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The Effectiveness of RME in Improving Numeracy of Class V Students in the Teaching Campus Program

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Abstract

The numeracy skills of students in the schools studied are still low, although numeracy is a fundamental skill needed to understand mathematical ideas. This study aims to examine the effectiveness of Realistic Mathematics Education (RME) in improving numeracy performance among fifth grade students in elementary schools who receive support from the national teaching placement program in Kebumen Regency. This study used a pre-experimental approach with a one-group pretest-posttest structure, involving all fifth graders selected through purposive sampling who took part in contextual learning activities related to daily living situations. Numeracy ability was measured using official government instruments provided before and after the intervention. The results showed a clear improvement in numeracy performance and highlighted increased student participation and a more positive response to math teaching when based on a real-world context. The study concludes that RME contributes to strengthening students' motivation, logical reasoning, and problem-solving skills, and is therefore recommended as an instructional approach to support the development of essential mathematics competencies in primary schools.

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INTRODUCTION

Literacy and numeracy are the main foundations for developing critical thinking, logic, and problem-solving skills in elementary school students (Rakhmawati & Mustadi, 2022). Especially for numeracy skills, today it is no longer seen only as numeracy, but also the ability to understand, interpret and apply numbers and data in a real context, and is an important competency that affects students' readiness to face the various challenges of life in the contemporary era (Sari et al., 2023). Good numeracy mastery will make it easier for students to develop logical, creative and reflective thinking in daily activities, as well as become the main provision for rational decision-making in modern society (Salminen et al., 2021).

As a basic ability that needs to be built, Numeracy skills are essential to be developed in students starting from primary school, as they are a foundational competency for lifelong learning and play a big role in building the foundations of other skills development (Sari et al., 2023). Numeracy not only helps students master math lessons, but also underlies the ability to understand social, economic, and scientific phenomena encountered in everyday life. Numeracy equips students to be able to recognize, formulate, and solve problems through mathematical thought processes, which include communication, representation, modeling, and reasoning (Díez-Palomar et al., 2023; Iasha et al., 2025). Numeracy skills are also the basis of the school's Essential Education Goals, as they are a prerequisite for students to be able to understand the material at the next level of education and adapt to a data-driven society (Guhl, 2019). In line with the ability to calculate, in the independent curriculum program there are numeracy skills. Numeracy skills are the ability to use number concepts, understand mathematical operations, and the ability to understand and interpret information and context related to mathematics (Nugraheni et al., 2024; Yohanah et al., 2024). The role of numeracy in education in Indonesia is so central, the reality on the ground shows that there are still many students in Indonesia who have difficulty developing these abilities (Ifrida et al., 2023; Mariamah et al., 2021; Siskawati et al., 2021). Shiva's numeracy difficulties arise due to the low ability to understand mathematical concepts and the lack of connection with the student's real environment. Barriers in interpreting data, and number-based information, such as tables, graphs, and charts, are caused by a lack of practice using real data. Difficulties in analyzing, choosing the right solution and drawing logical conclusions from numerical data. This shows that students' numeracy skills have not been thoroughly formed with conventional learning.

Responding to the urgency of learning problems, the Indonesian government through the Ministry of Education, Culture, Research, and Technology has initiated the implementation of a minimum competency assessment program as an instrument to assess students' reading ability and numeracy literacy nationally (M. Hasanah, 2021; Ministry of Education and Culture, 2020). Minimum competency assessment is not only a benchmark for cognitive achievement, but also serves as an evaluation tool to identify strengths and weaknesses in the learning system that runs (Nurwahidah et al., 2023; Purwati et al., 2021). Thus, the minimum achievement competency assessment is important data for policymakers and education practitioners to design more targeted interventions to improve the quality of elementary school mathematics lessons.

