
The Effectiveness of The RME Approach on Mathematics Learning Outcomes in Statistics for Junior High School Students in Palu City

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Abstract. *This study aims to determine the effectiveness of the RME (Realistic Mathematics Education) approach on the learning outcomes of eighth-grade students in statistics. This is a quantitative study using a quasi-experimental design with a pretest-posttest control group. The population of this study consists of eighth-grade students at SMP Labschool UNTAD Palu, comprising four classes with a total of 100 students. A sample of 50 students was selected using random sampling. The data collection methods used were learning outcomes from essay-based tests and observations. The data analysis techniques used were the independent samples t-test and the N-Gain test. The results of the independent samples t-test showed a Sig. (2-tailed) value of 0.001, indicating a significant difference in learning outcomes between the experimental and control classes. The N-Gain Score calculation for the experimental class yielded a value of 0.66, which falls into the moderate category. Therefore, it can be concluded that the RME approach is effective in improving the learning outcomes of eighth-grade students in statistics. The effectiveness of the RME approach is supported by learning stages that link mathematical concepts to real-life situations, enabling students to build understanding and deepen their grasp of statistical concepts, thereby improving their learning outcomes.*

Keywords: *Effectiveness, RME, Learning Outcomes*

INTRODUCTION

Mathematics is one of the subjects that plays a key role in developing pupils' logical, critical, systematic and creative thinking skills. Furthermore, the teaching of mathematics also aims to equip pupils with the problem-solving skills required in everyday life. According to Marni & Pasaribu (2021), mathematics provides a rational and systematic way of thinking to find solutions to the various problems encountered. Therefore, the mathematics learning process needs to be designed to encourage students' active engagement in developing a meaningful understanding of concepts, thereby supporting the achievement of optimal learning outcomes.

One area of mathematics that plays a role in developing these skills is statistics. Statistics not only requires students to perform calculations, but also to understand, organize, present, and interpret data in various forms of representation.

A relational conceptual understanding is essential for students to be able to connect the available data with the concepts being used and draw appropriate conclusions based on the information obtained (Ningsih et al., 2025). A solid grasp of statistical concepts is one of the factors that can contribute to students' success in achieving learning outcomes. This is consistent with the study by Naikofi et al., (2026), which shows that an increase in students' understanding of statistical concepts is associated with improved learning outcomes in statistics.

Based on observations and interviews with mathematics teachers at SMP Labschool UNTAD Palu, it was found that students still have difficulty determining measures of central tendency, such as the mean, median, and mode, especially when data is presented in the form of tables or diagrams. In addition, students often make mistakes in interpreting the information presented in the data, resulting in conclusions that do not align with the statistical concepts that should be applied. This indicates that some students tend to understand calculation procedures without grasping the meaning of the underlying concepts. This situation results in students' inability to solve statistics problems accurately, particularly those involving contextual problems, and thus their learning outcomes are not optimal.

These issues highlight the need for a learning approach that can help students develop a more meaningful understanding of concepts and improve their learning outcomes. Febriana et al., (2023) states that one of the challenges in the mathematics learning process is that students still do not fully understand mathematical concepts, so a teaching approach is needed that can help students improve their conceptual understanding and learning outcomes. One approach considered appropriate is Realistic Mathematics Education (RME).

The RME approach uses real-world contexts as a starting point for learning so that students can construct mathematical concepts on their own through exploration, modeling, discussion, and reflection. Setyawan (2020) states that RME helps students understand mathematical concepts through concrete situations that are relevant to their daily lives. In statistics education, using data drawn from students' own environments allows them to gain firsthand experience in collecting, presenting, and interpreting data, making the concepts they learn easier to

understand and leading to improved learning outcomes. These findings are consistent with those of Mangundap et al., (2025) who state that RME learning through real-world contexts relevant to students' lives can enhance active engagement and learning outcomes.

The role of RME in improving the quality of mathematics education is also supported by various research findings. Setyawan (2020) found that the implementation of RME was able to improve students' activity levels and learning outcomes in mathematics. Yanty et al., (2025) reported that RME has a positive effect on students' conceptual understanding and mathematical problem-solving skills. In addition,, Nurwahid et al., (2025) concluded that RME fosters more meaningful learning because students are actively engaged in constructing knowledge. These findings indicate that RME has the potential to enhance mathematics learning, which can ultimately impact student learning outcomes.

Based on the above discussion, this study focuses on the effectiveness of the RME approach on the learning outcomes of eighth-grade students at UNTAD Labschool Junior High School in Palu in the subject of statistics. The purpose of this study is to determine the effectiveness of the RME approach on the learning outcomes of eighth-grade students at UNTAD Labschool Junior High School in Palu. Furthermore, this study is expected to help design more effective and appropriate learning strategies.

