

Implementation of Realistic Mathematics Education (RME) Approach to Elementary School Mathematics Problem Solving Ability

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Abstract. Problem solving skills are indispensable as a part of 21st century skills. The low problem solving ability of students who have not been able to develop new knowledge actively in the classroom is caused because learning is still teacher-centered. The use of a learning approach can be a solution to train students' problem solving abilities. This study aims to conduct a literature review related to the implementation of the Realistic Mathematics Education (RME) approach in problem solving abilities in elementary schools. Data collection is done by documenting and reviewing all articles related to the Realistic Mathematics Education (RME) approach published in the last 5 years. The results showed that the Realistic Mathematics Education (RME) approach; 1) give real and practical math problems, 2) facilitate students' understanding of problem solving skills, 3) Improving students' cognitive and character aspects, and 4) increase students' interest and learning outcomes. From the data obtained, it can be concluded that the Realistic Mathematics Education (RME) approach can improve mathematical problem solving abilities in elementary schools.

Keywords: Realistic Mathematics Education (RME), Problem Solving Ability

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INTRODUCTION

Mathematics is a universal science that plays an important role in various fields in building human thinking power. Mathematics learning must be applied at all levels of education in schools. Both students and teachers need to understand mathematics, because mathematics is one of the disciplines that has a major role in science and technology in the 21st century. However, in practice, it turns out that not many students like mathematics and find it difficult to learn it.

Learning mathematics especially in elementary school is very important as it is the first concept that lays the foundation for learning at the next level. Learning mathematics must be studied at the basic education level so that students can solve everyday life problems both at home, school, and in the community environment because the reasons why schools must teach mathematics to their students are basically sourced from everyday problems.

Mathematics learning in primary school is designed by teachers to encourage students to think about problem solving and to develop their own abilities. In line with the opinion (Wandini, 2019: 5) states that learning mathematics is a process of learning mathematics that is designed in a structured way by involving ideas, activities to develop problem solving and convey information on ideas. Therefore, in the learning process it is hoped that students can create and shape their own way of learning, not just receiving explanations from the teacher without taking an active role, but students must be able to solve problems in the learning process related to everyday life.

In general, learning mathematics in elementary school has an important goal. Students are expected to be able to understand, manage and communicate information and solve problems in everyday life. In (Permendiknas, 2016: 417) formulates that learning mathematics aims so that students can: 1) Understand mathematical concepts that describe the interrelationships between concepts and apply concepts or logarithms in solving problems in a flexible, accurate, efficient and precise manner, 2) use inferences about patterns and ways of performing mathematical operations when generalizing, compiling proofs, or explaining mathematical ideas or statements, 3) problem solving, which includes the ability to understand problems, describe mathematical

models, complete models, and interpret the solutions obtained, 4) Communicate ideas using symbols, tables, charts, or other media to clarify situations or problems, 5) Usefulness of mathematics in life, i.e. curiosity, interest and interest in mathematics research, and persistence and confidence in problem solving. Therefore, the main goal of learning mathematics is to enable students to think critically, logically, and carefully to solve everyday life problems.

Problem solving ability is one of the important 21st century skills for students to have. (Aeni et al., 2022) states that problem-solving skills are important basic skills in 21st century learning by focusing on four skills known as 4C skills namely: Collaboration, Communication, Creative Thinking, Critical Thinking and Problem Solving. This shows that the ability to solve math problems is one of the main goals of mathematics learning, and that the process of solving math problems is central to mathematics.

Problem solving skills help students think analytically when making decisions in everyday life by increasing their critical thinking in new situations. In order to be able to solve a math problem solving problem, it is necessary to understand the steps that must be taken when solving the problem. Starting from understanding the problem in the problem by writing the mathematical model of the problem, planning the solution and implementing it, then checking is needed to be more sure about the solution being worked on. According to Polya (Rosyada et al., 2019: 117) The steps to solving mathematical problems are understanding a problem, planning how to solve the problem by writing formulas, solving problems and re-examining the results that have been obtained in solving the problem by writing the conclusions of the answers.