In addition to carrying out a minimum competency assessment, the Indonesian government through the Ministry of Education, Culture, Research, and Technology has launched various strategic policies to strengthen students' numeracy skills, namely the Teaching Campus Program which is part of the Government's policy in the Independent Learning Independent Campus initiative. The program specifically assigns students from various colleges to direct entry into elementary schools, particularly in disadvantaged, limited, outermost areas and schools with low accreditation, to assist teachers in learning literacy, numeracy, technology adaptation, and school administration (Busyairi & Kusuma, 2024; Fatonah et al., 2023). In its implementation, students not only help teach in the classroom, but also design and implement learning innovations based on local needs and provide character and technology reinforcement (Musliman & Damayanti, 2023).

The researcher as one of the students who had the opportunity to become one of the participants of the Teaching Campus program, felt called and involved in efforts to improve students' numeracy skills in elementary school. The efforts made by the researcher are to implement RME as a form of basic mathematics learning innovation where the researcher plays the role of one of the facilitators in the Teaching Campus program. The RME learning method was chosen based on the consideration that RME places real experiences, local contexts, and everyday problems as the starting point for learning (Anggraeni et al., 2024), so that students build a meaningful and actionable understanding of concepts, which can form an effective, collaborative, conducive and context-based numeracy learning environment is essential to build comprehensive communication, representation, reasoning, and problem-solving skills (Fauzan et al., 2024; U. Hasanah et al., 2023; Rachmawati et al., 2021). Learning stages The RME applied consists of: (i) introduction to contextual problems; (ii) transformation of real problems into mathematical problems; (iii) presentations and discussions; (iv) interesting conclusion (Chuseri et al., 2021; Fauzan et al., 2024; U. Hasanah et al., 2023). Direct RME treatment as an alternative method to improve students' numeracy skills. Providing a math learning treatment connects real activities in mathematics learning with the concepts of volume, geometry, and data analysis. After the implementation of RME, student learning outcomes will be measured using a minimum competency assessment instrument developed by the government.

Realistic math learning has been shown to be effective through learning that connects to students' daily activities (Chusna et al., 2022; Setianingsih et al., 2023). In research Ma’rufah et al. (2023) and Rachmawati et al. (2021), the application of RME learning is able to increase numeracy through multimedia, but there is no research available on the competency assessment program in the teaching campus program managed by the independent learning independent campus. The RME study on the teaching campus program managed by the independent learning independent campus is still limited so that there are theoretical and practical shortcomings that need to be researched. Based on this description, the main problem in this study is: Is the learning of RME carried out by the researcher effective in increasing the score of the minimum numeracy competency assessment score in elementary school level V students, in the context of the implementation of the Teaching Campus Program?" The results of this research are expected to make a positive contribution to the development of learning methods by elementary school teachers, and can be used as a basis for determining educational practice policies in Indonesia, especially for the development of elementary school students' numeracy skills. Research on improving numeracy with the RME method in the Teaching Campus program is still rare, in the Teaching Campus Program students as facilitators who present learning innovations.

RESEARCH METHODS

This study uses a quantitative approach with a pre-experimental design, namely a pretest-posttest design of one group with the main objective of testing the effectiveness of RME in improving the numeracy ability of grade V elementary school students as measured using the Minimum Competency Assessment organized by the government. The single-group pretest-posttest model is a research design that pretests subjects before treatment is performed, and then posttests after treatment to find out changes in the variables being studied. The selection of this design was based on the limitations of the research implementation, especially regarding access to the control group. The limitation in question is that there is only one school in Prembun Regency, Kebumen Regency, which is registered as a participant in the Teaching Campus Program and has access to a minimum numeracy competency assessment instrument, where in the research district is placed as teaching staff in the Independent Learning Independent Campus Initiative. In addition, the minimum numeracy competency assessment questions were closed and not disseminated to other schools outside the program participants, so that the researcher could not obtain comparative data from other schools with the same level. This condition made it difficult for researchers to find relevant control classes within the same population and region. Thus, the application of the pretest-posttest model of one group is the most rational and feasible approach so that research can still run validly and measurably under limited conditions. The stages of research on the pretest-posttest model of one group used are illustrated in Figure 1.

Figure 1. Research stages type pretest-one post-grade (adaptation Hananto & Melini, 2023).

