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Mathematics for Life: Community Service through Realistic Mathematics Education at SMP Muhammadiyah 1 Kartasura

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Abstract: This community service program aims to implement RME in secondary school mathematics, develop RME-based worksheets, assess its impact on students' outcomes, and explore teachers' and students' responses. The participants involved were students from a combined class of Grade VIII Tahfidz and Regular tracks. The activity was carried out using a Participatory Action Research model. Data were collected through questionnaires, mathematics tests, observations, interviews, and documentation. A paired sample t-test was employed to analyze the data and determine whether there was a significant difference in students' learning outcomes prior to and following the implementation of RME. The community service results indicated that the implementation of RME successfully enhanced student engagement and understanding in mathematics learning. Statistical analysis showed a significant difference between students' scores before and after the RME-based instruction, with the average score increasing from 46.36 to 62.44. Questionnaire responses revealed that students positively perceived the RME-based learning, particularly in terms of engagement, conceptual clarity, and meaningful learning experiences. Teachers also expressed that the RME approach provided new perspectives for delivering mathematics more contextually and engagingly, and showed interest in applying it to other mathematical topics. These findings imply that the RME approach has the potential to be sustainably integrated into broader mathematics learning through continued collaboration and material development.

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Introduction

Mathematics is one of the sciences that must be learned by every individual, especially secondary school students. This is reinforced by the Law of the Republic of Indonesia Number 20 of 2003, which states that mathematics is compulsory for primary and secondary school students (Pemerintah RI, 2003). The obligation to study mathematics is based on the crucial role of mathematics in developing logical and analytical thinking and its application in various aspects of life. Mathematics helps students to think critically, logically, and creatively when solving a problem (Arshad et al., 2017). In addition, mathematics plays an important role in various disciplines, such as physics, biology, chemistry, economics, and computer science, to solve complex problems and increase the development of knowledge and innovation in these fields (Crespo & Tohmé, 2017; Motta & Pappalardo, 2013; Quale, 2011; Restrepo, 2013).

However, learning mathematics has its challenges. In mathematics, the concepts learned are abstract (Kvasz, 2019). The abstract concept of mathematics causes many students to have difficulty understanding it, so their interest in learning mathematics decreases (Farida, 2018). Thus, applying or implementing a mathematics learning approach that connects abstract mathematical concepts with students' concrete experiences is necessary. One of the learning approaches that can be used is Realistic Mathematics Education (RME) (Koerunnisa et al., 2025).

These characteristics of the RME approach include real-world context, mathematical models, learners' production and construction, the interactive character of the teaching process, and the interweaving of various learning strands (Setyaningsih et al., 2019). The real world is a starting point for building mathematical concepts and ideas. RME directs students to rediscover mathematical ideas, concepts, and principles from real problems that can be used in solving mathematical problems (Suparni, 2020). Thus, RME can solve the common problems in learning mathematics, namely, low student involvement and difficulty understanding abstract concepts.

However, although the RME approach has great potential to improve the quality of mathematics learning, its implementation in the field still faces various limitations. This is supported by the results of observations and initial interviews with mathematics teachers at SMP Muhammadiyah 1 Kartasura, which shows that the RME approach has been applied in mathematics learning at the school, but has not been implemented optimally. One key issue is the absence of a systematic implementation model that directly engages students in contextual learning activities aligned with RME principles. As explained in the previous situation analysis, abstract mathematical concepts must be linked to students' concrete experiences to make learning more meaningful. Another problem identified was the unavailability of structured and systematic learning guides or tools to support the application of the RME approach in the classroom. Teachers admit that although they already know the basic concepts of RME, there is still confusion in designing learning activities that align with this approach's characteristics. This causes the implementation of RME to be less than optimal and tends to be incidental, depending on the initiative of each teacher and the limited references they have. These problems indicate the need for a structured intervention through a community service program to strengthen teachers' understanding of the RME approach, provide RME-based teaching tools such as LKPDs, and facilitate direct implementation with students to evaluate its effectiveness and gather feedback from teachers and students.