According to the results of the 2018 PISA (International Student Assessment Program) survey, problem-solving skills are declining in Indonesia. According to her PISA survey results in 2015, Indonesia was ranked 63rd out of 69 countries surveyed, and Indonesian students' average math problem-solving scores were below 500 average scores set by PISA. There were 386 of them. Meanwhile, according to her PISA survey results in 2018, Indonesia ranked 66th out of 73 countries surveyed, with Indonesian students having an average score of 379 in mathematics proficiency, compared to the average score set by PISA 489 compared (Puspendik dalam Tohir, n.d, 2019). From the results of the survey, it can be seen that students in Indonesia still find it difficult to apply problem solving steps, which is because students are accustomed to memorizing mathematical concepts instead of understanding them. This must be handled by the teacher properly because if not, it will have a bad impact.

A teacher is an educator, mentor, trainer and curriculum developer who can create conditions and a pleasant learning atmosphere, for example an interesting learning atmosphere and provides security for students, and provides space for students to think actively, creatively and innovatively in elaborating their abilities (Rusman dalam Susilowati : 2018:14). Teachers are expected to be able to select models, procedures, strategies, methods, and learning techniques appropriate to the learning goals to be achieved. This allows learners in the learning process to understand learning both conceptually and in relation to problem solving to everyday life.

The National Council of Teacher of Mathematics NCTM (dalam Purwanti 2015) states that focusing learning mathematics around solving problems can help students learn and understand a concept. This is consistent with Hudojo (dalam Amir 2015) statement that teaching students to solve problems can help them become more analytical when making decisions about their lives. Problem solving is a very important activity in learning mathematics because it can not only improve students' thinking ability but also motivate them to learn. Various approaches to learning mathematics are studied and practiced by teachers to students. One such approach is the Realistic Mathematics Education (RME) approach. It is a learning approach that helps teachers relate the material being taught to the real world of students and encourages students to connect their knowledge with the realities of life they experience and face every day.

Through the RME approach students are emphasized on real problem solving activities informally before using formal methods. In other words, this learning starts from a problem which is then directed towards a formal solution. This means that the learning is focused on giving students real-world problems that are close to their lives. This allows students to have a problem solver's soul and make their math learning meaningful. In this way, RME's approach to mathematics learning is closely related to students' problem-solving abilities.

The results of Rosyada's research (2019) entitled "The Influence of the Realistic Mathematical Education (RME) Learning Model on the Mathematical Problem Solving Ability of Class V Students of Prampela Public Elementary School" show an increase in mathematical problem solving abilities after using the Realistic Mathematical Education (RME) learning model. This is evident from the mean effect size of 0.42 for the intermediate effect category and the results of the Egger test using funnel plots and values of $Z = 0.075$ and $p = 0.940 > 0.05$, indicating the absence of publication bias.

Subsequent research from Rani, et al (2020) entitled "The Effect of the Realistic Mathematics Education (RME) Approach on the Problem Solving Ability of Class V Elementary School Students" It shows that by using the RME approach you can better understand the documentation on adding fractions with different denominators and solve the problem correctly. This shows that the post-test average is 79.06, while the pre-test average is 35.18. According to the results after the test, the students' problem-solving ability improved considerably.

Meanwhile, research conducted by Sulastri, et al (2021) entitled "Effectiveness of the Realistic Mathematics Education (RME) Approach Assisted by the Edmodo Application on Students' Mathematical Problem Solving Ability" shows that after students carry out the learning process by applying the RME approach assisted by the Edmodo application the results of learning on students' mathematical problem solving abilities with a maximum score of 92 and a minimum score of 0 with an average score of 53.83. Because $t_{\text{arithmetic}} = 3.13$ is greater than $t_{\text{table}} = 1.69$ then reject H_0 , meaning that the use of Realistic Mathematics Education (RME) assisted by the Edmodo application is effective in conveying the target of students' mathematical problem solving abilities in mathematical sequences and series.

Based on some of the research above, one way to improve students' problem-solving skills and math learning outcomes is to use the RME approach to learning math. In line with what was revealed by Jarmita & Hazami (2013) that RME will familiarize students with developing "process of doing math" skills, this makes researchers interested in conducting a literature review on the Application of a Realistic Mathematics Education (RME) Approach to Mathematical Problem-Solving Skills in Elementary Schools.