Data and Data Sources

The research sample consisted of 28 students in grade V of SDN Bagung. All students in the class are made subjects of research and act as experimental groups that receive the RME learning treatment. The research instrument is in the form of a numeracy test which is sourced from the minimum numeracy competency assessment questions provided by the Ministry of Education and Culture, Research and Technology and accessed through the official application of minimum competency assessment. The minimum competency assessment instrument is a national measurement tool that has gone through a validity and reliability process, so it is used consistently in the pretest and posttest to ensure the validity of the assessment. The implementation of the research has received permission from the education office and the principal through a letter of acceptance as a facilitator and researcher at the school. One example of a minimum competency assessment numeracy question used in this study can be seen in Figure 2.

The example question in Figure 2 is a true-false test instrument that measures students' ability to understand the everyday mathematical context and think realistically. The same questions are given in the pretest and posttest to maintain measurement consistency.

Data collection began with giving a pretest to all students to measure their initial numeracy skills. Furthermore, RME-based mathematics learning is carried out in several meetings through structured stages, namely: (i) the introduction of contextual problems that are close to students' lives (for example, calculating the floor area of the classroom, the volume of bottled drinks, or measuring the length of objects around it); (ii) the transformation of real problems into mathematical models, both in the form of images, tables, and mathematical symbols; (iii) presentation and discussion of student findings in class to build argumentation and reasoning; and (iv) draw conclusions with the teacher to relate learning outcomes to formal mathematical concepts (adherence to Chuseri et al., 2021; Fauzan et al., 2024; Lama, 2022; U. Hasanah et al., 2023). These steps are in line that mathematics learning ideally starts from a real situation that is close to the student's experience, then progresses to a more abstract concept through a gradual mathematical process (Mitraturrahmi, 2025). After the entire learning series is completed, a posttest is given to measure the development of numeracy skills.

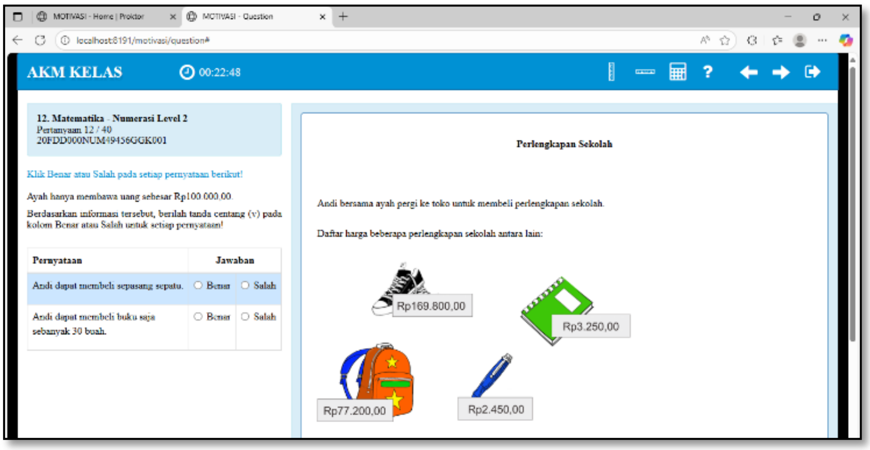

Figure 2. Example of calculating questions for the minimum competency assessment pretest and posttest

The data analysis stage is carried out systematically to ensure valid and accountable research results. The data on the pretest and posttest results that have been collected are first checked for completeness and validity. Furthermore, the data were analyzed to test the normality of the distribution using the Shapiro-Wilk test and the homogeneity of the variance using the Levene test, to ensure the fulfillment of the requirements of the parametric test. If the data is distributed normally and homogeneously, then the analysis is followed by a paired t-test using SPSS software to determine the significance of the difference in pretest and posttest values (Harahap et al., 2021; Wahjusaputri & Purwanto, 2022). However, if the data is not distributed normally, a non-parametric Marked Wilcoxon Rating Test is used. The results of statistical analysis were then interpreted to answer the research hypothesis, namely whether there was a significant increase in students' numeracy results after participating in RME learning. All analysis results are presented descriptively and visually, such as in the form of tables and graphs, so that the research findings are easy to understand. All research procedures are carried out in accordance with ethical principles, by maintaining the confidentiality of student data and obtaining approval from the school. Thus, the design and implementation of this study allows replication by other researchers in the same context and results in scientifically accountable findings.

