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THE INFLUENCE OF THE REALISTIC MATHEMATICS EDUCATION (RME) APPROACH ASSISTED BY THE PLSV BOARD ON THE MATHEMATICAL LITERACY ABILITY OF JUNIOR HIGH SCHOOL STUDENTS

Amelia Nur Oktaviani[1], Lia Kurniawati[2*], Otong Suhyanto[3]

[1, 2, 3] Mathematics Education, Faculty of Tarbiyah and Keguruan Sciences, UIN Syarif Hidayatullah Jakarta

Email: amelianur2002@gmail.com[1], liakurniawati@uinjkt.ac.id[2]

ABSTRACT

Mathematical literacy ability is one of the abilities that students must have. Mathematical literacy ability includes the ability to understand, use, and apply mathematical concepts and procedures in various situations, both in academic contexts and in everyday life. This study aims to analyze the effect of the Realistic Mathematics Education (RME) Approach Assisted by the PLSV Board on mathematical literacy ability. This research was conducted at one of the junior high schools in Tangerang City in the odd semester of the 2024/2025 academic year. This study used a quasi- experimental method with a randomized posttest only control design involving 30 students in the experimental group and 32 students in the control group. Data collection on mathematical literacy ability used a test instrument in the form of seven descriptive questions that had been tested for validity, reliability, discriminatory power and level of difficulty first. The indicators of mathematical literacy ability studied were formulate, employ and interpret. The results of the study showed that the mathematical literacy skills of students in the experimental class whose learning used the Realistic Mathematics Education (RME) Approach Assisted by the PLSV Board were higher than those in the control class whose learning used the scientific approach.

Keywords*: *Realistic Mathematics Education, Mathematical Literacy Skills, Quasi Experiment, PLSV Board.

A. INTRODUCTION

Education is a crucial factor in preparing individuals for life in the era of the Industrial Revolution 4.0. For Indonesian society, education plays a vital role in enabling individuals to learn and develop their abilities. Therefore, in the Industrial Revolution 4.0, thinking skills have become essential competencies that every graduate at all educational levels must possess (Zubaidah, 2018). According to Ekowati (2019), there are four key skills for enhancing competencies: Critical Thinking and Problem Solving, Creativity, Communication Skills, and the Ability to Work Collaboratively. These soft skills are more beneficial in daily implementation compared to hard skills. One such competency is mathematical literacy ability.

Mathematical literacy ability not only involves understanding and using mathematical concepts but also developing critical, analytical, and systematic thinking skills essential for everyday life. The Programme for International Student Assessment (PISA) defines mathematical literacy as an individual's capacity to formulate, use, and interpret mathematics in various contexts (OECD, 2018). According to Indraswati & Wardani (2022), mathematical literacy is crucial for equipping students to become independent individuals capable of discovering mathematical concepts to solve real- life problems. Additionally, the Indonesian government has introduced a national assessment program for mathematical literacy called the Minimum Competency Assessment (AKM) (Azid, 2023). As noted by Lestari & Effendi (2022), AKM consists of two parts: literacy and numeracy, where numeracy represents mathematical literacy. Lamada, cited in Lestari & Effendi (2022), emphasizes the importance of literacy development, as it benefits individuals in navigating future challenges, making it a foundational skill everyone should possess. AKM is designed to create more contextual education, aiming for students to apply higher-order thinking skills in problem-solving. The problems in AKM align with international standards like PISA and the Trends in International Mathematics and Science Study (TIMSS), expected to produce graduates better prepared for future academic and everyday challenges. However, Indonesia still faces the issue of low student mathematical literacy.

This is evidenced by PISA 2018 data, where the average mathematical literacy score of Indonesian students was only 379, far below the international average of 500. Only 28% of Indonesian students reached Level 2 or higher in mathematical literacy (OECD, 2018), compared to 76% in OECD countries. At this level, the low scores are attributed to students' weak ability to interpret simple situations into mathematical representations without direct instruction, such as comparing distances between two routes or converting prices into different currencies. The latest PISA 2022 data still shows low mathematical literacy among Indonesian students, with an average score of 366, a 13-point decline from 2018 (OECD, 2023). Only 18% of Indonesian students reached at least Level 2 in mathematics, significantly lower than the OECD average of 69%.

Further research by Kurniawati (2021) reveals concerning levels of mathematical literacy among madrasah students in Indonesia, with an average score of only 17.32%. The breakdown was 6.39% for Madrasah Ibtidaiyah (MI), 20.01% for Madrasah Tsanawiyah (MTs), and 25.29% for Madrasah Aliyah (MA) students. The low mathematical literacy is due to critical factors, including students' inability to understand contextual problems. Context is vital in mathematical literacy assessments, as it helps students recall learned concepts, connect them to problems, and formulate appropriate solutions.

Other studies highlight students' difficulties in interpreting mathematical formulas to solve problems (Masfufah & Afriansyah, 2021). Students need exposure to PISA-type questions to broaden their thinking. PISA questions assess students' ability to apply knowledge and skills in contexts requiring higher-order thinking and complex solutions. Consequently, students lack practice with contextual problems and struggle when faced with real-life mathematical applications.