METHOD

This study used the systematic literature review (SLR) method. In this case the researcher carried out several stages, namely reading, understanding, studying and analyzing several journals related to the topic of the Realistic Mathematics Education (RME) approach to problem solving abilities. As Mestika (2004) explains, library research is a set of activities related to library data collection, reading and recording, as well as methods of processing library collections that do not require field studies. To complete this research, the researcher collected journals within the last 5 years between publishing 2018-2022 from the time the research was conducted by the researcher. The number of journals related to the topic raised was collected as many as 20 journals.

RESULTS AND DISCUSSION

Realistic Mathematics Education (RME) Approach

Realistic Mathematics Education (RME) is a learning approach to create a meaningful learning environment and improve students' understanding of mathematical concepts. According to (Fathurrohman, 2015: 189) RME is an educational approach that starts with what is practical for students. This theory focuses on discussion and collaboration process skills, as well as arguing with classmates so that students can have their own knowledge as a result of teachers providing knowledge by using mathematics as the root of solving problems both individually and in groups. Meanwhile, (Aisyah in Susilowati: 2018: 48) states that the RME learning approach is an alternative learning approach that requires students to use their competencies to build knowledge through activities that take place in learning activities.

Therefore, realistic learning is a learning system based on cognitive, emotional, and psychomotor research. So the teacher has to facilitate the structuring of learning from the perspective of student study groups, considering the backgrounds and diversity of students'

knowledge, preparing questioning techniques, and conducting authentic assessments so that learning leads to an overall increase in student intelligence which is the main problem solver.

Learning mathematics following the RME approach reflects a particular view of how children learn mathematics and how mathematics should be taught. According to Marpaung in (Ningsih, 2014: 80), this view is reflected in six characteristics, namely: a) Activities, students must be treated as active participants in the process of developing mathematical insights. In this case, the student is faced with a problem situation that forms part of the problem and can be developed step by step. b) contextual, realistic mathematics should enable students to apply their mathematical understanding to solve problems. c) Gradually, learning mathematics means that students have to go through different levels of comprehension. From being able to find informal solutions that relate to the mathematical context, to building direct relationships on various levels. d) Interconnection, this is found in every path of mathematics, for example between topics such as material numbers, mental arithmetic, estimation (estimation) and algorithms. e) Interaction, in realistic mathematics, learning mathematics is considered a social activity. Education must provide opportunities for students to share their strategies and discoveries. By listening to what others have found and discussing those findings, students can get ideas for improving their learning strategies. f) Guidance, teachers have the most important role in directing students to acquire knowledge.

The steps for learning mathematics using the RME approach according to Hobri (in Ningsih 2014: 81) include: a) Understanding contextual issues, teachers ask questions and students are asked to understand the issues presented in those questions. The teacher explains the problem and points out specific parts as needed to help students understand. b) Solving Contextual Problems, students are individually asked to solve contextual problems in the Student Book or LKS in their own way. Different ways of solving and answering problems are preferred. Teachers motivate students to solve problems by asking questions that lead them to solve problems. c) Comparing and discussing answers, Students are asked to compare and discuss their answers in small groups. Discussion results are compared to teacher-led class discussions. This stage can be used to encourage students to have the courage to speak out, even if they are different from their peers and teachers. d) Drawing conclusions, based on the results of the guided group discussion and class discussion, the teacher directs students to draw conclusions about mathematical concepts, definitions, or procedures related to the contextual problem just solved. The characteristic of RME that appears in this step is using interaction between the teacher and students.

Implementation of Realistic Mathematics Education (RME) in Learning Mathematical Problem Solving

The Importance of Problem Solving

The problem-solving approach should be used when carrying out learning activities related to story problems or instilling the concept of fractions. According to Cooney (dalam Santi 2021:37) By teaching students how to solve problems, students can be more analytical when making decisions that affect their lives. In other words, students become more assertive when they are accustomed or constantly trained to solve problems on their own. Students become proficient in gathering relevant information, analyzing information, and recognizing the need to validate the results obtained. So that success in solving different problems motivates students to learn mathematics, especially in terms of instilling the concept of fractions.

There are three related benefits from the experience of solving problems in learning mathematics, including that students become (1) creative in thinking; (2) critical in analyzing data, facts and information; (3) independent in acting and working. Besides that, problem solving will foster students' creative attitudes in learning mathematics, so that the learning atmosphere will further enhance students' abilities (Muhsetyo, dalam Santi 2021:37).