RESEARCH RESULTS

The research was conducted at SDN Bagung, Prembun District, Kebumen Regency. The research subjects amounted to 28 students in class V of which there were 12 male students and 16 female students. All students become full participants in numeracy learning and assessment activities.

The location of the study is a public elementary school in a semi-urban area with heterogeneous student characteristics both in terms of socioeconomic background and academic ability. The school's facilities are adequate, with fairly representative classrooms, basic math learning equipment, and an environment around the school that allows for the use of real objects in contextual learning.

Learning Process with the RME Approach

Learning activities with the RME approach were carried out in six face-to-face meetings over three weeks. The learning process is designed to actively engage students in understanding mathematical concepts through hands-on experience and the use of real objects found in the school environment and daily life. The stages of RME implementation are as described.

Understanding Contextual Issues

Students determine objects of observation in the surrounding environment and then connect with mathematical concepts. At this stage, students prepare learning materials such as books, pens, rulers, and objects around the classroom (e.g., plant pots, blocks, bottles) as observation objects, as seen in Figure 3.

Figure 3. Understanding contextual issues (Chuseri et al., 2021)

As seen in Figure 3, students help each other find and prepare objects for use in learning. This activity aims to make realistic mathematics learning able to connect concepts with real objects around students.

Explain Contextual Issues

At this stage, students are divided into 9 groups, each consisting of 3-4 people. Group division aims to get students to work together, help each other, and discuss how to measure objects together. The division of group members is carried out randomly, so that in each group there are students with diverse numeracy skills. Each group chooses an object to use for measurement and calculation practices, such as length, area, or volume measurements. The process of group discussions carried out by students can be seen in Figure 4.

Figure 4. Explain contextual issues (Chuseri et al., 2021).

Figure 4 shows students in groups conducting a discussion process about the object to be used as a learning object.

Solving Contextual Problems

Students are required to use mathematical skills in solving problems that occur in daily life. At this stage, each group takes measurements (length, sides, volume) of the selected object. The results of the measurements are recorded systematically in the workbook. The student activity at this stage is seen in Figure 5.

Figure 5. Solving contextual problems (Chuseri et al., 2021).

Figure 5 shows a group of students measuring flower pots around the classroom. The measurement results are documented in the respective workbooks for analysis and presentation. An example of a note in a student workbook can be seen in Figure 6.

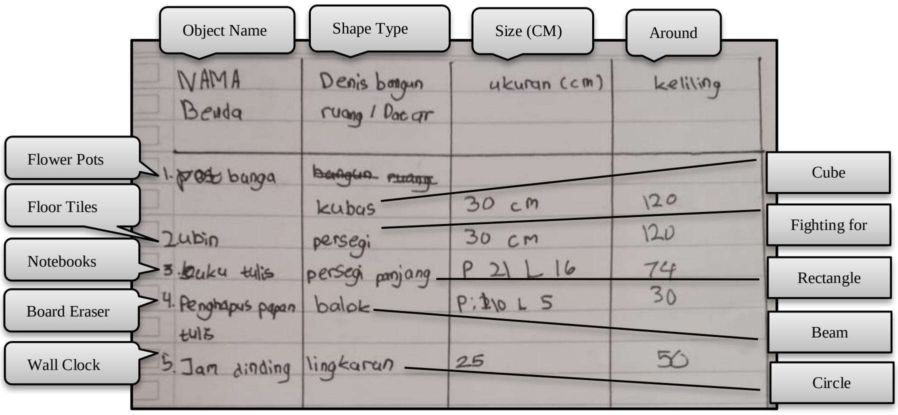

Figure 6. Student work results (Chuseri et al., 2021).

