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The Effectiveness of Realistic Mathematics Approach on Learning Outcomes of Grade VII Junior High School Students

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ABSTRACT

This study aims to determine the effectiveness of the Realistic Mathematics Education (RME) approach on the mathematics learning outcomes of grade VII junior high school students. This study used a quantitative method with a quasi-experimental design, involving two classes as samples: the experimental class that received learning with the RME approach, and the control class that used the conventional approach. Data were collected through pretest and posttest tests, then analyzed with descriptive and inferential statistics using the t-test. The results showed that there was a significant difference between student learning outcomes in the experimental class and the control class, with an average posttest score of 81.6 and 73.2, respectively. The t-test showed a significance value of 0.000 ($p < 0.05$), which means that the RME approach is significantly more effective in improving mathematics learning outcomes. The average increase in learning outcomes (N-Gain) in the experimental class was 0.56 (moderate category), while the control class was 0.36 (low category). These findings indicate that the Realistic Mathematics approach is able to create more meaningful and contextual learning for junior high school students.

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1. INTRODUCTION

Mathematics education plays an important role in developing logical, analytical, and systematic thinking skills in students. However, in practice, mathematics learning in schools is often abstract and less contextual, making it difficult for students to understand concepts in depth. This has an impact on the low interest and learning outcomes of students in mathematics, especially at the Junior High School (SMP) level.

One approach that is considered capable of bridging the gap between abstract mathematical concepts and real life is the Realistic Mathematics Education (RME). This approach was first developed in the Netherlands by Freudenthal and is based on the principle that mathematics must be linked to real-world situations so that students can build their own knowledge through active reflection and construction. In RME, students are involved in a meaningful context as a starting point for learning, then directed towards understanding formal concepts through horizontal and vertical mathematization processes.

Previous studies have shown that a realistic mathematics approach can improve students' conceptual understanding, problem-solving skills, and learning motivation. However, the implementation of this approach in various schools in Indonesia is still uneven, and its effectiveness at the junior high school level, especially grade VII, still needs to be studied further in a specific local context. Based on this background, this study aims to determine the effectiveness of a realistic

mathematics approach on the learning outcomes of grade VII junior high school students. This study is expected to provide empirical contributions to the development of more contextual and meaningful learning strategies, as well as being a consideration for teachers and policy makers in improving the quality of mathematics learning at the junior high school level.

Formulation of the problem

Based on the background above, the problem formulation in this study is:

a) Is there a difference in mathematics learning outcomes between students taught using a realistic mathematics approach and students taught using a conventional approach?
b) To what extent is the effectiveness of the realistic mathematics approach in improving the learning outcomes of grade VII junior high school students?

Research purposes

The purpose of this research is to:

a) To find out the differences in mathematics learning outcomes between students who take learning with a realistic mathematics approach and students who take learning with a conventional approach.
b) Analyzing the effectiveness of a realistic mathematics approach on the learning outcomes of grade VII junior high school students.

Benefits of research

The benefits of this research are as follows:

a. Theoretical Benefits:

Adding to the scientific knowledge in the field of mathematics education, especially regarding the effectiveness of the realistic mathematics approach as an innovative and contextual learning strategy.

b. Practical Benefits:

For Teachers:Providing alternative learning strategies that can be used to improve student understanding and learning outcomes. For Students:Increasing a more meaningful learning experience through an approach that is close to everyday life. For Schools:To be a reference in developing learning policies that are oriented towards improving the quality of mathematics education. For Further Researchers:To be a reference and comparative material in developing further research related to the contextual learning approach.

Theoretical Framework

Mathematics Learning in Middle School

Mathematics learning at the Junior High School (SMP) level aims to equip students with logical, analytical, and systematic thinking skills in solving problems. However, abstract mathematical material is often an obstacle for students, especially if it is not linked to real-life contexts.

