



Improving Junior High School Students' Learning Outcomes on State Changes of Matter Through Experimental Teaching Methods

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ABSTRACT

Student learning outcomes in science subjects often experience problems such as low learning outcomes due to the application of conventional learning models. This makes students passive and learning boring and non-contextual. To overcome this problem, one model that can be used is the experimental model, which is expected to improve student learning outcomes by actively involving them in the learning process directly. The purpose of this study was to determine the effect of the experimental method on student learning outcomes on the material on changes in the state of matter in class VII of junior high school. The type of research used was quasi-experimental research with a pretest-posttest control group design. There were 27 students in the study, with 14 students in the experimental class and 13 students in the control class. The research instrument was a multiple-choice test consisting of 20 questions that had been tested for validity and reliability. Data collection techniques were carried out through pretest and posttest, while data analysis used the Mann-Whitney U Test non-parametric test with the help of SPSS version 16.0. The results showed a significant difference in learning outcomes between the experimental class and the control class with a significance value of $0.000 < 0.05$. This proves that the application of the experimental method has an effect on student learning outcomes in class VII on the material on changes in the state of matter.

INTRODUCTION

Education is an important part of a country's development because it provides knowledge, skills, and values that support the progress of individuals and society (Nurlita et al., 2025). Education plays an important role in exploring and developing potential to prepare individuals to deal with various things they will face in their lives. Thus, education is a means of internalizing the values of life and living to individuals in order to shape their character and personality for the better (Astuti, 2025).

The teaching and learning activities carried out at Rangka Rame Private Junior High School are ineffective, still heavily reliant on traditional learning models, where teachers are more dominant in delivering learning materials and students tend to be passive listeners. The models and methods of learning used by teachers do not involve students in an active learning process (Berutu & Simaremare, 2025). This can be seen from the way students tend to passively receive information analysis, without involving their abilities or deep problem solving. In the long term, learning that does not actively involve students can have an impact on low student motivation and interest in learning, which directly affects low student learning outcomes (Mu'aziyah & Isnawati, 2023; Udung et al., 2025).

The low learning outcomes of seventh-grade students at Rangka Rame Private Junior High School indicate problems in the learning process that occur in the classroom, where student learning outcomes in science lessons have not yet reached the expected standards and are even relatively low. These low learning outcomes are caused by the lack of interactive and varied learning models and a tendency toward Teacher-Centered Learning (TCL) or learning models that only focus on the teacher, making students passive during the learning process (Desi et al., 2023; Gulo, 2025). Therefore, efforts to improve the quality of learning by applying more innovative and effective learning models are urgently needed so that students can achieve maximum learning outcomes (Aprilia et al., 2025; Sirait & Ginting, 2025).

One of the efforts that can be made to overcome this problem is to use learning methods that are able to actively involve students in the teaching and learning process so that student learning outcomes improve (Audria, 2025; Harepa et al., 2025). One learning method that is considered to be a solution to this problem is the experimental learning method. The experimental learning method is a learning method that is able to actively involve students when learning takes place in the classroom (Marzuki & Mukaromah, 2025). This method also emphasizes direct student involvement, so that students will be actively involved in working together in groups. Therefore, with the application of this method, students are actively involved in learning.

Several studies have shown that the application of the experimental method can improve student learning outcomes in science subjects (Murni et al., 2025). This learning method emphasizes the active involvement of students in solving problems that are relevant to everyday life so that students can understand concepts deeply and critically (Fadilla, 2025). The experimental learning method also encourages students to work collaboratively, improve critical thinking and creativity, and strengthen their understanding of basic biology concepts, including the material on changes in the form of substances (Islami & Ulya, 2025). The application of the experimental method allows students to be more active in discussing and developing conceptual understanding through complex problem solving (Hsb & Naelofaria, 2025).

Based on the background described above, this research aims to determine the impact of the chosen instructional approach on student achievement, titled "Improving Junior High School Students' Learning Outcomes on State Changes of Matter Through Experimental Teaching Methods".

