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The Effect of Problem Based Learning Assisted by Quizizz on Students' Learning Outcomes in Salt Hydrolysis

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Abstract:The Effect of Problem Based Learning Assisted by Quizizz on Students' Learning Outcomes in Salt Hydrolysis. This study aimed to analyze the effect of Quizizz-assisted Problem-Based Learning (PBL) on students' learning outcomes in salt hydrolysis material. This study employed a true experimental design using a two-group pretest-posttest design. The population consisted of eleventh-grade students of SMA Negeri 10 Medan in the 2025/2026 academic year, comprising six classes. The sample was selected using random sampling, with class XI F-2 as the experimental class and XI F-6 as the control class. The research instrument consisted of 20 multiple-choice questions. The data were analyzed using n-gain and hypothesis testing with a t-test. The results showed that the n-gain values of the experimental and control classes were 0.72 (high category) and 0.62 (medium category), respectively. The hypothesis testing result showed that Sig. < 0.05, indicating that the learning outcomes of students in the experimental class were higher than those in the control class. Therefore, Quizizz-assisted Problem-Based Learning is effective in improving students' learning outcomes in salt hydrolysis material.

Keywords: Problem Based Learning,Quizizz,Learning outcomes,salt hydrolysis

Abstrak:Pengaruh Model Problem Based Learning (PBL) Berbantuan Quizizz Terhadap Hasil Belajar Pada Materi Hidrolisis Garam. *Penelitian ini bertujuan untuk menganalisis pengaruh model Problem Based Learning (PBL) berbantuan Quizizz terhadap hasil belajar siswa pada materi hidrolisis garam. Penelitian ini menggunakan True Experimental Design dengan jenis two group pretest-posttest design. Populasi penelitian adalah siswa kelas XI SMA Negeri 10 Medan tahun ajaran 2025/2026 yang terdiri dari enam kelas. Sampel diambil dengan teknik random sampling, yaitu kelas XI F-2 sebagai kelas eksperimen dan XI F-6 sebagai kelas kontrol. Instrumen penelitian berupa 20 soal pilihan ganda. Data dianalisis menggunakan n-gain dan uji hipotesis dengan uji t. Hasil penelitian menunjukkan bahwa nilai n-gain kelas eksperimen dan kelas kontrol berturut-turut sebesar 0,72 (kategori tinggi) dan 0,62 (kategori sedang). Hasil uji hipotesis menunjukkan bahwa nilai Sig. < 0,05, sehingga hasil belajar siswa pada kelas eksperimen lebih tinggi dibandingkan kelas kontrol. Dengan demikian, model PBL berbantuan Quizizz efektif dalam meningkatkan hasil belajar siswa pada materi hidrolisis garam.*

Kata kunci: *Problem Based Learning, Quizizz, hasil belajar, hidrolisis garam*

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▪ INTRODUCTION

The rapid development of science and technology in the 21st century requires education to produce creative, innovative, and competitive generations (Erlangga et al., 2021). In addition, 21st-century learning emphasizes the mastery of 4C competencies, namely critical thinking, communication, collaboration, and creativity (S. & Jatmiko, 2021). The achievement of these competencies is closely related to the teacher's role in selecting appropriate learning models and media, including the integration of digital technology in the learning process (Boentolo et al., 2024).

The selection of interactive learning models supported by appropriate media can improve student engagement and learning outcomes (Sutrisno in Prasetia & Sylvia, 2023). However, chemistry learning is still often dominated by conventional methods that make students passive. Chemistry itself is characterized by abstract and complex concepts, making it difficult and less attractive to students (Sih Agung Lumadya, 2024; Subagian in Simatupang, 2021). In fact, chemistry is closely related to everyday life, but uninteresting learning delivery often hinders students' conceptual understanding (Mudewaran et al., 2019; Refelita et al., 2023).