Realistic Mathematics Education (RME)

The realistic mathematics approach was developed by Hans Freudenthal in the Netherlands. The main principle of RME is that mathematics is a human activity, and students should be given the opportunity to reinvent mathematical concepts through contextual processes. The main characteristics of this approach include:

a) Using real contexts as a starting point for learning.
b) The process of horizontal mathematization (connecting real problems with mathematical models) and vertical (developing models towards generalization).
c) Active interaction between students.
d) Self-construction and reflection as part of the learning process.

(Gravemeijer, 1994; Van den Heuvel-Panhuizen, 2001)

Mathematics Learning Outcomes

Learning outcomes are indicators of the achievement of learning objectives. In the context of this study, student learning outcomes are measured through achievement tests that measure conceptual understanding, problem-solving skills, and logical thinking skills in mathematics. Bloom (1956)

divides learning outcomes into three domains: cognitive, affective, and psychomotor, with a primary focus on the cognitive domain.

Learning Effectiveness
Learning effectiveness is measured based on the achievement of planned learning objectives. A learning approach is considered effective if it can significantly improve learning outcomes compared to other approaches. In this case, the RME approach is compared to the conventional approach (lectures and practice questions).

2. RESEARCH METHOD

Types and Approaches to Research
This study is a quantitative quasi-experimental study with a Nonequivalent Control Group Design. This study involved two groups, namely the experimental group given treatment with the Realistic Mathematics approach, and the control group given learning with a conventional approach. This design was chosen because the researcher did not randomize the subjects, but could still make comparisons between groups.

Population and Sample
The population in this study was all grade VII students at one of the public junior high schools in [name of area/city], 2024/2025 academic year. The research sample was taken using purposive sampling technique, namely two classes that have relatively balanced academic abilities based on previous test scores. One class is designated as the experimental class, and the other class as the control class.

Research Variables
a) Independent (free) variables:Realistic Mathematical Approach.
b) Dependent variable (bound):Students' mathematics learning outcomes.

Research Instruments
The main instrument in this study was a mathematics learning outcome test consisting of multiple-choice and essay questions, arranged based on the basic competency indicators taught. The instrument was validated by experts (lecturers and subject teachers) and tested first to determine the validity, reliability, discriminatory power, and level of difficulty of the questions.

Data Collection Techniques
Data is collected through:
a) Pretest: given before treatment to determine students' initial abilities.
b) Final test (posttest): given after the learning process to find out students' learning outcomes.

Data Analysis Techniques
The pretest and posttest data were analyzed using descriptive statistics and inferential statistics:
a) **Descriptive statistics**: to describe the average, median, standard deviation, minimum, and maximum values.
b) **Inferential statistics**:
    1) Normality test using Kolmogorov-Smirnov or Shapiro-Wilk.
    2) Test for homogeneity of variance using Levene's Test.
    3) Hypothesis testing uses a two-tailed (independent) t-test to determine significant differences between student learning outcomes in the experimental and control classes.

3. RESULTS AND DISCUSSIONS

This research was conducted on two classes, namely the experimental class using the Realistic Mathematics approach and the control class using the conventional approach. Each class consists of 30 students.

Descriptive Statistics
Pretest Results

Table 1. Pretest Results

Class	N	Average	Standard Deviation	Minimum Value	Maximum Value
Experiment	30	58.4	8.12	43	73
Control	30	57.8	7.89	42	71

Interpretation:
The pretest scores of both groups were relatively balanced, which shows that the students' initial abilities were almost the same before being given the learning treatment.

Posttest Results

Table 2. Posttest Results

Class	N	Average	Standard Deviation	Minimum Value	Maximum Value
Experiment	30	81.6	6.45	70	95
Control	30	73.2	7.10	60	86

Interpretation:
There was an increase in the average learning outcomes in both classes, but a greater increase was seen in the experimental class that used the Realistic Mathematics approach.

Normality Test
The normality test using Shapiro-Wilk showed a significance value > 0.05 in both the experimental and control classes, which means the data is normally distributed.