In the picture, students write down the measurement results in the form of a table. The table contains the name of the object, the type of space building or flat building, the size in centimeters, and the circumference of the object. This shows that students are able to identify, measure, and calculate the concept of flat buildings and spaces using real objects, although in some objects there are calculation errors that are the subject of joint evaluation.

Discussion and Drawing Conclusions

After completing the measurements and calculations, each group presented the results of their work in front of the class, as seen in Figure 7.

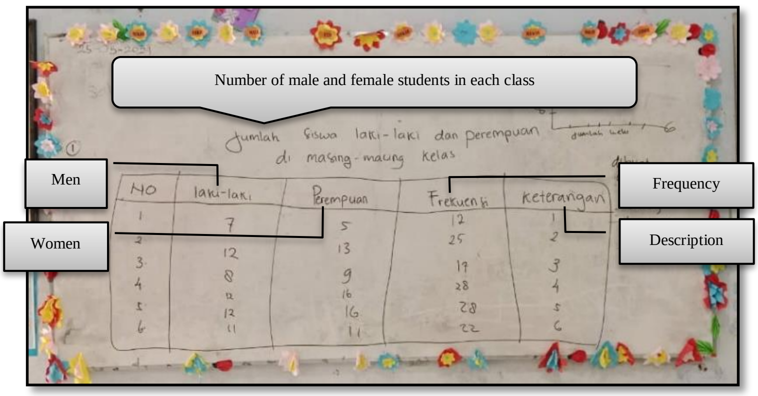

Figure 7. Discussion and drawing conclusions (Chuseri et al., 2021).

Seen in Figure 7, students present the calculation results, such as the volume of packaged drinks, the volume of boxed milk, and the volume of boxed tea. All stages of learning went smoothly with the full participation of all students. All stages of learning run according to the schedule that has been set with the full participation of all students.

Pretest and Posttest Results for the Assessment of the Minimum Competency

Students' numeracy ability is measured before and after learning using a minimum competency assessment instrument Numeracy. The results of the pretest and posttest of all students are presented in Table 1.

Table 1. Results of pretest and posttest for minimum competency assessment of numeracy for class V students of SDN Bagung

Students Code	Pretest	Posttest	Students Code	Pretest	Posttests
1	25	65	15	35	80
2	40	85	16	25	60
3	20	45	17	45	95
4	40	65	18	90	80
5	25	75	19	60	85
6	25	55	20	60	55
7	35	50	21	35	25
8	60	70	22	35	45
9	25	45	23	35	70
10	40	55	24	25	80
11	50	55	25	55	80
12	45	65	26	25	55
13	25	30	27	25	70
14	55	80	28	50	60
Average				39.642	63.571

Table 1 shows that the average score of students is 39,642, while the average score of postgraduation is 63,571, meaning there is an average increase of 23,929 points. These results show that students who have participated in learning using the RME approach have experienced an increase in numeracy understanding. The average comparison of pretest and posttest results is presented in Figure 8.

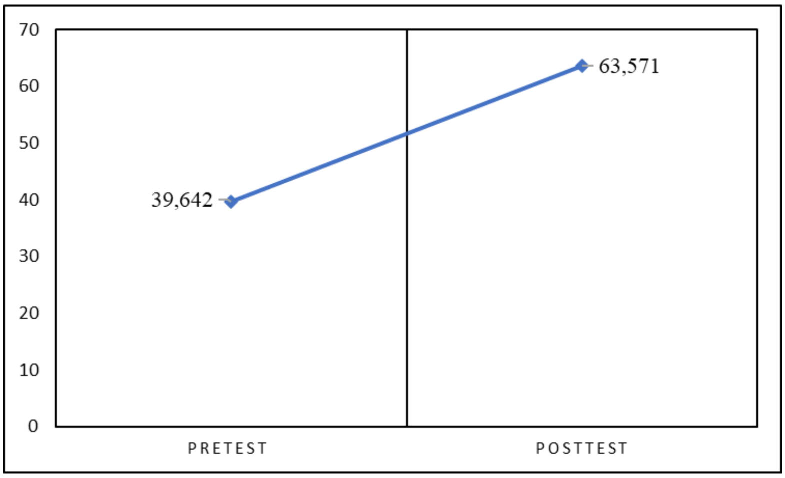

Figure 8. Comparison of average pretest and posttest scores

Normality Test

Normality tests are used to find out whether or not data is distributed normally. The data will be said to be normal if the significance value of the test result is more than 0.05 and vice versa, the data will be said to be abnormal if the significance value of the test result is less than 0.05. The normality test was carried out using the Shapiro-Wilk Test because of the small number of samples, namely 28 students. A summary of the results of the Shapiro Wilk Test is presented in Table 2.