Furthermore, studies related to community service in mathematics learning have been conducted. Some of them were carried out by (1) Hydorn (2007) related to community service in the form of applying various service-learning models in teaching statistics and providing principles for assessing the quality of service-learning implementation, (2) Mahmudi et al. (2018) conducted community service by introducing a realistic mathematics learning approach in elementary schools, (3) Ishartono et al. (2021) focused on the implementation of a matrix calculator to enhance digital-based mathematics teaching competencies among mathematics teachers, (4) Kristanto (2021) related to community service in the form of providing a self-development program for teachers to design digital mathematics learning activities using Desmos, (5) Auw et al. (2023) applied the ethnomathematics approach in learning mathematics in elementary schools, (6) Faiziyah et al. (2023) carried out a program on the implementation of problem-based learning using multiple

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Vol. 6, No. 3 (August 2025)
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Pg : 497-512

solution tasks for mathematics teachers in Sragen Regency, and (7) Ulima & Zubaidah (2024) conducted community service in the form of applying the discovery learning model to mathematics learning in grade 7 secondary school. However, until now, no community service program has been found that specifically applies the RME approach in learning mathematics at the junior high school level. In fact, the study by Mahmudi et al. (2018) still implements the RME approach at the elementary school level. It does not explicitly explain the theoretical basis of the RME approach used as a reference.

Therefore, there is a need for a study or community service program that specifically implements the RME approach at the junior high school level. The RME approach in this service program is designed by applying four main activity levels, namely situation (presentation of contextual problems close to students' lives), model of situation (use of representation models that reflect real situations), model for knowledge (model development towards understanding more abstract mathematical concepts), and formal mathematics (reinforcement of formal mathematical concepts and representations) (Gravemeijer, 1994; Johar et al., 2021). The novelty of this program lies in the application of RME, which does not simply use a contextual approach but is based on a theoretical framework oriented towards systematic and tiered learning stages. This program is important because it can provide a theoretical and applicable learning model for teachers in applying the RME approach as a whole.

Based on this description, the purpose of this community service program is to systematically implement the RME approach in mathematics learning in secondary school through hands-on activities with students. This program also aims to produce and utilize RME-based LKPD and teaching materials as examples of contextual learning practices that can be used and further developed by teachers in their classes. In addition, this activity aims to evaluate the effectiveness of RME-based learning in improving student learning outcomes, as well as exploring teacher and student responses to the application of this approach.

Method

This community service activity is carried out through RME-based mathematics learning assistance with a Participatory Action Research (PAR) approach, which is a form of action-based service carried out in a participatory manner through the stages of preparation, implementation, and evaluation (McTaggart et al., 2017). In general, the details of each stage are as follows.

1) Preparation Stage

   The service implementing team conducted surveys and discussions with partners, namely the principal, homeroom teacher, and math subject teacher at SMP Muhammadiyah 1 Kartasura. The junior high school is at Jalan Ahmad Yani 160, Kartasura, Hamlet, Sedahromo Lor, Kartasura District, Sukoharjo Regency, Central Java 57169. In addition, the implementing team designed learning tools in the form of teaching materials such as presentations (PPT) and Student Worksheets (LKPD) based on the RME approach. The material used in this activity is the Pythagorean Theorem, with the context of real-life problems, namely calculating the length of the diagonal cable of the soccer field.

2) Implementation Stage

   The learning activities were implemented directly by the implementing team for the students through a series of systematic steps. Learning begins with an introduction to the real context, where students are shown contextual problems in the form of pictures of a

Vol. 6, No. 3 (August 2025)
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Pg : 497-512

soccer field through presentation media. Next, students are divided into groups to discuss and solve the problem using the LKPD. In this stage, they do various activities such as measuring side lengths, recognizing angles, drawing sketches, and completing triangle side relationship tables. After that, students explore the relationship pattern between the squared lengths of the sides of a triangle ($a^2 + b^2 = c^2$) and relate it to the shape of a right triangle. The next stage is concept application, where students apply the Pythagorean Theorem to solve contextual problems related to the length of a rope connecting two points in a field. Finally, the implementing team facilitated class discussion and reflection to review the solutions and summarize the findings from each group.

3) Evaluation Stage

The evaluation was conducted to assess the effectiveness of the mentoring activities and the extent to which the RME approach was successfully applied in mathematics learning. The evaluation was conducted by observing students' involvement during the activities, teachers' participation in assisting students, and the suitability of the implementation with the learning design that had been prepared. In addition, the implementing team also collected feedback from students and teachers regarding the clarity of the material, involvement in group discussions, and ease of using the RME-based LKPD.