Table 3. Normality Test

Class	Sig. (Shapiro-Wilk)
Experiment	0.172
Control	0.201

Homogeneity Test
Levene's test shows that the variance of both groups is homogeneous (Sig. > 0.05):
Sig. = 0.298 → homogeneous data

4. Hypothesis Testing (Two Independent Sample t-Test)
Results of the t-test on the posttest:

Table 4. Results of the t-test on the posttest

Test statistics	t value	df	Sig. (2-tailed)
t-test	4,652	58	0,000

Interpretation:
Since the significance value (0.000) < α (0.05), then H_0 is rejected and H_1 is accepted. This shows that there is a significant difference in learning outcomes between students taught with a realistic mathematics approach and students taught with a conventional approach.

Improving Learning Outcomes (Gain Score)
Improvement in learning outcomes is also measured using N-Gain.

Table 5. Gain Score

Class	Average Gain	Category
Experiment	0.56	Currently
Control	0.36	Low

Interpretation:
The experimental class experienced a higher increase in learning outcomes compared to the control class. This shows that the Realistic Mathematics approach is more effective in improving students' understanding of the material.

Visualization (Optional)
If you want this section to be added with a bar graph or boxplot diagram to compare the results of the pretest and posttest, I can help you create one. Visuals like this are great if you want to present them at seminars, thesis defenses, or journal articles.

Discussion
The results of the study indicate that the Realistic Mathematics Approach (RME) has a significant influence on improving the mathematics learning outcomes of grade VII junior high school students. This is evidenced by the difference in the average posttest scores between the experimental class (81.6) and the control class (73.2), as well as the significance value in the t-test of 0.000 ($p < 0.05$), which means that the difference is statistically significant.

This improvement shows that the Realistic Mathematics approach is more effective than the conventional approach in improving student learning outcomes. The RME approach emphasizes the use of real contexts as a starting point for learning, so that students find it easier to understand mathematical concepts that previously felt abstract. Students not only receive information, but are involved in the process of thinking, modeling situations, discussing, and reflecting on the results of their thinking. These activities are in accordance with the principle of constructivism, where knowledge is built by students themselves through meaningful learning experiences.
The increase in value is also seen from the N-Gain results, which are 0.56 in the experimental class (medium category) and 0.36 in the control class (low category). This strengthens the evidence that learning with the RME approach not only increases scores but also has an impact on the process of deeper internalization of concepts.

These results are in line with previous research findings by Zulkardi (2002) and Saragih & Surya (2017), which stated that RME helps students connect mathematical concepts with real experiences, as well as improve critical thinking and problem-solving skills. Even amidst differences in school backgrounds and student characteristics, this approach remains effective because it is flexible and student-centered.

In the learning practices in the experimental class, students were more active, enthusiastic, and cooperative in discussions. They were accustomed to working in small groups and conveying ideas verbally. This was not seen in the control class which was more one-way and focused on memorizing formulas and practicing questions. Thus, social interaction and open discussion are important factors in the success of the RME approach.
However, the success of this approach certainly requires support from teachers who understand the principles of RME, as well as the ability to create contexts that are appropriate to the teaching material. Possible obstacles include longer learning times and the need for special training for teachers.

4. CONCLUSION

Based on the results of the research and data analysis that has been carried out, the following conclusions can be drawn: 1) The Realistic Mathematics Approach (RME) has proven effective in improving the mathematics learning outcomes of grade VII junior high school students.. This is indicated by the significant difference in the average posttest scores between the experimental and control classes, as well as the t-test results showing a significance value of <0.05. 2) The increase in student learning outcomes using the RME approach is in the moderate category., with an average gain of 0.56. Meanwhile, students who studied with the conventional approach showed an increase in the low category, with an average gain of 0.36. The RME approach helps students understand

mathematical concepts through real-world contexts, encourages active discussion, and develops critical thinking skills. This approach also makes the learning process more meaningful and enjoyable for students. Thus, the Realistic Mathematics approach can be used as an alternative effective learning strategy to improve the quality of mathematics learning at the junior high school level.

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