METHOD

This study uses a quasi-experimental design with a pretest-posttest control group design. This design was chosen because it allows researchers to compare learning outcomes between the experimental group taught using the experimental method and the control group taught using the conventional learning model, by measuring changes in learning outcomes before (pretest) and after (posttest) the treatment was given.

This research will be conducted in the odd semester of the 2025/2026 academic year, namely in September 2025, and the location of the research is at Rangka Rame Private Junior High School, located in Wee Pangali Village, Tambolaka District, Southwest Sumba Regency, East Nusa Tenggara Province.

The experimental class will be taught using the experimental learning method, while the control class will be taught using the conventional learning model. The research instrument consists of a learning outcome test (pre-test and post-test) with 30 multiple-choice questions that will be tested for validity, reliability, difficulty level, and discriminating power. The data were analyzed using normality and homogeneity tests, t-tests for normally distributed data, and Mann-Whitney tests for non-normally distributed data.

RESULTS AND DISCUSSIONS

Results

Normality Test

A normality test is conducted to determine whether the research data, both pre-test and post-test data, are normally distributed or not. Normal distribution is one of the important assumptions in the use of parametric statistical analysis techniques such as the t-test. If the data are not normally distributed, the analysis is continued with a non-parametric statistical test.

The normality test is an important stage in statistical analysis that aims to determine whether the data obtained from the research sample is normally distributed or not. Normal distribution is a basic assumption for many parametric statistical techniques, t-tests, and variance analysis. Therefore, before conducting a hypothesis test, a normality test is performed to ensure that the data meets this assumption. If the data is not normally distributed, then it is necessary to use non-parametric statistical tests that do not require the data to follow a normal distribution.

In this study, normality tests were conducted on the pre-test and post-test data for both sample groups, namely the experimental class that used the experimental method and the control class that used conventional learning. To test the normality of the data, two test methods commonly used in statistics were used, namely Kolmogorov-Smirnov and Shapiro-Wilk, with the help of the SPSS version 16.0 program.

The results of the data normality test are shown in Table 1. Based on the Shapiro-Wilk test, it is known that the pre-test data of the experimental class has a significance value of 0.045 (< 0.05), so it can be concluded that the data is not normally distributed. Meanwhile, the post-test data for the experimental class had a significance value of 0.088 (> 0.05), the pre-test data for the control class had a significance value of 0.160 (> 0.05), and the post-test data for the control class had a significance value of 0.348 (> 0.05). Thus, all three data sets are normally distributed. Therefore, overall, only the pre-test data in the experimental class is not normally distributed, while the other data sets are normally distributed.

The Shapiro-Wilk test was chosen for this study based on the relatively small sample size, which was less than 50 respondents. According to statistical literature, the Shapiro-Wilk test is more appropriate for small sample sizes than the Kolmogorov-Smirnov test because it has higher power in detecting deviations from normal distribution. In addition, Shapiro-Wilk is also more sensitive and is widely recommended in experimental studies with a limited number of subjects, such as in this study. Therefore, the normality test results in this study refer to the Shapiro-Wilk test significance value.

Thus, because most of the data in the experimental pre-test did not meet the normality assumption, this study used non-parametric tests such as Wilcoxon and Mann-Whitney. Non-parametric tests were chosen because they do not require a normal distribution and are suitable for ordinal or non-normal data.

Tabel 1. Test of Normality

Treatment	Kolmogorov-Smirnov ^a			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
Postest eksperimen class	.248	14	.020	.893	14	.088
Postest control class	.184	13	.200*	.931	13	.348
Pretest eksperimen class	.160	14	.200*	.872	14	.045
Pretest control class	.232	13	.053	.906	13	.160

a. Lilliefors Significance Correction

*. This is a lower bound of the true significance.

