

# The Application of the RME Approach to Improve Students' Mathematical Concepts Understanding

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**Abstract.** Learning mathematics less favored by students is a severe problem. This study aimed to improve mathematics learning outcomes in terms of mathematical concepts understanding using the RME approach. The research design used is quasi-experimental, with a pretest-posttest control group design. The data analysis technique used is the *t*-test. The population in this study is the third-grade students of SD Muhammadiyah Nitikan (Mumita) Yogyakarta, Indonesia, with a sample of 10 students whose learning process is carried out online. The data was collected through a test of mathematical concepts understanding. The data were analyzed descriptively to determine the improvement of the average of mathematical concepts understanding. Based on the results of data analysis, the average initial score was 38.70, and the final test was 75.30. This result increases students' ability to understand mathematical concepts using the RME approach.

**Keywords:** Mathematical Concepts Understanding, Mathematics Learning, RME Approach

## INTRODUCTION

Mathematics learning is a process of teacher-student interaction that involves developing thinking patterns in a learning environment created by teachers with various methods so that mathematics learning programs grow and develop optimally. Students can carry out learning activities effectively and efficiently. The objectives of learning mathematics are (1) to prepare students to be able to face changing circumstances and mindsets in life and the ever-evolving world; and (2) to prepare students to use mathematics and mathematical thinking in everyday life and in studying various sciences (Chisara et al., 2018). From the objectives of learning mathematics above, it can be seen that students are not only required to count but students are also required to be better able to deal with various problems regarding mathematics itself and problems from other sciences in everyday life (Chisara et al., 2018; Fuadi et al., 2016).

Mathematics is a universal science that spearheaded the development of modern technology and became the main thing in advancing human thought. Mathematics is also a driving factor in information and communication technology (Elwija et al., 2021). Mathematics is also a science that is taught at every level of education. This knowledge is so necessary because it is related to the environment of everyday life. This fact is in line with Permendikbud No. 58 of 2016 concerning the guidelines for mathematics subjects. It is stated that mathematics learning is carried out to achieve an ideal goal, namely the mastery of mathematical skills needed to understand the world around them (Maimunah et al., 2019)

Mathematics is one of the subjects given to all students from elementary school to college to equip students with the ability to think logically, analytically, systematically, critically, and creatively and work together. Students are expected to survive in constantly changing,

uncertain, and competitive conditions with this ability. Students must be educated to be creative so that they are not only consumers of knowledge but also able to produce new knowledge. For this reason, the teacher's role is required in preparing materials, processing the learning process, and assessing students' competencies according to the demands of the curriculum. The objectives of mathematics education are prerequisites for further education, practical needs in daily life, thinking mathematically, and developing cultural values such as democratic learning, the beauty of mathematics, and appreciation of the role of mathematics in society (Natalia, 2017). Education should allow students to apply the concept and be creative in understanding and solving problems. It will benefit students because it will make the concept last longer and be competitive (Ndiung et al., 2021).

When students sit in elementary school, which is the beginning of a student to explore his mathematical concepts understanding because the concepts obtained will affect the next level of education, concept understanding where students can define concepts, identify and give examples or non-examples of concepts. Concept understanding is a competency students show in understanding concepts and performing procedures (algorithms) flexibly, accurately, efficiently, and precisely (Mendrofa, 2021). Solving problems related to concepts and applying them is the goal of studying mathematics (Mendrofa, 2021).

Concept understanding needs to be instilled in students early, namely when sitting in elementary school. Students must understand the definition, solve problems, and operate mathematics correctly because it will provide provisions for students when they enter higher education (Saputri et al., 2020; Fredriksen, 2021). Understanding is a process consisting of the ability to explain and interpret something, provide a broader and adequate description, example, and explanation, and provide a more creative description and explanation. At the same time, a concept is drawn in the mind, a thought, an idea, or an understanding. Students are said to be m the ability to understand mathematical concepts if they can formulate solving strategies, apply simple calculations, use symbols to represent concepts, and change one form to another, such as fractions in learning mathematics (Mawaddah & Maryanti, 2016).

The concept is part of a clear boundary between examples and non-examples. A clear concept allows for classification based on specific definitions (Romadon & Mahmudi, 2019). Understanding ability needs to be mastered in learning mathematics, meaning that mathematical concepts are not only in the form of rote memorization but can be absorbed into students' minds to apply these concepts in other situations and circumstances. It is one of the goals of each material to be taught by the teacher because the teacher guides students in achieving the concept (Sugandi & Benard, 2018). Understanding mathematical concepts is an ability that absorbs and understands mathematical ideas systematically (Nurani et al., 2021).