Efforts to improve mathematical literacy include regular practice with literacy questions and teachers adopting approaches that engage students in mathematical literacy activities (Ananda & Wandini, 2022). Teachers can use engaging and enjoyable approaches to boost student interest. Interactive classrooms with active student involvement enhance motivation. One such approach is Realistic Mathematics Education (RME).

According to Nurkamilah (2018), RME allows students to construct knowledge through guided reinvention and mathematization based on real-life contexts. RME steps directly facilitate mathematical literacy, aiming for students to understand and apply basic mathematical concepts in daily life and further education. RME emphasizes real- world situations and relevant contexts to help students see mathematics' practical utility, making learning more natural and meaningful.

Supporting this, Istiana (2020) found that RME positively impacts learning outcomes and student motivation. However, RME has drawbacks, such as student frustration when facing difficulties. To enhance RME's effectiveness, integrating teaching aids like the PLSV Board is recommended.

The PLSV Board is an educational tool designed to help students visualize mathematical equations and understand solution steps. This tool makes abstract concepts tangible, aiding comprehension. Research by Puspitasari (2020) confirmed the PLSV Board's positive effect on learning outcomes in linear equations. Similarly, Setyawan (2020) showed that RME-assisted concrete media improved test scores from 73.68% in Cycle 1 to 100% in Cycle 2.

This study aims to provide further evidence of RME's effectiveness in enhancing mathematical literacy. Based on the background, the research focuses on the influence of the RME Approach Assisted by the PLSV Board on junior high school students' mathematical literacy.

B. RESEARCH METHOD

This study was conducted in Grade VIII during the odd semester of the 2024/2025 academic year. Cluster random sampling was used, with a Quasi- Experimental Design involving an experimental group (30 students) taught using RME and a control group (32 students) taught using a scientific approach. The design was a Randomized Posttest-Only Control Design, with posttests administered to measure differences in mathematical literacy. The test instrument comprised seven descriptive questions on Linear Equations and Inequalities, based on the indicators: Formulate, Employ, and Interpret. Data analysis included descriptive (mean, median, mode, variance, standard deviation) and inferential statistics (hypothesis testing). Prerequisite tests (normality and homogeneity) determined parametric or nonparametric analysis, followed by hypothesis testing to assess treatment effects.

C. RESULTS AND DISCUSSION

Result

The experimental group outperformed the control group in mathematical literacy posttests. Key statistics:

Tabel 1 Descriptive Statistics of Mathematical Literacy Ability

Statistic	Experimental Group	Control Group
Number of Students	30	32
Maximum Score	100	100
Minimum Score	5	0
Mean	54.25	36.71

Median	55	37.5
Mode	100	2.5
Standard Deviation	27.18	26.10

Variance	738.85	681.22

Based on Table 1, it can be observed that the experimental group has superior statistics compared to the control group. The average score of the experimental group is higher than that of the control group. This difference can be explained by the special treatment applied to the experimental group, such as innovative learning approaches and the use of interactive learning media. This treatment allowed students in the experimental group to better understand the material, thereby improving their learning outcomes.

In terms of data distribution, the experimental group has slightly higher variance and standard deviation than the control group. The wider spread of scores in the experimental group indicates that the effects of the treatment may have been perceived differently by each student, depending on their background or initial abilities. However, despite the larger spread, the average score and overall data trend remain better, demonstrating the success of the learning approach. Overall, these results show that the learning approach in the experimental group not only improved the average student performance but also enhanced the overall distribution of scores. Factors such as more engaging learning approaches, relevant assignments, or the use of technology in the learning process likely contributed to these better results. Conversely, the learning approach in the control group appears less effective in encouraging students to reach their full potential, as seen in the lower average, median, and mode scores.

The collected data from both the experimental and control groups were statistically tested through prerequisite tests, including normality and homogeneity tests, followed by hypothesis testing. The data processing in this study was conducted using SPSS software. The following are the results of the normality test for both groups:

Tabel 2 Normality Test Results

	Statistic	**df**	**Sig.**
Experimental Group	.962	30	.342
Control Group	.973	30	.626

It can be seen that the Shapiro-Wilk normality test results at a significance level of α = 0.05 yielded a *p-value* of 0.342 (> 0.05) for the experimental group, so $H{\sim}0{\sim}$ is accepted, meaning the sample comes from a normally distributed population. Similarly, the *p-value* for the control group is 0.626 (> 0.05), so $H{\sim}0{\sim}$ is accepted, indicating that the sample also comes from a normally distributed population. Next, a homogeneity test was conducted using *Levene's* test. The following are the homogeneity test results for both groups:

Tabel 3 Homogeneity Test Results

Levene Statistic	**df1**	**df2**	**Sig.**

.142	1	60	.707

It can be observed that the *Levene's* homogeneity test results at a significance level of α = 0.05 yielded a *p-value* of 0.707 (> 0.05), so H~0~ is accepted, meaning the sample variances come from a homogeneous population. Based on the normality and homogeneity tests conducted, it is shown that the data on students' mathematical literacy test results from both the experimental and control groups come from normally distributed populations with homogeneous variances. Therefore, the hypothesis testing in this study used an *Independent Sample T-Test*. The following are the hypothesis test results presented in the table below:

Tabel 4 Hypothesis Test Results

Equal variances assumed	T	df	*Sig. (2-tailed)*
	2.447	60	.017

It can be seen that the results of the two-group mean difference test for students' mathematical literacy skills show that H~0~ is rejected and H~1~ is accepted at a significance level of α = 0.05. This can be determined by looking at the *Sig. (2- tailed)* value of 0.017. For a one-tailed test, this value is divided by 2, resulting in sehingga $\frac{0,017}{2} = 0,0085$. The resulting one-tailed significance value is smaller than the predetermined α = 0.05 (0.0085 < 0.05), and the $tCalculated$ > $tTable$ (2.447 > 1.670) with df = 60 and a significance level of α = 0.05. Based on the t-test calculations, it can be concluded that H_0 is rejected and H_1 is accepted, meaning that the average mathematical literacy skills of students taught with the RME approach are higher than those of students taught with the scientific approach at a 95% confidence level. Thus, it can be said that learning with the RME approach has a significant effect on mathematical literacy skills.

Discussion

The research results show that students taught with the Realistic Mathematics Education (RME) approach have higher average mathematical literacy scores than those taught with the scientific approach. This indicates that the RME approach is more effective in improving students' mathematical literacy skills, particularly in understanding, applying, and interpreting mathematical concepts in everyday contexts. The difference in treatment between the experimental and control groups influenced how students answered questions categorized into three mathematical literacy indicators: Formulate, Employ, and Interpret.

For the Formulate indicator, students in the experimental group were better able to understand the context of the questions and correctly construct linear inequality models compared to the control group. They could identify key information in the questions, translate it into mathematical models, and understand the relationships between variables. In contrast, students in the control group made more errors in placing inequality signs, indicating difficulties in formulating problems into appropriate mathematical models. For example, some control group students wrote inequality models that were less accurate, such as $2x + 2 \geq 10$, which did not match the contextual situation in the question. These errors suggest that they struggled to grasp the logical relationship between the given information and the inequality concept that should have been applied.

For the Employ indicator, students in the experimental group demonstrated a better understanding of applying mathematical concepts to solve contextual problems. They not only constructed correct mathematical models but also applied appropriate mathematical operations to arrive at reasonable solutions. For instance, in a question involving purchasing items with a limited budget, experimental group students realized that the number of items purchased must be whole numbers, even if the calculation yielded a decimal. They concluded that if the calculation result was 6.67, the maximum number of items that could be purchased was 6, as purchasing more would exceed the available budget. Conversely, many control group students merely recorded the calculation results without considering contextual aspects, such as budget constraints and the requirement for whole numbers. These errors indicate that they still faced challenges in interpreting calculation results and applying them in real-world contexts. For the Interpret indicator, both experimental and control group students struggled with questions requiring deeper analysis. In a question related to calculating the perimeter of a sports field, many students from both groups only noted the given information without proceeding to the calculation stage. Experimental group students tended to record the length and width of the field and write the perimeter formula but did not complete the calculations to arrive at a final solution. Meanwhile, control group students often copied formulas or information from the question without truly solving the problem or drawing appropriate conclusions. These errors suggest that students still need practice in connecting given information with more structured problem-solving procedures.

Overall, the research results demonstrate that context-based approaches like RME can help students connect mathematical concepts with real-life situations, making it easier for them to understand and apply the concepts learned. Context-based learning creates meaning in the learning process, where students not only memorize formulas but also understand how mathematics can be applied in various situations. Additionally, this approach trains students to think more critically and analytically when solving problems, particularly in constructing mathematical models, applying concepts, and interpreting calculation results. However, the results also reveal that further reinforcement is needed in analytical-based learning, especially in training students to be more meticulous in solving problems requiring deep understanding and awareness in drawing conclusions relevant to the given situations. Therefore, the implementation of the RME approach in mathematics education can continue to be developed and combined with other learning strategies to further enhance students' mathematical literacy skills.

D. CONCLUSION

Based on the research results and discussion, the conclusions of the study are as follows: (1) The mathematical literacy skills of students taught using the Realistic Mathematics Education (RME) approach achieved an average score of 54.25, (2) The mathematical literacy skills of students taught using the scientific approach achieved an average score of 36.71, (3) The research results show that the mathematical literacy skills of students taught with the RME approach are higher than those of students taught with the scientific approach. This is based on the hypothesis test analysis of post-test scores, which indicates that the average mathematical literacy skills of the experimental group are higher than those of the control group.

Based on the research findings, the following recommendations are offered: (1) For teachers intending to implement the RME approach in classroom instruction, it is advisable to prepare detailed Student Worksheets (LKS) and consider time allocation to optimize students' problem-solving. Additionally, incorporating non-routine problems into each topic is recommended, (2) For schools, the research results indicate that the average mathematical literacy skills of students taught with the RME approach are higher than those taught with the scientific approach. Therefore, the RME approach can be recommended as an alternative for mathematics instruction in schools, (3) For future researchers studying the RME approach, it is suggested to conduct research on other topics and measure other mathematical competencies.

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