Furthermore, data collection in this activity was carried out through five techniques: a questionnaire, a mathematical test, observation, interviews, and documentation. The questionnaire was prepared using a Likert scale (1-5) to measure students' responses to RME-based mathematics learning, including three main aspects: student engagement, concept understanding, and meaningful learning experiences. The mathematical test consisted of five essay questions prepared by the implementing team and given after the learning activities. This test aims to measure students' learning outcomes on the Pythagorean Theorem material after participating in RME-based learning. The questions given were designed to be equivalent to those previously given by the class teacher, thus allowing a fair comparison between the scores before and after applying the RME approach.

Then, observations were made during the learning process to assess the implementation of RME-based learning. Interviews were conducted with teachers to determine their responses, understanding, and plans for continuing the application of RME after the service activities. Documentation was used to obtain student score data before implementing RME learning. This value was obtained from the teacher due to previous assessments and was used as comparison data against post-RME test results. Both data were analyzed using a paired sample t-test to determine the significance of improving learning outcomes (Ravid, 2020).

Result and Discussion

Preparation Stage

This community service activity began with a visit by the implementing team to the partner school, namely SMP Muhammadiyah 1 Kartasura. During the visit, the team coordinated with the school, involving the principal, homeroom teacher, and mathematics teacher. The discussion focused on identifying learning needs and the program's suitability to run. The discussion results showed the school's interest in the RME approach, especially in improving students' understanding of mathematical concepts. Based on mutual consideration, it was agreed that the mentoring activities would focus on mathematics learning in class VIII,

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Vol. 6, No. 3 (August 2025)
E-ISSN : 2722-5097
Pg : 497-512

with the topic of the Pythagorean Theorem as the main material. This is as stated by the math teacher in the following quote.

> "So far, students have difficulty understanding the concept of the Pythagorean Theorem because the material is abstract. Many students have not understood the side relations in triangles in depth. We hope that the RME approach can help students understand more easily through real situations that are close to their lives."

After the coordination stage, the implementing team continued developing learning tools, including teaching materials, LKPD based on the RME approach, and test instruments to measure student understanding after learning.

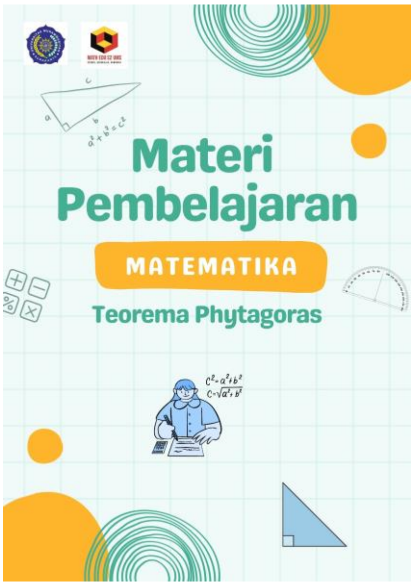

Figure 1. Pythagorean Theorem Learning Material

Figure 2. Pythagorean Theorem Student Worksheet

Implementation Stage

Mathematics learning activities on the topic of the Pythagorean Theorem are carried out using the RME approach, which refers to four levels of RME activities, namely situation, model of situation, model for knowledge, and formal mathematics (Gravemeijer, 1994; Johar et al., 2021). This activity was implemented in class VIII of SMP Muhammadiyah 1 Kartasura, with participants consisting of a combination of students from class VIII Tahfidz and VIII regular (36 students). The four levels of RME activities applied in this learning activity were implemented through the following stages.

1) Situation

At the situation stage, learning begins by introducing a real context that is relevant and close to students' experience, namely, the situation on the soccer field. This context is chosen because it is quite familiar to students and can arouse their curiosity about the problem to be solved. In the presentation material shown at the beginning of the lesson, students are shown a sketch of a soccer field complete with the length and width of the field (120 meters and 90 meters, respectively). Students are asked to observe the field's shape and the poles' position in the four corners.

The contextual problem posed at this stage was: "If two poles in opposite corners of a field are to be connected by a cable, how long would the cable need to be?" (see Figure 3).

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Vol. 6, No. 3 (August 2025)
E-ISSN : 2722-5097
Pg : 497-512

This question was posed to generate student engagement and trigger natural mathematical exploration. With this context, students begin to imagine that they are in a real field and facing a problem that must be solved logically.