Implementation in Learning

Students often find it difficult to apply the experiences and skills they acquire in school to real, everyday social life. This is because the skills and experience provided by teachers to

students at school are more oriented towards their relationship with the school than the actual situations of students' daily lives outside of school. The assignments and exercises given by the teacher are meaningless because they do not correspond to real situations in students' lives, and students cannot relate them to the knowledge they already have or know (Fendrik, 2019).

Problem-solving learning in mathematics sees learning as a goal and as a tool to assist in understanding concepts. Problem solving learning focuses on learning problem solving strategies as a tool for solving problems. Problem solving learning also emphasizes learning that students use problem solving strategies to deal with difficult problems, especially those related to everyday life. One of the methods teachers can use to solve math problems is to use the theory of the RME approach to learning. By referring to the theory of realistic mathematics education, students will have a better understanding of mathematics concepts. Understanding this concept will help students solve the math problems they face. Therefore, the Realistic Mathematical Education (RME) approach can be used to train students' mathematical problem solving abilities in elementary schools which can be seen in the following table:

Table 1. Implementation of Realistic Mathematics Education (RME) Approach to Elementary School Mathematics Problem Solving Ability

Researcher, Year and Title	Research Subjects and Research Types	Research Result
Wayan Widana (2021) Realistic Mathematics Education (RME) to Improve Students' Mathematical Problem Solving Ability in Indonesia	Research subjects are scientific articles published in SINTA 2,3, and 4 accredited journals as well as national proceedings in the 2016-2021 year range. This type of research is an experimental design.	As a result, the mean effect size for the intermediate effect category was 0.42, and the funnel plot and Eggers test using values of $z = 0.075$ and $p = 0.940 > 0.05$ indicated no publication bias. Therefore, the RME model has a moderate impact on students' mathematics problem-solving abilities.
Arnida Sari, Suci Yuniati (2018) Application of a Realistic Mathematical Education (RME) Approach to the Ability to Understand Mathematical Concepts	The research subject was to test whether there were differences in the ability to understand concepts between students who studied with RME and students who used conventional methods. The research method is Quast Experimental Design	The results showed that the mean difference using the t-test was superior to the experimental class over the control class. To enable concepts to be understood between students learning using the RME approach and those using traditional methods.
Astuti (2018) Application of Realistic Mathematics Education Increases Mathematics Learning Outcomes of Grade VI Elementary School Students	The research subjects were students of class VI SDIT Raudhaturrahmah Pekanbaru in the academic year 2013/2014. Types of PTK research (classroom action research)	The average percentage of teacher activity was 85.22% in the first cycle and 93.18% in the second cycle. On the other hand, the student's learning activity presentation increased from 70.5% in the first cycle to 86.3% in the second cycle. Classical perfection was achieved in cycles I and II. This means that the RME approach can improve the mathematics learning outcomes of her SDIT Raudhaturrahmah Pekanbaru Class VI students

Researcher, Year and Title	Research Subjects and Research Types	Research Result
Dedy Setyawan (2020) Improving Student Learning Outcomes Using Realistic Mathematics Education (RME) Assisted by Concrete Media.	The research subjects for class V SDS Muhammadiyah Pahandut Palangka Raya totaled 19 people. PTK research method with saturated sampling technique.	The results showed that student learning activities in learning to calculate the volume of a cube using the RME model resulted in the final test results in cycle 1 of 73.68% and the results of the final test in cycle 2 became 100% and are in very good criteria.
Tika Dwi Nopriyanti, Monika Erlina, Andinisari (2019) The Effect of RME Learning Models on the Mathematical Problem Solving Ability of SMK PGRI 2 Palembang Students	The research subjects were class X TO 4 X TO 6 at SMK PGRI 2 Palembang for the 2018-2019 academic year. The research method is an experiment with a Posttest-Only Control Design.	The results showed that the RME model had a significant impact on the mathematical problem-solving abilities of SMK PGRI 2 Palembang students.
Oktaveni Yetri, Ahmad Fauzan, Desyandri, Yanti Fitria, and Farida Fahrudin (2019) Effects of Realistic Mathematics Education (RME) and Self-Efficacy Approaches on Students' Mathematical Problem Solving Ability in Elementary Schools	The research subjects were students in class IV b as the experimental class and students in class IV c as the control class at SDN 22 Andalas Padang for the 2018/2019 academic year. This type of research is quasi-experimental	The results show differences in the mathematical problem-solving skills of students taught with the RME approach compared to the traditional Fcount>Ftable approach. If Fcount math problem-solving ability of students with high self-efficacy is no different than that of students with low self-efficacy.
Efrata Gee (2019) Mathematical Problem Solving Ability Through RME Based Learning Flow.	The research subjects were class IX students of SMP Negeri 1 Telukdalam with a qualitative descriptive research type.	The results of this study found that students improved their math problem-solving skills after using an RME-based learning flow. We can see that the average pre-action problem-solving ability is 48.41. After Action, on the other hand, ranks well with an average of 74.85.
Muhammad Syahril Harahap (2018) Improving Mathematical Problem Solving Ability Using RME Realistic Mathematic Education Teaching Materials	The research subjects were teaching materials based on RME. This type of research is qualitative.	Using RME-based geometry materials can improve students' problem-solving skills.
Nurul Aeni, Hamidah Suryani Lukman, Ana Setiani (2022) The Effectiveness of the Reciprocal Teaching Model with the RME Approach on the Mathematical Problem	The research subjects were Grade VIII students of SMPN 2 Cibadak. The type of quantitative research uses a quasi-experimental model.	Based on the research results, it was concluded that students who underwent the interactive education model using the RME approach performed better at solving mathematics problems than those who underwent the mutual education model.