Homogenitas Test

After conducting a normality test, the results proved that most of the data, especially the post-test in both classes, was not normally distributed. However, to complete the analysis and ensure variance equality between groups, a homogeneity test was also conducted. This test aims to determine whether the two classes have homogeneous variances, i.e., equal variances between groups, which is one of the requirements in comparative analysis, both parametric and non-parametric.

The data is declared homogeneous if the significance value (sig. >0.05). Based on the homogeneity test using the SPSS version 16.0 program, a significance value for the pre-test data of 0.083 was obtained, as shown in Table 2.

Based on Table 2, it can be seen that the significance value of $0.083 > 0.05$, so it can be concluded that the variance of the two groups is homogeneous. In other words, even though the data as a whole is not normally distributed, the two research groups have a relatively similar variance distribution.

Thus, it can be stated that the student learning outcome data in the experimental class and the control class have homogeneous variance, making it appropriate to proceed to the next stage of hypothesis testing.

Tabel 2. Test of Homogeneity of Variances

Levene Statistic	df1	df2	Sig.
2.357	3	50	.083

Hipotesis Test

This study used a non-parametric hypothesis testing approach to test the differences in learning outcomes between groups. Non-parametric tests were used to reinforce the findings, as some of the data were not normal. One of the tests used was the Mann-Whitney U Test to determine the effect of learning outcomes between two groups, namely the experimental class and the control class after being given treatment. This test is a non-parametric alternative to the Independent Sample t-Test, which is used when the assumption of normality is not fully met.

Table 3 shows that the significance value Asymp. Sig. (2-tailed) = $0.000 < 0.05$, indicating that H_a is accepted. In other words, there is a significant effect of the experimental method on student learning outcomes in the material on changes in the form of substances in grade VII at Rangga Rame Private Junior High School.

Tabel 3. Test Statistics

	Result
Mann-Whitney U	13.000
Wilcoxon W	104.000
Z	-3.842
Asymp. Sig. (2-tailed)	.000
Exact Sig. [2*(1-tailed Sig.)]	.000 ^a

Discussions

Based on the data obtained from the analysis, it can be concluded that the experimental method has a significant effect on student learning outcomes in the subject of changes in the form of matter. This

effect is clearly seen from the comparison between the experimental class (which used the experimental method) and the control class (which used conventional learning). The Mann-Whitney test results with a significance value (Asymp. Sig. 2-tailed) = 0.000, <0.05. This figure statistically proves that there is a significant difference between the two groups, where the experimental group showed much better results (Jusariani et al., 2024; Sirait & Ginting, 2025). The experimental method can be explained through its characteristics that allow students to interact directly with the phenomena being studied.

In the experimental process, students did not just passively receive theory, but also made observations, collected data, and drew their own conclusions (Harepa et al., 2025). This approach actively involved students in the learning process, stimulated their curiosity, and strengthened their understanding (Irfan, 2025; Murni et al., 2025). These results are in line with research stating that learning based on direct experience can improve knowledge and scientific thinking skills (Fadilla, 2025). Thus, the application of the experimental method not only improves student learning outcomes but also develops scientific process skills (Nurlita et al., 2025).

In contrast, conventional learning applied in the control class tended to focus on lecture methods, where students were passive (Berutu & Simaremare, 2025). Although there was an increase in learning outcomes from the pre-test to the post-test in this group, the increase was not comparable to that of the experimental class (Gulo, 2025). This shows that conventional learning is less effective in encouraging active engagement and deep understanding of the material (Udung et al., 2025). Therefore, the researchers concluded that the experimental method is a superior or more appropriate method for teaching conceptual science material that requires practical understanding, such as changes in the form of matter (Aprilia et al., 2025; Marzuki & Mukaromah, 2025).

CONCLUSION AND SUGGESTION

Based on the results of research and discussions conducted on the effect of experimental methods on student learning outcomes in Grade VII science material on changes in the form of substances at Rangka Rame Private Junior High School, it can be concluded that the experimental model has an effect on the science learning outcomes of Grade VII students at Rangka Rame Junior High School in the material on changes in the form of substances.

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