Understanding less established concepts can be characterized by not understanding the meaning of knowledge content, definitions, and reasons from interrelated parts of knowledge (Sadiqin et al., 2017). With a good understanding of mathematical concepts, students will easily remember, use, and rearrange a concept that has been studied and can solve various variations of math problems (Hadi & Kasum, 2015). The ability to understand concepts is essential in learning mathematics so that teachers are expected to be able to design learning activities to improve the ability to understand concepts (Mayasari & Habeahan, 2021).

The number of students who do not understand mathematics makes all parties concerned, especially during the current pandemic. The learning process that used to occur at school is now moving to the house. This policy causes many children to get bored in the learning

process. Learning carried out online is of little use to the participants where the teacher cannot see whether the students understand the material. Although the teacher can give assignments to be collected, this is less effective because many of our students receive help to complete them, either from the media or from parents or friends. Learning as above is closely related to students' mathematical concepts understanding in solving mathematical problems.

A realistic approach can encourage students to understand the subject matter more realistically or not abstractly because the teacher uses examples or props of objects around him so that they are easy to understand. It can also stimulate students' interest in learning mathematical concepts that seem monotonous and abstract because realistic mathematics approaches are very close to various problems in everyday life. It can make mathematics learning more authentic or not seem abstract. In this case, a realistic mathematical approach helps most students understand the material that has been given by the teacher in a fun way and does not seem abstract (Siregar et al., 2020).

Realistic Mathematics Education (RME) is an approach to learning mathematics that involves the reality and experience of students. The RME approach provides opportunities for students to rediscover and construct mathematical concepts based on realistic problems given by the teacher because students build their knowledge, students will not easily forget (Elwija; et al., 2021). RME helps students to be able to understand concepts in mathematics thoroughly and not separately. RME places the relationship between mathematical concepts as things that need to be considered in the mathematics learning process (Natalia, 2017; Aprianka, 2020).

RME is mathematics learning that invites students to implement accepted learning materials into everyday life. When providing learning materials, the teacher does not directly provide formulas or concepts to students. Students are directed or build the concepts being studied. Furthermore, in applying the RME approach, the teacher acts as a mentor by providing opportunities for students to learn actively. Conditions like this want to change teacher-oriented teaching and learning activities to student-oriented (Saputri et al., 2020; Putri, 2020).

Applying mathematics teaching materials based on Realistic Mathematics Education (RME) shows a good influence on students' mathematical problem-solving abilities. Some factors that influence this are contextual problems in teaching materials and students' motivation because it is related to everyday life (Aprianka, 2020). Gravemeijer suggests three critical principles of realistic mathematics learning: guided reinvention/progressive mathematizing, didactical phenomenology (didactic phenomena), and self-developed models (developing your model). First, rediscovering (guided reinvention), students must be allowed to find their concepts, definitions, theorems, or solutions through providing contextual problems in various ways. Second, didactic phenomena (didactical phenomenology), to introduce mathematical topics to students, teachers must emphasize contextual problems that come from the real world or problems that students can imagine. Lastly, developing their models (self-developed models), students develop models in their way when working on contextual problems (Holisin, 2007).

The Realistic Mathematics Education learning model is a learning model that uses problems in everyday life and emphasizes that students are active in learning activities (Septian et al., 2019). The Realistic Mathematics Education approach is an approach to learning mathematics by prioritizing reality and the environment as the first step in learning. It will affect the understanding of mathematical concepts, so it can be concluded that the RME approach can improve students' understanding of mathematical concepts (Jeneman et al., 2019). This research aims to improve students' understanding of mathematical concepts by using the RME approach.

## METHOD

The research design used is quasi-experimental, with a pretest-posttest control group design. The data analysis technique used is the t-test. The population in this study is the 3rd-grade students of SD Muhammadiyah Nitikan (Munita) Yogyakarta, with a sample of 10 students whose learning process is carried out online. This research design model uses a pretest-posttest control group design to determine whether there is an increase in students' mathematics learning outcomes by using the RME approach.

The instrument used in this study was a concept understanding test with ten description questions given at the beginning and the end of the lesson. The indicators that show understanding of the concept include restating a concept, classifying objects according to specific properties (according to the concept), giving examples and non-examples of the concept, presenting concepts in various forms of representation mathematical, developing the necessary or sufficient conditions for a concept, and applying problem-solving concepts or algorithms (Shadiq, 2009). The test results were analyzed using a holistic rubric with a scale of 1-3. The score obtained by students must be converted into a fixed number scale (within 0-100). The scores obtained by students when converted to a scale of 0-100 are:

$$\text{Student Value} = \frac{\text{skor yang diperoleh siswa}}{\text{skor total}} \times 100$$

The analysis of learning outcomes data aims to answer the research questions posed. Observation of the pre-test and post-test results was conducted to determine the improvement of students' mathematics learning outcomes using the RME approach.