One of the most challenging topics in chemistry is salt hydrolysis, as it requires prior understanding of acid-base concepts and strong analytical skills (Suhita, 2021; Syafitri et al., 2022). Conventional teaching approaches further reinforce these difficulties, even though this topic has the potential to encourage active learning due to its relevance to real-life phenomena (Gusman et al., 2022).

Based on interviews conducted at SMA Negeri 10 Medan, the learning process is still less varied and tends to be monotonous, resulting in low student participation and difficulties in understanding salt hydrolysis. One alternative approach is the Problem Based Learning (PBL) model, which focuses on problem-solving and can improve students' critical thinking skills (Raman et al., 2024; Hung in Shofiya & Wulandari, 2018). In addition, the use of Quizizz as a game-based learning medium can increase student motivation and engagement through an interactive learning environment (Astari, 2023; Haddar & Juliano, 2021).

Several previous studies have shown that the implementation of Problem Based Learning (PBL) and the use of Quizizz media can improve students' learning outcomes and motivation in the learning process. However, most previous studies only focused on general learning outcomes and were not specifically conducted on chemistry topics that are considered difficult, such as salt hydrolysis. In addition, previous studies rarely integrated Problem Based Learning with Quizizz simultaneously in chemistry learning at the senior high school level. Therefore, this study positions itself as an effort to fill the research gap by examining the effect of Quizizz-assisted Problem Based Learning on students' learning outcomes in salt hydrolysis material. The scientific contribution of this study lies in the integration of problem-based learning and interactive digital media to create more active, meaningful, and student-centered chemistry learning.Therefore, the implementation of Problem Based Learning assisted by Quizizz is expected to improve students' learning outcomes on the topic of salt hydrolysis (Sadriati, 2025).

▪ METHOD

Research Design

This study employed a true experimental design using a two-group pretest–posttest design. The research was conducted at SMA Negeri 10 Medan during the

2025/2026 academic year. The study involved two classes that received different treatments. The experimental class was taught using the Problem Based Learning (PBL) model assisted by Quizizz, while the control class was taught using the Direct Instruction model.

Before the treatment, both classes were given a pretest to determine the students' initial abilities. After the learning process was completed, a posttest was administered to measure the improvement in students' learning outcomes on salt hydrolysis material.

Population and Sample

The population of this study consisted of all eleventh-grade students of SMA Negeri 10 Medan comprising six classes. The sample was selected using a random sampling technique, in which class XI F-2 was assigned as the experimental class and class XI F-6 as the control class, with a total sample of 72 students.

Research Instrument

The research instrument used in this study was a multiple-choice test consisting of 40 items before validation. The instrument was used to measure students' cognitive learning outcomes.

Before being administered to the research sample, the instrument was tested for validity and reliability. The validity test was conducted using the Product Moment correlation formula with the help of Microsoft Excel. The instrument was considered valid if $r_{count} > r_{table}$. At a significance level of $\alpha = 0.05$ with $N = 32$, the r_{table} value was 0.349. The reliability test was analyzed using the KR-20 formula at a significance level of $\alpha = 0.05$ with $N = 32$.

Data Analysis Technique

The collected data were analyzed using several statistical tests. Data normality was tested using the Shapiro–Wilk test at a significance level of 0.05. The data were considered normally distributed if the significance value (Sig.) was greater than 0.05. Homogeneity testing was conducted using Levene's Test to determine whether the variances of both groups were homogeneous.

Hypothesis testing was carried out using the independent sample t-test with a significance level of 0.05. If the significance value (Sig. 2-tailed) was less than 0.05, then H_a was accepted and H_0 was rejected.

The improvement in students' learning outcomes was analyzed using the N-Gain formula:

$$N\text{-}Gain = \frac{\text{Posttest} - \text{Pretest}}{\text{Maximum Score} - \text{Pretest}}$$

The N-Gain results were categorized into high, medium, and low categories to determine the level of improvement in students' learning outcomes after the implementation of the learning model.