RESEARCH METHOD

The study employed a quasi-experimental design with two groups: the experimental group, which received instruction using the RME approach, and the control group, which received instruction using the scientific approach. The research design used was a pretest-posttest control group design. Both groups took a pretest, received instruction, and then took a posttest.

Table 1 Research Design

Group	Pretest	Treatment	Posttest
Experiment	O_1	X_1	O_2
Control	O_3	X_2	O_4

The population in this study consisted of eighth-grade students at SMP Labschool UNTAD Palu, comprising four classes with a total of 100 students. Random sampling was used to select two classes: one control class with 25 students and one experimental class with 25 students.

The data used in this study consists of quantitative data in the form of test scores measuring learning outcomes. The data sources for this study were students in the experimental and control classes. The research instruments used included a three-question essay test, a learning module, worksheets, and an observation sheet for assessing the implementation of the RME approach. To determine whether the instruments used were appropriate for the research objectives, an expert validation test was conducted.

To address the research question in this study, inferential statistical tests were conducted using an independent-samples t-test, following the prerequisite tests of normality and homogeneity. The decision rule is as follows: if Sig. (p-value) < 0.05, then H_0 is rejected and H_1 is accepted. The hypotheses are as follows:

H_0 : There was no significant difference between the average mathematics achievement scores of eighth-grade students at SMP Labschool UNTAD Palu who were taught using the RME approach and those who were taught using the scientific approach.

H_1 : There is a significant difference between the average mathematics achievement scores of eighth-grade students at SMP Labschool UNTAD Palu who were taught using the RME approach and those who were taught using the scientific approach.

An N-Gain Score test was then conducted to determine the effectiveness of the RME approach. A learning approach is considered effective if the N-Gain falls into the high or moderate category. The formula for N-Gain is as follows (Sukarelawan et al., 2024):

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

According to the N-Gain classification:

Table 2 N-Gain Classification

Average Normalized N-Gain	Classification
$0,70 < \text{N-Gain} \leq 1.00$	High
$0,30 < \text{N-Gain} \leq 0.70$	moderate
$\text{N-Gain} \leq 0.30$	Low

RESULTS AND DISCUSSION

This section presents research findings based on descriptive statistics, prerequisite tests, hypothesis testing, N-Gain analysis, and observations of the implementation of the RME approach.

Descriptive Statistics for Pre-test and Post-test Scores

A descriptive analysis was conducted to describe the students' initial and final learning outcomes in the experimental and control classes. A pretest was administered before the intervention to determine the students' initial proficiency in statistics, while a posttest was administered after the intervention to measure learning outcomes.

The results of the study show that the average pretest scores of the experimental and control classes were relatively similar. This indicates that both groups had comparable initial abilities before the learning approach was implemented. After implementation, the average posttest scores of the experimental class increased significantly and were higher than those of the control class. The improvement in the experimental class was more pronounced than that in the control class.

In the experimental class, student learning outcomes were higher after the implementation of the RME approach. Meanwhile, in the control class, although there was an improvement, it was not as significant as that observed in the experimental class.

These descriptive findings indicate that students taught using the RME approach showed greater improvement in learning outcomes compared to students taught using the scientific approach.

Table 3 Results from the Experimental and Control Groups

Data	experimental class		control class	
	Pretest	Posttest	Pretest	Posttest
number of students	25	25	25	25
Maximum value	55	95	50	75
Average score	47,2	82,04	43,40	65,00

The results of the descriptive analysis of student learning outcomes showed that the average post-test score for the control class was 65.00, while that for the experimental class was 82.04.

Prerequisite Test

Before conducting a hypothesis test, a test of the prerequisites is performed to ensure that the data meet the assumptions required for inferential statistical analysis.

Normality Test

A normality test was conducted to determine whether the pretest and posttest data from both classes were normally distributed.

Table 4 Normality Test Results

Hasil	Shapiro-Wilk		
	Statistic	df	Sig.
Pretest experimental class	0,975	25	0,771
Pretest control class	0,938	25	0,132
Posttest experimental class	0,970	25	0,639
Posttest control class	0,981	25	0,897

The results of the normality test show that the significance value (Sig.) for both the experimental and control groups is greater than 0.05. Therefore, it can be concluded that the pretest and posttest data for both groups are normally distributed.

Homogeneity Test

A homogeneity test was conducted to determine whether the variances of the two groups were equal. The results of the homogeneity test showed that the significance value was greater than 0.05.

Table 5 Results of the Homogeneity Test for the Pretest and Posttest

Levene Statistic	df1	df2	Sig.
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Pretest	0,204	1	48	0,653
Posttest	3,489	1	48	0,068

Based on the table of homogeneity test results for the pretest data, we can see that the Sig. value for the Mean is $0.653 > 0.05$, and the Sig. value for the posttest data is $0.068 > 0.05$. Therefore, it can be concluded that the variances of the posttest data for the experimental and control classes are homogeneous.