Figure 3. Contextual Problem

The activity then continued by dividing students into four small groups. Each group was given directions to work on the tasks in the LKPD, such as sketching two location points to be connected, measuring the length of the other two sides, and identifying the geometric shapes that appeared. In this activity, students began to recognize that the shape formed was a triangle, and the context of measuring the length of sides and angles led them to think about the relationship between sides.

The situation stage in the RME approach emphasizes concrete experience and direct observation of students of the problem context, and is an initial bridge to the formation of mathematical models (Juana et al., 2022). This is in line with the opinion of Sunindri et al. (2018) and Masduki & Safitri (2022) that mathematics learning should start from realistic problems that are close to students' lives so that students can build mathematical understanding through the process of modeling and guided reinvention. Furthermore, activities at the situation stage do not directly mention the Pythagorean Theorem but provide space for students to experience real situations that contain the concept. In this way, students learn math not only as a collection of formulas but as a tool to solve real problems around them (Koerunnisa et al., 2025).

Figure 4. Tahfidz and Regular Classes

Figure 5. Presentation of Preliminary Material

Figure 6. Presentation of Contextual Problems

Figure 7. Instructions to Student Groups

2) Model of Situation

Students begin to build a representation of the real situation, which is presented as a visual model at the model of situation stage. After understanding the contextual problem of measuring the distance between two points on the field through a cable or rope scenario to be installed, the implementing team gave each group of students a different location in the volleyball court area. These locations include various positions, such as the center of the field, the edge of the field, or certain predetermined corners. In line with this, Passarella (2022) stated that the diversity of contexts and situations provided to students encourages the development of different models due to each group's process of constructing understanding rather than merely copying existing ones. This variety enriches the mathematization process and fosters deeper conceptual understanding through meaningful engagement with real-life experiences (Kholid et al., 2021).

Based on the instructions in the LKPD, each group takes measurements of two known sides using tools such as a meter. After the measurements are taken, students draw a sketch based on the location and data they obtained directly. This sketch serves as a representative model of the situation they experience and a tool for finding mathematical patterns or relationships. This is in line with the opinion of Ulrich et al. (2014) that the models that students build from their concrete experiences serve as a bridge between the world of reality and the world of formal mathematics, where the initial contextual model gradually develops into a more general mathematical model.

Figure 8. Students Measure the Volleyball Court

Figure 9. Students Draw a Sketch of the Court in Geometric Form

Students are not yet fully using formal math symbols or terms such as $a^2 + b^2 = c^2$. However, they have started to think about triangles and the length of the sides as a representation of the distance between points. The models they create are still closely related to real situations in the field, but have begun to show more explicit mathematical structures, namely the measurement and formation of triangles. This is characteristic of the model of situation stage, when the model starts to become a tool for understanding and solving problems, although it is still contextual and concrete (Gravemeijer, 1994; Gravemeijer & Doorman, 1999). This shows that the model is starting to function as a representation of reality and as a means to access more abstract mathematical thinking (Kholid & Aisyah, 2025).

3) Model for Knowledge

At the model for knowledge stage, students begin to use the triangle model they built from real measurements as a tool to understand mathematical concepts more generally. By filling in the table in the LKPD, they recorded the lengths of the sides of the triangle (a, b, and c) and their squares (a^2, b^2, and c^2), then observed the emerging mathematical patterns.

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Vol. 6, No. 3 (August 2025)
E-ISSN : 2722-5097
Pg : 497-512

Although each group's data differed, students found a consistent pattern that $a^2 + b^2 = c^2$. This led to an initial understanding of the Pythagorean Theorem. The model that initially represented the position of a point on the ground now began to be used abstractly to understand relationships in right-angled geometric shapes in general.