▪ RESULT AND DISCUSSION

Results

The results of this study were obtained from students' pretest and posttest scores in both the experimental and control classes. The pretest was administered before the learning treatment to determine students' initial abilities, while the posttest was conducted

after the learning process to measure students' learning outcomes on salt hydrolysis material.

The experimental class was taught using the Problem Based Learning (PBL) model assisted by Quizizz, while the control class was taught using the Direct Instruction model assisted by Quizizz. Based on the research results, the average pretest score of the experimental class was 48.05, while the control class was 35.28. This indicates that the initial abilities of students in both classes were different but still comparable for research purposes.

After the implementation of the learning models, the average posttest score of the experimental class was 85.28, while the control class was 75.28. These results show that both classes experienced an improvement in learning outcomes; however, the improvement in the experimental class was higher than in the control class. Therefore, students taught using the Problem Based Learning (PBL) model assisted by Quizizz achieved better learning outcomes compared to those taught using the Direct Instruction model assisted by Quizizz.

Instrument Validity and Reliability Test

Before being used in the research, the test instrument was first tested for validity and reliability. The validity test was conducted using the Product Moment correlation formula with the help of Microsoft Excel. The instrument was considered valid if rcount > r_{table}. At a significance level of $\alpha = 0.05$ with N = 32, the r_{table} value obtained was 0.349. The analysis results showed that out of 40 multiple-choice questions tested, 27 items were declared valid and 13 items were declared invalid. Therefore, only the valid questions were used as the research instrument in the pretest and posttest. The reliability test was conducted using the KR-20 formula. The analysis result showed that the r_{count} value was 0.947, which was higher than the r_{table} value of 0.349. Thus, the instrument was declared reliable with a very high level of reliability.

Normality Test

Experimental class

Based on the tests conducted, the pretest data (Sig. = 0.402) and posttest data (Sig. = 0.143) showed significance values greater than 0.05. Therefore, it can be concluded that the data in the experimental class were normally distributed.

Test of Normality

	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	df	Sig	Statistic	df	Sig
Pretest	.129	36	.141	.969	36	.402
Post-test	.139	36	.077	.954	36	.143

Table 1. Normality Test Results of the Experimental Class

Control class

Based on the tests conducted, the pretest data (Sig. = 0.198) and posttest data (Sig. = 0.388) showed significance values greater than 0.05. Therefore, it can be concluded that the data in the control class were normally distributed.

Test of Normality						
	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	df	Sig	Statistic	df	Sig
Pretest	.149	36	.043	.959	36	.198
Post-test	.109	36	.200	.969	36	.388

Table 2. Normality Test Results of the Control Class

Homogeneity Test

` The homogeneity test aims to determine whether the variance of data within a population is equal. The test was conducted using SPSS version 26 with Levene's Test, where the data are considered homogeneous if the significance value (Sig.) is greater than 0.05. Based on the table, the pre-test and post-test results of both the experimental and control classes show Sig. values greater than 0.05. Therefore, it can be concluded that both groups come from a homogeneous population.

Data	Sig	α	Keterangan
Pretest	0,396	0,05	Homogeneous
Post-test	0,157	0,05	Homogeneous

Table 3. Results of the Homogeneity Test

Hypothesis Test

After the data were confirmed to be normally distributed and homogeneous, hypothesis testing was conducted using SPSS through an independent sample t-test. The results showed a significance value of 0.000, which is less than 0.05, so the alternative hypothesis (Ha) is accepted and the null hypothesis (H0) is rejected. Therefore, it can be concluded that the Problem Based Learning model assisted by Quizizz has an effect on students' learning outcomes in the topic of salt hydrolysis.