## FINDINGS

Based on the analysis that has been carried out for three meetings, data regarding the mathematics learning outcomes of students is obtained. The data were obtained through the initial test conducted before implementing the RME approach and the final test carried out after the implementation of the RME. With a test in the form of a description of 10 questions with the same indicator. The mean of the initial test was 38.70, and the average of the final test was 75.30. In the initial test of 10 students, only two students scored above the minimum mastery criteria or KKM, which was 80, while in the final test of 10 students, six students scored above the KKM, and four people were below the KKM. This finding means an increase in the average score of students' mathematics after learning using the RME approach. This finding can be seen in Table 1.

**Table 1. Pretest and Posttest Result**

Test	Average	Stdev	T <sub>count</sub>	T <sub>table</sub>
Pre-test	38,70	11,64	2,45	1,812
Posttest	75,30	14,26		

This research was conducted at SD Munita Yogyakarta, which was held three times online through the zoom application. Based on Table 1, it can be seen that the average pre-test scores are lower than the post-test value. This finding means that the average score of understanding mathematical concept with RME learning is better than direct learning. Based on

the t-test investigation, it was gotten that t-count is more noteworthy than t. This table shows that students' understanding of numerical concepts by applying RME is higher than recently utilizing RME.

## DISCUSSION

This difference in the average score of understanding mathematical concepts occurs because learning activities using RME prioritize student activities. Through the RME approach, students can find out the relationship between mathematics and daily life (real-world life) and know the usefulness of mathematics in general for humans. The steps for learning mathematics with the Realistic Mathematics Education (RME) approach are (1) Providing contextual problems; (2) Solving problems in their way; (3) Generating interaction; (4) Compare and discussing answers; and (5) Summarizing the results of the discussion (Chisara et al., 2018). The RME learning syntax is carried out in Table 2.

**Table 2. Syntax of RME**

<b>Step</b>	<b>Teacher activity</b>	<b>Student activity</b>
Introduction	The teacher stage greets and prays. The teacher reminds the previous material. The teacher conveys the learning objectives. The teacher attends to the students.	Students answer greetings and pray. Students recall the previous material. Student listen. Student listen.
Provide Problem Contextual	The teacher provides contextual problems related to everyday life in a picture.	Students individually observe the problems given by the teacher.
Complete to observe and the problem with think of own strategy way.	The teacher responds positively to the students' answers. Then students are given the opportunity complete to observe, and the problem with think of their strategy way most effective in solving the problem.	Students solve problems individually.
Bring up interaction	The teacher directs students in solving problems and as students to do it with bring up use your way.	Students solve problems individually.
Compare and discuss answers	The teacher asks one of the students to discuss to present an answer.	Listen and pay attention.
Conclude the results of the discussion	The teacher directs students conclude to conclude.	Students conclude lessons that have been discussed.
Closing	The teacher tells the next material, prays, and say greetings.	Students listen, pray and answer greetings.

RME learning is carried out according to the steps in Table 2. There is what takes students understanding of mathematical concepts to increase. This result is in line with research conducted by (Ilhaq, 2021) which say that teachers need to use learning methods that make students physically active, and teachers, it is also necessary to relate things in everyday life using the RME method so that the learning atmosphere becomes more meaningful dan fun. Application of mathematics teaching materials based on Realistic Mathematics Education It is hoped that it can improve the ability to understand students' mathematical concepts because these teaching materials are used as tools for students to understand concepts, and students are

given material that is related to real-life (Putri, 2020; Hadi, 2017). Applying mathematics teaching materials based on Realistic Mathematics Education (RME) shows a good influence on students' mathematical problem-solving abilities. Some factors influence this, including: (1) in teaching materials, there are contextual problems, (2) students are more motivated because they are related to everyday life (Aprianka, 2020; Ndiung et al., 2021).

## CONCLUSIONS

Based on the study results, it was concluded that applying the RME approach could improve students' understanding of mathematical concepts at SD Munita Yogyakarta. It means that Realistic Mathematics Education (RME) approaches can be implemented in mathematics learning. Teachers can use the RME approach in the learning process of mathematics and any other subjects in general.

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