Researcher, Year and Title	Research Subjects and Research Types	Research Result
Solving Ability of Grade VII Middle School Students.		
Endang Susilowati (2018) Increasing Activity and Mathematics Learning Outcomes of Elementary School Students Through Realistic Mathematical Education (RME) Models in Class IV Semester 1 Students at SD Negeri 4 Kradenan	The research subjects were teachers and fourth grade students at SDN 4 Kradenan with a total of 27 students consisting of 11 male students and 16 female students. This type of research is classroom action research carried out in 2 cycles	The results show that the application of the RME learning model can increase the activity and results of students' mathematics learning. It can be seen from the activity of students in cycle 1, the average value was 59.84% in the fairly active category, which increased in cycle II by 7.78 to 67.62 in the active category. The percentage of student activity classically in cycle I was 57.14% in the quite active category, increasing 19.05% in cycle II to 76.19% in the active category.
Farida Soraya, Yurniwati, Ucu Cahyana (2018) Application of a Realistic Mathematical Education (RME) Approach to Improve Creative Thinking Ability on the Subject of Fractions in Grade IV Students at SDN Rawajati 06 Pagi	The research subjects for class IV students at SDN Rajawati for the 2017/2018 school year totaled 28 students. This type of research is PTK	The results demonstrating that learning the concept of fractions by applying the RME approach can improve the ability to think creatively about fraction material.
Fasadena Saraseila, V.Karjiyati, Neza Agusdianti (2020) The Effect of the Realistic Mathematical Education (RME) Model on the Mathematical Literacy Ability of Class V Elementary School Cluster XIV Bengkulu City	The research subjects were students of SD Cluster XIV Bengkulu City. Quasi-experimental research method.	Based on the calculation of the t-test results of the students' posttest, where $t_{count} = 4.09$ and t_{table} . Because $t_{count} > t_{table}$, it can be concluded that there is a significant difference in the use of realistic mathematics education models on the mathematical literacy abilities of class V class XIV Bengkulu city