Data	Class	Average	Standart Deviation	Sig.(2 tailed)	α	Information
Result Study Student	Experiment	85,28	8,013	0,000	**0,05**	Ha Accepted
	Control	75,28	10,820			

Table 4. Results of the Independent Sample t-Test

N-Gain Test

The average N-Gain score in the experimental class was 0.72, which is categorized as high, while the control class obtained an average N-Gain score of 0.62, which is categorized as medium. These results indicate that the improvement in students' learning outcomes in the experimental class was higher than in the control class.

	Class	N	Average Pretest Score	Average Post-test Score	Average N-Gain Score	Category
N-Gain Score	Experiment	36	48,05	85,28	0,72	High
	Control	36	35,27	75,28	0,62	Medium

Table 5. N-Gain Calculation Results

Discussion

The results of this study show that the implementation of the Problem Based Learning (PBL) model assisted by Quizizz has a significant effect on students' learning outcomes in salt hydrolysis material. Based on the research results, the average pretest score in the experimental class was 48.05, while in the control class it was 35.28. This indicates that the initial abilities of students in both classes were relatively different but still comparable before the treatment was applied. After the treatment, the average posttest score in the experimental class increased to 85.28, while in the control class it was 75.28. These results show that the average score of the experimental class is higher than that of the control class.

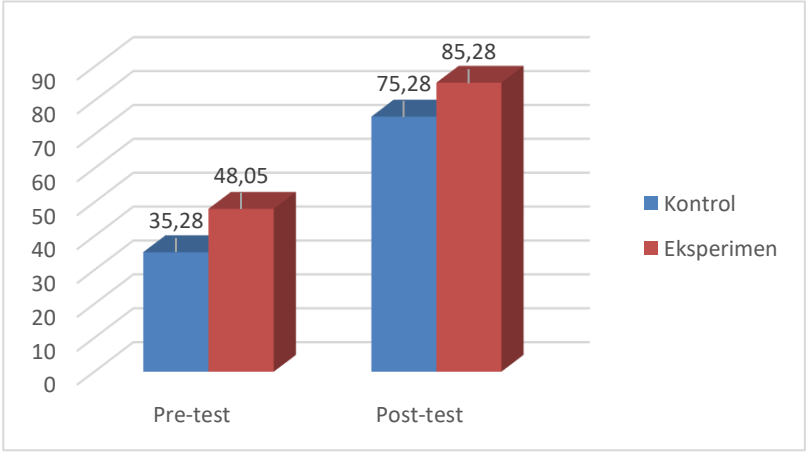


Figure 1. Average Pre-test and Post-test Diagram

Based on the diagram, it can be seen that the average learning outcomes of students taught using the PBL model are higher than those of students taught using the Direct Instruction model.

Furthermore, the results of the hypothesis test using the independent sample t-test showed that the significance value (Sig. 2-tailed) was less than 0.05, so H0 was rejected and Ha was accepted. This means that there is a significant effect of the Problem Based Learning (PBL) model assisted by Quizizz on students' learning outcomes in salt hydrolysis material.

The N-Gain test results showed that the average N-Gain score in the experimental class was 0.72, which is categorized as high, while the control class obtained 0.62, which is categorized as medium. This indicates that the improvement in students' learning outcomes in the experimental class was higher than in the control class. Therefore, it can be concluded that the implementation of the Problem Based Learning (PBL) model assisted by Quizizz is more effective in improving students' learning outcomes.