Table 1. Table of Variation in Distance Between Two Locations

Length of the first side (a)	Length of the second side (b)	Distance between the two locations (c)	a^2	b^2	c^2
3 m	4 m	5 m	9	16	……
6 m	8 m	10 m	36	…..	100
8 m	15 m	17 m	….	…..	…..
5 m	12 m	13 m	…..	……	…..
9 m	12 m	15 m	……	…….	……

Intergroup discussions reinforced students' understanding that the pattern is universal. The implementation team encouraged students to express the relationship $a^2 + b^2 = c^2$ in their own words as part of the conceptualization process. This stage becomes an important transition point from contextual thinking to mathematical thinking when students realize that the relationship between the sides of a triangle applies to one case and is a general rule in geometry. It is also an important foundation for students to step into the formal stage of mathematics, where they begin to use formal symbols and notations fully. This follows the statement of Gulkilik et al. (2020) that the transition process from contextual models to formal understanding in mathematics learning can be effectively facilitated through discussion-based exploration activities and visual representations constructed by students.

Figure 10. Documentation of the Model for Knowledge Stage

4) Formal Mathematics

In the formal mathematics stage, students use mathematical symbols and notations formally to solve problems. After finding the relationship pattern between the sides of the triangle in the previous stage, they are directed to conclude and write it down in the form of the formula $a^2 + b^2 = c^2$ and apply it to calculate the length of the hypotenuse based on the two sides they have measured in the field. Each group does this process independently with the implementing team assistance if needed, and it involves math operations such as square numbers, square roots, and other basic operations. As the formula is discovered gradually through exploration, students operate mathematical symbols with a deeper understanding. In line with this, Lockwood & Purdy (2019) said that formal mathematical concepts will be more meaningful if they are obtained through reinvention by the students, not just given directly by the teacher.

After the calculation, students test the results concretely by cutting the rope according to the calculated size and then matching it with the distance between two points in the field.

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Vol. 6, No. 3 (August 2025)
E-ISSN : 2722-5097
Pg : 497-512

This step reinforces the understanding that mathematical formulas are not just memorization but real tools to solve contextual problems. At this stage, students show mature abstract thinking skills, where formal procedures no longer depend on the initial context because understanding has been formed meaningfully and gradually since the beginning of the learning process with the RME approach. This follows Resi's (2021) opinion that the formal mathematization process is the result of a learning journey that starts from a concrete context to a symbolic structure through the gradual development of models and generalizations.

Evaluation Stage

RME-based mathematics learning activities were evaluated through analysis of observation results, student questionnaires, and interviews with partner teachers. Based on the observation results, students actively participated in the learning process. They enthusiastically participated in group discussions, completed the LKPD collaboratively, and showed interest when linking mathematical material with the real context. Students also took the initiative in exploring patterns of relationships between concepts, especially when concluding learning activities. In general, the implementation of learning took place following the steps that had been designed, and RME characteristics such as the use of context, modeling, and interactivity were reflected in the active involvement of students. This is in line with the findings of Setyaningsih et al. (2019) that the RME approach can increase students' involvement and learning activities because learning starts from a real context that is close to their lives. Furthermore, Table 2 shows the observation results obtained by the implementing team.

Table 2. Observation Sheet of Mathematics Learning Implementation Based on RME

Observed Aspect	Observed Behavioral Indicator	Score	Observation Notes
Student Active Participation	Students actively and enthusiastically engage in all parts of the learning process	4	Students paid attention, joined discussions, and responded to the implementation team’s prompts.
Collaboration and Group Discussion	Students worked together in groups and completed the worksheet collaboratively	3	Group discussions were productive; students exchanged ideas and completed tasks together.
Connection to Real-life Context	Students showed interest in relating mathematical content to real-life situations	4	Some students shared relevant real-life experiences connected to the context given.
Initiative and Concept Exploration	Students took initiative in drawing conclusions and exploring relationships between concepts	3	Students tried to identify patterns and summarize the outcomes of their group activities.
Implementation of RME Characteristics	The implementation team clearly implemented the use of context, modeling, and interaction	4	The team presented contextual problems, encouraged modeling, and fostered interactive learning.

Notes: 4 = Excellent, 3 = Good, 2 = Fair, 1 = Poor

Furthermore, the questionnaire results showed that students responded positively to the RME-based mathematics learning (see Table 3). On the engagement aspect, more than 85% of the students agreed (4) or strongly agreed (5) to their active involvement in group discussion and task completion. On the concept understanding aspect, most students felt they understood the Pythagorean Theorem better after the learning, with more than 85% choosing 4 or 5. Meanwhile, on the meaningful learning experience aspect, students felt the learning was more relevant and fun, and it encouraged them to think independently. Overall, the RME approach successfully creates active, easy-to-understand, and meaningful learning. In line

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Vol. 6, No. 3 (August 2025)
E-ISSN : 2722-5097
Pg : 497-512

with Susanti's (2025) findings, RME-based learning can increase students' engagement and understanding of concepts because it starts from a context close to real life and encourages reflective thinking processes. This approach is also considered effective in building meaningful learning experiences through modeling activities, group discussions, and independent exploration of concepts (Hakim et al., 2024; Lady et al., 2018).