Table 2. Normality test results using the shapiro wilk test

Test Type	Statistics	Students	Limbs
Pretest	.872	28	.003
Posttests	.968	28	.516

As seen in Table 2, the significance value of the pretest data is 0.003 (<0.05) so that the data from the pretest results is said to be not distributed normally. Meanwhile, the significance value of the posttest data was 0.516 (>0.05), so that the posttest data was dissected normally.

Homogeneity Test

The homogeneity test is used to find out whether the pretest and posttest data have the same diversity or not. The data is said to be homogeneous if the significance value of the test results is more than 0.05 and the data is said to be inhomogeneous if the significance value of the test results is less than 0.05. The homogeneity test is carried out using the Levene Test because the results of the normality test are not distributed normally, as an alternative to the Bartlett Test (Sianturi, 2022). A summary of the results of the Lavene Test is presented in Table 3.

Table 3. Homogeneity test results using the levene test

Groups	Levene Statistic	df_1	F^2	Meaning
Pretest dan Posttest	.228	1	54	.635

As seen in Table 3, are said to be homogeneous because they have a significance value of 0.635 which is greater than 0.05.

Effectiveness Test

The effectiveness test was carried out using the Wilcoxon Signed Rank Test Test with the aim of Ensure significant differences in pretest and posttest scores. The Wilcoxon test was chosen because it was based on the assumption of data normality that was not achieved. Paired *t*-test (Mubarak, 2020). If you look at the results of the normality test in Table 2, then Wilcoxon Signed Rating This test meets the criteria for use in this process, i.e. because the data is not distributed normally but still has a paired relationship between the pretest and the posttest. Summary of Wilcoxon Signed Rank test results This test is presented in Table 4.

Table 4. Effectiveness test results using wilcoxon marked rating test

Statistics	Value
Z	-4.564
p-value	0.000

As seen in Table 4, the significance value (p-value) is 0.000 (<0.05), so the conclusion of the test is that there is a significant difference between the student's pretest and posttest results. So based on the results of the statistical test, it can be said that there is a significant increase in students' numeracy scores after learning using the RME approach.

DISCUSSION

The results of this study clearly show that the implementation of RME in grade V of SDN Bagung has a significant impact on increasing the numeracy results of the minimum competency assessment of students. It was proven that there was an increase in the average score of 23,929 points, from 39,642 in the pretest to 63,571 in the posttest which was in the medium to high category. This increase not only shows success in transferring mathematical concepts, but is also influenced by the high enthusiasm and involvement of students during RME-based learning. This spirit is reflected in the positive response of students when mathematics learning is carried out outside the classroom. The initial stage in the learning of RME students uses real contexts such as measuring flower pots, counting the volume of beverage bottles and packaged beverages, counting the number of male and female students from grades 1-6. This process occurs in horizontal mathematics, i.e. The process of turning a problem from a real-life to a mathematical model (Aniati et al., 2024). Furthermore, students are free to experiment directly with mathematical concepts, measure various objects in the environment, and determine for themselves the objects they want to calculate according to their abilities. This freedom in choosing objects encourages creativity, fosters curiosity, and deepens students' understanding of mathematics. This process occurs in vertical mathematics, i.e. Steps to process or refine mathematical models to get solutions (Aniati et al., 2024).