Since the data satisfy the assumptions of normality and homogeneity, an independent-samples t-test can be used to test the research hypotheses.

Hypothesis Testing

Hypothesis testing was conducted using an independent samples t-test to determine whether there was a significant difference in learning outcomes between students taught using the RME approach and those taught using the scientific approach.

The results of the independent samples t-test show that the significance value (Sig., 2-tailed) is less than 0.05. Based on the decision criteria, if $\text{Sig.} < 0.05$, then H_0 is rejected and H_1 is accepted. Therefore, H_0 , which states that there is no significant difference between the average mathematics achievement scores of eighth-grade students at SMP Labschool UNTAD Palu taught using the RME approach and those taught using the scientific approach, is rejected. The results of the t-test calculations can be seen in Table 6

Table 6 t-Test Results

	t	df	Sig.(2-tailde)
Pair 1 Posttest	9,639	48	0,001

These results indicate a statistically significant difference in learning outcomes between the two groups. Students taught using the RME approach achieved a significantly higher average posttest score compared to students taught using the scientific approach.

N-Gain Analysis

To determine the effectiveness of the RME approach in improving student learning outcomes, N-Gain scores were calculated for both classes. The results of the average N-Gain score calculations for the experimental class are as follows:

Table 7 N-Gain Scores for the Experimental and Control Classes

		N	Minimum	Maximum	Mean
experimental class	N-Gain Score	25	0,38	0,90	0,66
control class	N-Gain Score	25	0,29	0,53	0,38

The results of the N-Gain analysis show that the experimental class achieved a higher average N-Gain score than the control class. Based on the N-Gain classification criteria, the improvement in both classes falls into the moderate category. However, the experimental class showed a greater improvement in learning outcomes than the control class.

Discussion

The findings of this study indicate that the implementation of the RME approach has a positive and significant impact on the learning outcomes of eighth-grade students at SMP Labschool UNTAD Palu in the subject of statistics. This conclusion is supported by descriptive and inferential statistical analyses, which consistently show that students taught using the RME approach achieved higher posttest scores and greater learning gains compared to students taught using the scientific approach.

Descriptive analysis shows that the average pretest scores of the experimental and control classes were relatively similar, indicating that both groups had comparable initial abilities before the instructional approach was implemented. This is consistent with Lestari et al., (2023) who state that a pretest is administered to assess students' initial abilities before the intervention is implemented. This similarity is an important prerequisite in experimental research, as it ensures that any differences observed in the posttest results can be attributed to the intervention. This was particularly evident with the implementation of the intervention, given the pre-existing differences between the groups. After the intervention, the

experimental class showed a significantly higher average posttest score compared to the control class.

These descriptive findings are further supported by inferential statistical analysis. The results of the independent samples t-test indicate a statistically significant difference between the posttest scores of the experimental and control classes. In addition to hypothesis testing, the analysis of N-Gain scores provides further evidence of the effectiveness of the RME approach. Although both the experimental and control classes were classified as moderate in terms of learning improvement, the experimental class achieved a higher average N-Gain score than the control class. These results indicate that students in the experimental class showed greater improvement in learning outcomes from the pretest to the posttest.

This indicates that the learning outcomes achieved by students who learn through the RME approach are significantly better than those achieved by students who learn through the scientific approach. These findings highlight the effectiveness of learning approaches that actively engage students in the learning process and encourage them to construct their own understanding through structured learning stages. A higher N-Gain score indicates that the RME approach not only improves final achievement but also strengthens the overall learning process by facilitating a deeper conceptual understanding. These findings are consistent with those of Lololuan et al., (2024) who reported that the implementation of the RME approach had a significant positive effect on students' mathematics learning outcomes because the learning process was centered on students' active involvement in solving contextual problems. Furthermore, Pujilestari & Juliangkary (2025) explained that the characteristics of the RME approach, which emphasize the use of real-life contexts, student interaction, and independent knowledge construction, contribute to improving students' conceptual understanding of mathematics. These findings highlight the effectiveness of learning approaches that actively engage students in the learning process and encourage them to develop their own understanding through structured learning stages.

The success of the RME approach in improving student learning outcomes is closely tied to its learning characteristics, which link mathematical concepts to real-life situations relevant to students' lives. During the stage of understanding contextual problems, students are given the opportunity to observe and collect data from objects in their surroundings, such as writing utensils, the colors of bottle caps, and the sizes of their classmates' beverage bottles. The use of real objects helps students understand data concepts more concretely because they interact directly with the objects they observe. This makes students more active and enthusiastic during the learning process. These findings are consistent with the study by Romero et al., (2025), which states that RME instruction that begins with contextual problems can increase student engagement and participation in learning. These findings are also supported by Alim et al., (2024), who reported that the RME approach emphasizes the use of real-life situations in mathematics learning, enabling students to connect mathematical concepts with their daily experiences. This contextual learning process increases students' learning motivation and improves mathematics learning outcomes.