Table 3. Students' Responses to the RME-Based Mathematics Learning Questionnaire

Aspect	Statements	Choice of Answer				
		1	2	3	4	5
Engagement	I actively participated in the learning activities from beginning to end.	3.1%	1.5%	6.2%	47.7%	41.5%
	I took part in group discussions when working on the student worksheet (LKPD).	1.5%	6.2%	4.6%	49.2%	38.5%
	I felt confident in expressing my ideas or opinions during the activity.	1.5%	7.7%	3.1%	43.1%	44.6%
	I was directly involved in completing the tasks with my group.	4.6%	6.2%	4.6%	40%	44.6%
Conceptual Understanding	I understand the relationship between the sides in a right-angled triangle.	3.1%	3.1%	7.7%	44.6%	41.5%
	I can apply the Pythagorean Theorem to solve contextual problems.	3.1%	9.2%	3.1%	44.6%	40%
	My understanding of the Pythagorean Theorem improved after this learning activity.	3.1%	4.6%	3.1%	47.7%	41.5%
	I can explain the Pythagorean Theorem to others.	1.5%	12.3%	6.2%	40%	40%
Meaningful Experience	I felt that the learning was connected to real-life situations.	1.5%	7.7%	4.6%	41.5%	44.6%
	I enjoyed the learning experience more than in regular classes.	3.1%	6.2%	6.2%	38.5%	46.2%
	The activity encouraged me to think independently in discovering mathematical ideas.	4.6%	9.2%	6.2%	36.9%	43.1%
	The LKPD helped me understand the material clearly and step by step.	3.1%	10.8%	4.6%	40%	41.5%

In addition, the interviews with mathematics teachers revealed that teachers felt helped by the teaching tools and examples of learning practices developed by the implementation team. Furthermore, the interview process with the math teacher is as follows.

Team : "What do you think about the mathematics lesson that was delivered using the RME approach?"

Teacher : "I think it was very engaging. The students were more active and seemed to understand the material more easily because it was connected to real-life situations."

Team : "Did the teaching materials, such as the student worksheet and presentation slides, help support the learning process?"

Teacher : "Yes, very much. The worksheet was well-structured and easy for the students to follow. It also gave me a clearer idea of how to design RME-based activities."

Team : "Would you be interested in applying this approach to other math topics?"

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Vol. 6, No. 3 (August 2025)
E-ISSN : 2722-5097
Pg : 497-512

Teacher : "Absolutely. In fact, I hope there will be further assistance to help us implement RME in other topics like ratio or solid geometry. I would also appreciate it if more teaching materials could be developed."

Based on the results of these interviews, teachers acknowledged that the RME approach provides a new perspective in delivering mathematics materials in a more contextual and interesting way. They wanted to apply this approach to other materials, like comparison and building space. They hoped there would be further assistance in developing RME-based teaching tools, per Gravemeijer's (2020) opinion, which is that the RME approach allows teachers and students to reconstruct mathematical concepts more meaningfully by exploring real contexts and progressive modeling processes.

Figure 11. Interview with Teacher

Analysis of Students' Mathematics Test Results

The implementation team analyzed the students' mathematics test results after the RME-based learning and compared them with the students' scores before the treatment (obtained from conventional learning by the previous class teacher). A paired sample t-test was used to determine whether there was a statistically significant difference. However, before the t-test, a normality test was first conducted on the data as a prerequisite test to ensure that the data met the assumption of normal distribution (Ghasemi & Zahediasl, 2012). Figure 12 displays the results of the normality test.

Tests of Normality

	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
Scores	.138	36	.081	.970	36	.439

Figure 12. Normality Test of the Score Differences Before and After RME-Based Mathematics Learning

The normality test was conducted using the Shapiro-Wilk method because the number of samples was less than 50 (Razali & Yap, 2011). Based on Figure 12, a significance value of 0.609 was obtained, which is greater than the significance level α = 0.05, so it can be concluded that the difference between the scores before and after RME learning is normally distributed. Therefore, the analysis continued with the paired sample t-test to determine significant differences. The test results are shown in Figure 13.