These exploratory and contextual learning experiences make math learning more enjoyable and less daunting, even though the material studied, such as building spaces, flat buildings, and volumes, is often perceived as abstract and difficult by students. This research proves that RME is a mathematics learning method that provides flexibility in determining observation objects, presents interesting concepts, and is effective in helping students understand the material. The effectiveness of RME is reflected in the results of the minimal competency assessment numeracy posttest, which shows an improvement in students' abilities after this method is applied. The implementation of the teaching campus program managed by the independent learning independent campus opens cooperation between teachers and students, so that there is collaboration so that the implementation of RME becomes more directed and effective because students collaborate with teachers in compiling context-based activities and assessments. Through RME steps, especially at the core stage that involves the observation of the surrounding environment and relates to mathematical concepts, students become more easily able to understand the material contextually.

The findings of this study reinforce previous results showing that the implementation of RME consistently encourages positive interactions between learning methods and students' numerical abilities, thereby contributing to improved mathematics learning outcomes and mathematical literacy, especially at the primary school level (Ariati et al., 2022; Purna et al., 2021). In addition to improving knowledge and problem-solving skills in a structured manner, RME also builds students' confidence through appreciation of their thought process (Ma'ruf et al., 2024; Manggarrani et al., 2024). Experimentally, Ma'ruf et al. (2024) proves that RME is more effective than expository methods in improving understanding of geometry concepts, supported by literature that emphasizes the importance of contextual learning and real-life experiences so that students are able to connect mathematics with everyday life (Rakhmawati & Mustadi, 2022; Sari et al., 2023).

Therefore, the application of RME is very relevant to build reflective mindsets, problem-solving abilities, and complete math literacy in elementary school students.

Practically, the results of this study show that RME has great potential to be applied to various grade levels and variations of mathematics materials. This approach is highly recommended to strengthen mathematics learning in elementary school because it is able to foster contextual understanding, build intrinsic motivation, and facilitate students in solving real problems in a creative and organized manner. Thus, the implementation of RME not only improves numeracy results quantitatively, but also improves the quality of students' mathematics learning experience. The RME learning model is flexible and can be used in a variety of other math materials, such as fractions, integers, percentages, and data analysis, as long as the teacher is able to provide real context and connect in students' daily activities with mathematical concepts.

However, this study has some limitations that need to be considered. The limited number of samples, which involved only 28 students from a single class in the absence of a control group, limited the generalization of the findings to the context of the school or the wider population. The absence of a control group also makes it difficult to ensure that all student grade improvements are entirely the result of the RME intervention, unaffected by other external factors. Therefore, further research with a stronger experimental design, a larger sample count, and a variety of school contexts is needed to test the consistency and validity of the findings.

Overall, this study confirms the effectiveness of RME in improving elementary school students' numeracy outcomes and enriching the literature on contextual mathematics learning. A learning model that is oriented towards real experiences, environmental exploration, and open discussion has been shown to build a strong foundation of numeracy, while also creating a more inclusive and enjoyable math learning atmosphere.

CONCLUSION

The results of the study showed a significant improvement in students' numeracy skills. The average numeracy score for the minimum competency assessment increased from 39,642 (pretest) to 63,571 (posttest), with an increase of 23,929 points. The Wilcoxon Ranking Test yielded a significance value of $p = 0.000$ (<0.05), which confirms that RME learning has a significant positive impact on improving students' numeracy outcomes. All stages of learning are carried out with the active participation of students, who show a positive response to real-life experiential learning methods and freedom of exploration.

The main contribution of this study lies in the empirical proof of the effectiveness of RME in the context of numeracy of minimum competency assessment and real implementation at the elementary school level, especially in areas that participate in the Teaching Campus Program. This research also provides a basis for teachers and education policy makers to adopt RME as an adaptive, contextual, and mathematical learning strategy that is oriented towards strengthening students' numeracy from an early age. Overall, this study confirms that RME is a learning approach that has great potential to improve the numeracy outcomes of elementary school students. This research not only shows an improvement in students' numeracy skills through the minimum competency assessment score, but also strengthens the RME theory as an effort to build students' mathematical understanding. These findings support the independent learning policy of an independent campus through the teaching campus program in the government's efforts to build students' numeracy skills at the elementary school level.

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