During the contextual problem-solving stage, students work in groups using worksheets to analyze and present data in frequency tables. Through this activity, students are given the opportunity to discover and construct the concepts they are learning on their own. Students' active involvement in the learning process makes the knowledge they gain more meaningful than learning that focuses solely on the teacher's explanations. The results of this study are consistent with the findings of Sukardi & Widiyastuti (2023) who state that the RME approach is effective in improving mathematics learning outcomes because students are directly involved in the process of discovering concepts. Similarly, Gunawan & Hadi, (2024) found that the RME approach significantly improves students' conceptual and procedural understanding by engaging them actively in constructing mathematical knowledge through meaningful learning experiences.

The next step is to compare and discuss the answers. At this stage, each group presents the results of its discussion, and the other groups provide feedback and input. The discussion activity allows students to compare problem-solving

strategies and reinforce their understanding of the concepts through the process of exchanging ideas and justifying their answers. According to Putri & Sutarni (2025), discussion activities in RME instruction have a positive impact on mathematics learning outcomes because students are actively engaged in communicating and defending their mathematical ideas. This finding is also consistent with Nafia et al., (2023), who reported that learning through the RME approach encourages students to actively construct mathematical concepts through discussion and interaction, thereby improving their conceptual understanding and learning outcomes.

The final stage involves drawing conclusions or formalizing mathematical concepts. At this stage, teachers and students work together to draw conclusions about statistical concepts based on the results of observations, data analysis, and discussions that have taken place. Students are guided to discover for themselves concepts related to data, frequency, frequency tables, and data presentation so that the understanding they gain becomes deeper and more enduring. These findings are consistent with Daaliuwa et al., (2023) who state that the application of RME can enhance the understanding of mathematical concepts through the process of knowledge construction carried out by students during learning. This process also aligns with the core characteristics of RME, which guides students from informal knowledge toward formal mathematical concepts through contextual learning experiences. In line with this Masruroh & Apriyono, (2025) explain that the RME approach helps students understand mathematical concepts through contextual and student-centered learning, thereby improving students' conceptual understanding.

In addition to improving conceptual understanding, observations made during the learning process show that students have become more active participants in learning activities. Students appear more confident in asking questions, expressing their opinions, and engaging in group discussions. This increased level of participation has also contributed to improved learning outcomes among students. These findings are consistent with those of Alyanak & Özkaya (2026), who demonstrated that mathematics instruction based on RME with meaningful contexts enhances student engagement in learning and has a positive impact on learning outcomes. Similarly, Arni et al., (2023) reported that the

implementation of the RME approach increased students' learning activities and learning outcomes, indicating that active student participation is an important factor in achieving better mathematics learning outcomes.

The findings of this study are also supported by previous research. Sukardi & Widiyastuti (2023) found that the implementation of the RME approach has a positive effect on students' mathematics learning outcomes because learning is linked to real-life contexts, making the concepts studied more meaningful. In addition, Wibowo et al, (2021) reported that the learning outcomes of students taught using the RME approach were higher than those of students taught using the scientific approach. Furthermore, Ulfa & Liesdiani, (2025) reported that the implementation of the RME approach has a significant impact on students' conceptual understanding and mathematics learning outcomes. Learning that begins with contextual problems and actively engages students helps them build a more meaningful understanding. Similarly, Armanda et al., (2025) concluded that the integration of real-life contexts, structured discussions, and active student participation in RME instruction significantly improves both conceptual understanding and mathematics learning outcomes. These findings reinforce the results of this study, which show that the RME approach is effective in improving mathematics learning outcomes because it provides students with opportunities to develop conceptual understanding through contextual problems relevant to their daily lives.

Based on the results of data analysis, classroom observations, and previous research, it can be concluded that the Realistic Mathematics Education (RME) approach is effective in improving the mathematics learning outcomes of eighth-grade students at SMP Labschool UNTAD Palu in the area of statistics. This effectiveness is demonstrated by the significant difference in learning outcomes between the experimental and control classes, as well as the greater improvement in student learning outcomes in the class that received instruction using the RME approach.

CONCLUSION

The RME approach is effective in improving eighth-grade students' mathematics learning outcomes in statistics. The effectiveness of the RME approach is supported by its learning stages, which link mathematical concepts to real-life situations, enabling students to develop conceptual understanding through activities such as observing, collecting data, discussing, and drawing conclusions. These steps encourage students' active participation in the learning process, deepen their understanding of statistical concepts, and make learning more meaningful, thereby improving student learning outcomes.

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