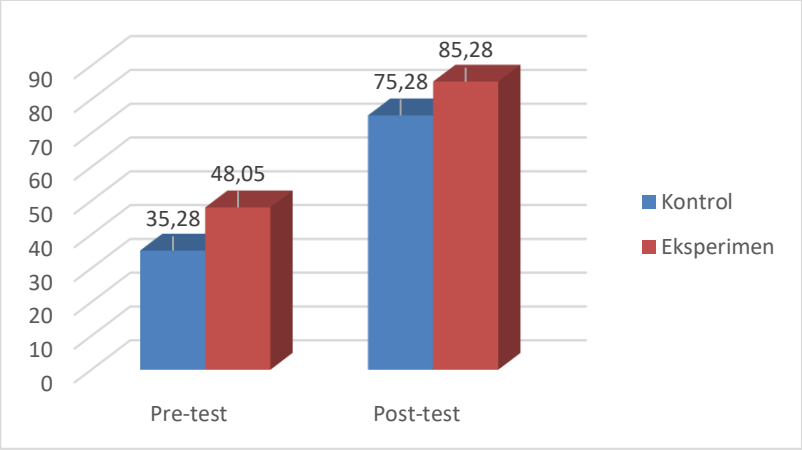


Figure 2. Average N-Gain Diagram

The improvement in learning outcomes in the experimental class is closely related to the characteristics of the Problem Based Learning (PBL) model. PBL encourages students to be more active in the learning process through problem-solving activities, discussions, and collaborative learning. Through these activities, students are trained to analyze problems, identify concepts, and construct their own understanding of the material. This learning process helps students develop critical thinking skills and improve conceptual understanding, which ultimately affects their learning outcomes.

In addition, the use of Quizizz as a learning medium also contributes to the improvement of students' learning outcomes. Quizizz provides interactive and enjoyable learning activities that can increase students' motivation, interest, and participation during the learning process. The quiz features, instant feedback, and competitive atmosphere in Quizizz make students more enthusiastic and actively engaged in learning activities.

The findings of this study are in line with the research by Syahira & Zaus (2025), which stated that the implementation of the Problem Based Learning (PBL) model can improve students' learning outcomes because students are directly involved in problem-solving activities and actively construct knowledge. In addition, the study also showed that the use of Quizizz as a learning medium is able to increase students' motivation, engagement, and classroom interaction, which has a positive impact on learning outcomes.

The higher improvement in learning outcomes in the experimental class was caused by several factors. First, the PBL model creates a student-centered learning environment, allowing students to have more opportunities to discuss, ask questions, and solve problems independently. Second, Quizizz helps students review and strengthen their understanding of the material through interactive exercises and immediate feedback. Third, the combination of PBL and Quizizz encourages students to become more motivated and confident during the learning process.

Meanwhile, although the control class also used Quizizz, the learning process was still teacher-centered because it applied the Direct Instruction model. Students mostly received explanations from the teacher and had more limited opportunities to explore problems independently. As a result, students in the control class were less active during learning activities, which affected the improvement of their learning outcomes.

Therefore, the implementation of the Problem Based Learning (PBL) model assisted by Quizizz can be considered more effective in improving students' learning outcomes compared to the Direct Instruction model assisted by Quizizz, especially in chemistry learning on salt hydrolysis material.

▪ CONCLUSION

Based on the results of the study, it can be concluded that the implementation of the Problem Based Learning (PBL) model assisted by Quizizz has a significant effect on students' learning outcomes in salt hydrolysis material. This is supported by the findings showing that the average pretest score in the experimental class was 48.05, while in the control class it was 35.28. Meanwhile, the average posttest score in the experimental class increased to 85.28, while in the control class it was 75.28. In addition, the N-Gain results showed that the experimental class obtained a score of 0.72 in the high category, while the control class obtained 0.62 in the medium category. Students taught using the PBL model assisted by Quizizz achieved higher results compared to those taught using the Direct Instruction model assisted by Quizizz. This indicates that the PBL model assisted by Quizizz is more effective in improving students' learning outcomes.

The practical implication of this study is that chemistry teachers can use the Problem Based Learning (PBL) model assisted by Quizizz as an alternative learning approach to create a more active, interactive, and student-centered learning environment. The integration of technology-based learning media such as Quizizz can also help increase students' motivation and participation in classroom learning activities.

It is recommended that future researchers conduct similar studies on different chemistry topics or educational levels to obtain broader findings regarding the effectiveness of the PBL model assisted by Quizizz. Future studies are also expected to examine other variables such as critical thinking skills, learning motivation, and student learning independence.

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