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Vol. 6, No. 3 (August 2025)
E-ISSN : 2722-5097
Pg : 497-512

Paired Samples Test

		Paired Differences					t	df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference Lower	Upper			
Pair 1	Before - After	-1.608E1	15.48156	2.58026	-21.32154	-10.84513	-6.233	35	.000

Figure 13. Paired Sample T-Test of Scores Before and After RME-Based Mathematics Learning

Based on Figure 13, the significance value is 0.003, smaller than α = 0.05. This shows a significant difference between the average score of students before and after participating in RME-based mathematics learning. The descriptive analysis result in Figure 14 shows that the average score of students after RME learning is 62.44, higher than the average score before RME learning, which is 46.36. Thus, it can be concluded that students who followed mathematics learning with the RME approach obtained better learning outcomes than before.

Statistics

		Before	After
N	Valid	36	36
	Missing	36	36
Mean		46.3611	62.4444
Median		47.0000	61.5000
Std. Deviation		2.0540E1	1.4938E1
Variance		421.894	223.168
Range		73.00	54.00
Sum		1669.00	2248.00

Figure 14. Descriptive Statistics of Students' Scores Before and After RME Approach

This finding aligns with the research of Pakpahan & Matondang (2023) and Lestari et al. (2020), who found that applying RME in mathematics learning can significantly improve student learning outcomes. The improvement occurs because RME allows students to build their understanding of concepts through contexts close to everyday life (Sintawati et al., 2020). This approach also encourages students' active involvement in the learning process, individually and in groups. Thus, RME improves understanding and strengthens retention and application of mathematical concepts in real situations. Such meaningful learning experiences contribute to stronger memory retention, as students are more likely to recall and apply concepts that are personally constructed and contextually relevant (Santosa et al., 2025).

Several follow-up plans have been established to ensure this community service activity's long-term sustainability. First, continuous mentoring and consultation will be provided to mathematics teachers at SMP Muhammadiyah 1 Kartasura to support the integration of RME into their regular teaching practices. Second, periodic workshops will enhance teachers' capacity to design and implement RME-based learning materials. Lastly, a monitoring and evaluation framework will be implemented to assess the impact and effectiveness of RME integration over time, allowing for improvements and adaptations based on classroom realities. These initiatives aim to embed the principles of RME as a sustainable instructional approach in the school's mathematics curriculum.

Conclusion

Community service activities through the application of RME-based mathematics learning at SMP Muhammadiyah 1 Kartasura showed positive results. Applying the RME approach, which consists of the stages of situation, model of situation, model for knowledge, and formal mathematics, successfully created contextual, interactive, and meaningful learning. Students actively participated in the learning process, such as measuring actual distances on the school's volleyball field, discussing real-life triangle formations, sketching their findings, and independently discovering the relationship between the sides. Questionnaire and observation results supported that this approach increased students' engagement, conceptual understanding, and overall learning experience. Quantitatively, students' mathematics scores improved significantly, with the average score rising from 46.36 to 62.44—a gain of approximately 34.7%. Teachers responded positively to the RME-based teaching tools and expressed interest in applying this approach to other mathematical topics. These findings reinforce that RME is an effective and sustainable method to improve the quality of mathematics learning at the junior secondary school level.

Recommendation

Based on the results of the activities, it is recommended that the RME approach be applied more widely in schools, not only limited to certain materials such as the Pythagorean Theorem, but also to other abstract topics. Schools can encourage teachers to develop or adapt RME-based teaching tools with the support of continuous training. In addition, collaboration between schools and external parties such as universities can be improved to strengthen learning innovation through module development, teacher training, and joint evaluation. Similar service activities also need to be carried out in other schools that face similar challenges in learning mathematics.

As a follow-up, mathematics teachers are encouraged to reflect on their classroom practices regularly and gradually integrate RME principles into their lesson plans. Teachers should be provided opportunities to participate in professional development programs focused on realistic contexts, modeling strategies, and student-centered learning. Forming a community of practice among mathematics teachers within or across schools is also recommended so they can share experiences, co-develop RME-based materials, and support each other in implementing innovative mathematics instruction.

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