. Normality Test Learning Outcomes

Kelas	Perlakuan	Sumber Data	Shapiro-Wilk (Sig)	Keterangan
Eksperimen	Menggunakan model <i>Problem Based Learning</i>	N-gain	0,916	Normal
Kontrol	Menggunakan metode konvensional	N-gain	0,985	Normal

Tabel 3. Normality Test Learning Motivation

Kelas	Shapiro-Wilk		
	Statistic	df	Sig
Eksperimen	0,957	35	0,188
Kontrol	0,967	35	0,371

2. Homogeneity Test

In the research, the data homogeneity test was carried out using SPSS version 21 through the Levene statistical test with a significance level of 0.05. The criteria taken based on the test, if $\text{sig} > 0.05$ then the data is considered homogeneous. Based on the

research, the significance value of the data on the improvement of learning outcomes of the experimental class and control class is $0.779 > 0.05$, which means that the data is homogeneous. The homogeneity test of learning motivation also obtained a significance value of student learning motivation in the experimental class and control class of $0.282 > 0.05$, which means that homogeneous data can be seen in tables 3 and 4.

Tabel 3. Homogenitas Test Learning Outcomes

Sumber Data	Levene Statistic	df1	df2	Sig.	Keterangan
N-Gain	0,079	1	68	0,779	Homogen

Tabel 4. Homogenitas Test Learning Motivation

Sumber Data	Levene Statistic	df1	df2	Sig.	Keterangan
N-Gain	1,177	1	68	0,282	Homogen

3. Linearity Test

In the linearity test, the data was analyzed using SPSS version 21 with a significance level of Deviation from Linearity > 0.05 , indicating a significant linear relationship between the learning motivation variable and student learning outcomes. Conversely, if the significance value of Deviation from Linearity < 0.05 , then the relationship between learning motivation and learning outcomes is not significantly linear. Based on Table 5, the calculated F value (0.301) is smaller than the F table (3.98) which indicates a linear relationship between learning motivation and improving student learning outcomes. The significance value of Deviation from Linearity of $0.985 > 0.05$ indicates that the relationship between learning motivation and improved learning outcomes is significantly linear.

Tabel 5. Linearity Test

	F Hitung	F Tabel	Sig. Deviation from Linierity	Keterangan
Motivasi dan Hasil Belajar	0,301	3,98	0,985	Linier

4. Hypothesis 1

Hypothesis testing was carried out using data on increased learning motivation (N-gain). Based on the research the value of Sig. (2-tailed) value of 0.001, based on hypothesis testing criteria, if the significance value $\leq \alpha$ (0.05), then H_a is accepted and H_o is rejected. Thus, in the first hypothesis it can be concluded that H_a is accepted, meaning that there is an effect of the problem-based learning model on student learning motivation. Hypothesis test data can be seen in table 6 below.

Tabel 6. Results of Hypothesis Test Analysis of Student Learning Motivation

	<i>Independet Sample Test</i>				
	t	df	Sig. (2-tailed)	Mean Difference	Keterangan
Peningkatan Motivasi Belajar	5,335	68	0,001	0,07743	Ha diterima

The results of the study indicate that the increase in learning motivation taught using the PBL model is higher than that of students taught using conventional methods. The data was obtained through questionnaires filled out by students after learning. The increase in learning outcomes was due to the use of the PBL learning model, which attracted students' interest during the learning process and encouraged improved learning outcomes. These results are in line with research conducted by Vegetama (2018), who found that the use of the PBL model affects student learning outcomes and motivates them to learn. Research conducted by Kurniawati and Amarlita (2018) also found that the use of problem-based teaching materials had a higher average effect on student learning outcomes compared to before using teaching materials.

5. Hypothesis II

Data analysis was carried out systematically using SPSS version 21 after ensuring that the data were normally distributed and had homogeneous variations. Independent sample t test was conducted with an error rate of 5% and a confidence level of 95% ($\alpha = 0.05$). The test criteria is if the significance value $\leq \alpha$ (0.05), then Ha is accepted and Ho is rejected. Based on the research, the Sig. (2-tailed) of 0.000. Based on the hypothesis test criteria, if the significance value $\leq \alpha$ (0.05), then Ha is accepted and Ho is rejected. Thus, in the second hypothesis it can be concluded that Ha is accepted, so there is an effect of the problem-based learning model on student learning outcomes. Hypothesis test data can be seen in table 7 below.

Tabel 7. Results of Hypothesis Test Analysis of Student Learning Outcomes

	<i>Independet Sample Test</i>				
	t	df	Sig. (2-tailed)	Mean Difference	Keterangan
Peningkatan Hasil Belajar	8,509	68	0,000	0,07286	Ha diterima

This improvement in learning outcomes was due to the use of the PBL learning model, which was able to attract students' interest in learning during the learning process and encourage improved learning outcomes. These results are in line with research conducted by Vegetama (2018), which found that the use of the PBL model influenced student learning outcomes and motivated them to learn. Research conducted by Kurniawati and Amarlita (2018) also found that the use of problem-based teaching materials had an effect on higher average student learning outcomes compared to before using teaching materials.

6. Hypothesis III

Data analysis was conducted systematically using SPSS version 21 after ensuring that the data was normally distributed. The third hypothesis test tested whether students' learning motivation and learning outcomes were positively correlated using the problem-based learning model.

Tabel 8. Results of Correlation Test Analysis of Motivation and Learning Outcomes

Kelas	Correlations			
	r hitung	r tabel	Sig. (2-tailed)	Keterangan
Motivasi belajar dan Hasil Belajar	0,96	0,333	0,000	Ha diterima

Based on table 8, it shows that the rcount is 0.96 while the rtable is 0.333 at the significance level $\alpha = 0.05$. The rcount value of 0.96 indicates that the correlation level is very high (0.81-1.00). Based on the correlation test criteria, if the rcount > rtable value, Ha is accepted and Ho is rejected. Thus, in the third hypothesis it can be concluded that Ha is accepted, meaning that there is a positive correlation between learning motivation and learning outcomes of students taught with the problem-based learning model. These findings are in line with research conducted by several researchers, such as Sadirman (2011), who stated that learning motivation plays an important role in improving student learning outcomes. Other studies conducted by Aritonang and Zubir (2022) and Simorangkir (2021) also show that high learning motivation can improve student learning achievement. Thus, the results of this study reinforce previous findings that learning motivation plays an important role in improving student

■ CONCLUSION

In this study, it can be concluded that there is a significant effect of the Problem Based Learning model on student learning motivation in the subject of reaction rates in the class XI at Pencawan High School in Medan. There is an effect of the Problem Based Learning model on student learning outcomes in the subject of reaction rates in the class XI at Pencawan High School in Medan. There is also a significant correlation between learning motivation and improved student learning outcomes in the Problem Based Learning model.

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