Researcher, Year and Title	Research Subjects and Research Types	Research Result
Fadiyah Elwijaya, Mardiah Harun, Yullys Helsa (2021) Implementation of a RME Approach in Elementary Schools.	The research subjects were 32 main studies on the effect of RME on learning fractional mathematics. The research method uses the literature review method.	The results of the study yielded data on an increasing number of fractional themes that are still being studied using the RME approach.
Febriyanti, Riana Bagaskorowati, Makmuri (2019) The Influence of Realistic Mathematics Education (RME) Approaches and Students' Initial Abilities of Mathematical Connection Ability	The research subjects were grade III elementary school students. The research method is an experiment with level design treatment with a sample of 30 people.	Research results 1) The ability of students who are taught with the RME approach to mathematical connections is higher than students who are taught with conventional approaches. 2) There is an interaction between the use of learning approaches and students' initial skills and students' mathematical connection skills. 3) the ability of elementary school students to make mathematical connections among students learning with traditional approaches, who have higher initial competence than students learning with traditional approaches.
Khairida, Hasratuuddin, Dian Armanto (2020) Development of ICT-Assisted RME Learning Models to Improve Students' Mathematical Communication and Critical Thinking Skills.	The research subjects were Methodist P.Labu Middle School students. This type of research uses the ADDIE model (Analysis, Design, Development or production, Implementation and Evaluations).	The results showed that the learning objectives were achieved, the students' mastery learning classically from the results of communication skills and critical thinking in mathematics was 52%. The trials show that the students' mastery of learning classically from the results of communication skills and critical thinking in mathematics was 72%.
Rizma Vira Artika, Rahmat Sudrajat, Arfilia Wijayanti (2019) The Influence of the Realistic Mathematical Education (RME) Model Aided by Folding Paper Media on the Planting of Flat Shape Concepts.	The research subjects were 30 students of grade II elementary school. This type of quantitative research with the type of pre-experimental design with the type of One-Group Pretest-Posttest.	It was concluded that there was a positive and significant relationship between student ability and the introduction of flat geometry concepts through the use of RME models assisted by folded paper media.

Researcher, Year and Title	Research Subjects and Research Types	Research Result
Unun Julaeni Maemunah Sa'diyah, Salati Asmahasanah (2019) The Influence of Using RME Models on Class IV Mathematics Learning Outcomes at SDIT Kaifa Bogor	The research subjects were fourth grade students at SDIT Kaifa Bogor. This type of quantitative research with experimental methods.	From hypothesis testing and two class averages, it was concluded that learning with specific media in the RME learning model had a significant impact on student learning outcomes.
Asrina Mulyati (2017) The Effect of the RME Approach on Students' Problem Solving Ability in Mixed Arithmetic Operation Material in Grade IV SD IT Adzkie 1 Padang.	The research subjects were all students of the sample class, fourth grade teachers at SD IT Adzkie Padang. This type of research uses quantitative research	From the results of the study, we can conclude that the mathematics learning outcomes of the students in the experimental class are higher than those in the control class. This is also evidenced by the fact that the average scores of the students in the experimental class are higher than the average scores of the students in the control class. Students in the experimental class had a mean score of 73.92 and students in the control class had a mean score of 64.82.
Lisa (2019) Application of Realistic Mathematics Learning to Improve Mathematical Problem Solving Ability for Students of SMP Negeri 8 Lhokseumawe	The research subjects were all students of SMPN 8 Kota Lhokseumawe with a quasi-experimental type of research (quasi experiment) with a pretest-posttest group design.	The results of the post-test data obtained for the ability to solve mathematical problems in a class with a realistic mathematical approach with a sig. $0.200 > 0.05$. This means that H_0 which states that the posttest data of the ability to solve mathematical problems with a realistic mathematical approach with normal distribution is significantly accepted. While the data analysis used is the t-test, showing that the value of t is 7.705 greater than $t(0.05;103) = 1.671$.
Ilma Nurfadilah, dkk (2021) Using RME In Mathematical Problem Solving Ability Based On student's Mathematical Initial Ability	The research subjects were all SMP Mathla'ul Anwar Global School Students and the research sample was in seventh grade. This study is a true experimental research design	The results show that students using the RME approach are better at solving math problems than those using the scientific approach. There was no interaction between learning approaches and early mathematics proficiency in students' mathematics problem-solving abilities.

Based on the results of the research conducted, which is presented in the table legend above, a realistic mathematics education (RME) approach is proposed for solving mathematics problem-solving skills in elementary school students of varying abilities. It can be said that it can be used as an alternative. Significant improvement in learning outcomes.

CONCLUSION

The application of the Realistic Mathematics Education (RME) approach is well suited for use in primary schools. This approach is student-centered and helps students learn and understand concepts as they learn mathematics. Because, A Realistic Mathematics Education (RME) approach can have a positive impact on improving students' problem-solving skills and developing their own potential. Using the Realistic Mathematics Education (RME) approach in learning mathematics can also provide real and practical mathematics, facilitate students' understanding of problem solving abilities, improve cognitive aspects and student character, and increase student interest and learning outcomes. A realistic mathematics education (RME) approach is therefore very supportive in the process of learning mathematics, especially in terms of problem-solving skills.

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