

***Improving Students' Mathematical Problem Solving Abilities
With an Approach Realistic Mathematics Education
in Junior High Schools***

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Abstract

Mathematical problem solving ability is a mathematical skill that students must have in order to solve problems both in mathematical material, in other sciences and problems in everyday life. This research aims to determine whether there is an increase in mathematical problem solving abilities through the RME approach in students in class VIII.3 MTsN 1 Lhokseumawe City. This research uses a qualitative approach with the type of classroom action research. The subjects of this research were 34 students in class VIII-3. Overall, it shows that there is an increase from cycle I activities to cycle II activities, namely 94% learning completeness, obtaining a completeness score of ≥ 75 (*minimum completeness criteria or KKM*). This number is sufficient for the research success level, namely $\geq 80\%$ of students who obtain a score \geq KKM. Teacher and student activities have reached a success rate of 94% for teacher activities and 93% for student activities. Both of these activities are in the very good category. So it can be that learning using the RME approach can improve the mathematical problem solving abilities of MTsN 1 Lhokseumawe City students.

Keywords: *Mathematical Problem Solving Abilities; Realistic Mathematic Education (RME) Approach; Classroom Action Research.*

Abstrak

Kemampuan pemecahan masalah matematis merupakan suatu keterampilan matematika yang harus dimiliki oleh siswa dalam rangka menyelesaikan permasalahan baik pada materi matematika, pada ilmu yang lain maupun permasalahan dalam kehidupan sehari-hari. Penelitian ini bertujuan untuk mengetahui adanya peningkatan kemampuan pemecahan masalah matematika melalui pendekatan RME pada siswa kelas VIII.3 MTsN 1 Kota Lhokseumawe. Penelitian ini menggunakan pendekatan kualitatif dengan jenis penelitian tindakan kelas (PTK). Subjek penelitian adalah siswa kelas VIII-3 sebanyak 34 siswa. Secara keseluruhan menunjukkan adanya peningkatan dari kegiatan siklus I hingga kegiatan siklus II yaitu ketuntasan belajar 94% memperoleh nilai ketuntasan ≥ 75 (KKM). Jumlah tersebut sudah mencukupi taraf keberhasilan penelitian yaitu $\geq 80\%$ siswa yang memperoleh skor \geq KKM. Kegiatan guru dan siswa sudah mencapai tingkat keberhasilan yaitu 94% untuk kegiatan guru dan 93% untuk kegiatan siswa. Kedua kegiatan ini sudah masuk kategori sangat baik. Sehingga dapat disimpulkan bahwa pembelajaran dengan pendekatan RME dapat meningkatkan kemampuan pemecahan masalah matematis siswa MTsN 1 Kota Lhokseumawe.

Kata Kunci: *Kemampuan Pemecahan Masalah Matematika; Pendekatan Realistic Mathematic Education (RME); Penelitian Tindakan Kelas.*

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INTRODUCTION

Mathematics is one of the solutions to solve or resolve problems in everyday life that are mathematical in nature. With the ability to solve problems, a person will be able to keep up with the current developments in increasingly sophisticated technology and digitalization. Mathematical problem solving abilities not only solve problems in everyday life, but are also able to solve problems that arise in other sciences and also in mathematics itself.

According to Agustmi et al., (2021), there are several abilities that must be possessed in studying mathematics, one of which is the ability to solve problems. NCTM in (Agustmi et al., 2021) suggests that problem solving is an integral part of mathematics learning, so that problem solving and learning cannot be separated. According to Polya in (Maya Sari, 2019), problem solving is an effort to find a way out of a difficulty, to achieve a goal that cannot be easily achieved. According to (Maya Sari, 2019) Problem solving is a person's ability to face, overcome and solve problems in unusual situations, in mathematics it means students' ability to solve mathematical problems in the learning process in the classroom. It is important for students to have mathematical problem solving abilities so that students can be trained in how to analyze a problem, so that students can have and hone other abilities such as creative thinking and critical thinking. The importance of problem solving skills is also stated in the Minister of National Education Regulation no. 22 of 2006, namely that students have mathematical problem solving abilities so that later students can apply them to problems in everyday life.

The current problem that often occurs is the way teachers teach mathematics, teachers tend to give examples of problems and their solutions and continue with exercises for students without considering the level of ability that students must train and possess as stated in Minister of Education and Culture Regulation no. 22 of 2006. According to (Azhar et al., 2021) One of the big problems with mathematical problem solving abilities is that when students do not understand the text implicitly, they have difficulty starting the thinking process in solving problems. Problems like this will result in students having difficulty in

changing story/text description questions into a simple form, namely a mathematical model.

In essence, problems in mathematics are divided into routine and non-routine problems. Routine problems are problems given to students to see the extent of students' abilities in applying basic mathematical concepts and formulas from the material being taught. Meanwhile, non-routine problems are problems that are unusual for students or are new problems for students and to solve them require in-depth analysis of the problem which then requires a way of thinking that is logical, creative and critical. (Hobri et al., 2020) Resolving non-routine problems can also be solved by transferring the non-routine problem to a previously known problem (routine problem). (Widana, 2021) states that the cognitive level included in the realm of high-level thinking skills includes the ability to analyze, evaluate and create. This shows that problem solving abilities include high-level thinking abilities. According to (Rahman Md, 2019) Problem solving abilities include the ability to identify and understand problems, develop mathematical models that suit the problem, complete mathematical models that have been prepared previously and interpret the solutions obtained with the aim of solving the given problem. According to Polya in (Rahmawati & Kurniawan, 2023) There are 4 steps to solving problems, namely: 1) understanding the problem, 2) planning problem solving, 3) solving the problem according to plan and 4) reviewing the results achieved so that proper implementation is expected.

One approach that can improve and increase students' mathematical problem solving abilities is the realistic mathematics approach (RME). To build students' initial understanding of the concept of the material being studied is to connect the material or use of the material with the real world that students have experienced. (Hadi, 2005) states that the RME theory was first introduced and developed in the Netherlands in 1971 by the Freudenthal Institute. This theory refers to Freudenthal's opinion which said that mathematics is considered a human activity and must be linked to reality. The rediscovery of mathematical ideas and concepts must start from exploring various problems and situations in the real world. Realistic Mathematics (MR) referred to in this case is school

mathematics which is implemented by placing realistic and student experiences as the starting point for learning. Realistic problems are used as a source for the emergence of mathematical concepts or formal mathematical knowledge.

According to Susanti & Nurfitriyanti, (2018) RME is a learning approach that has the characteristics of using contextual problems, using models, using results and students' own constructions, learning is focused on students and there is interaction between students and teachers. There are three principles of RME which require students to learn mathematics through their own experiences so that in learning students' creative and critical thinking abilities can develop and improve their achievements and attitudes towards mathematics (Rifandi et al., 2021). Teachers help students develop mathematical ideas and concepts to construct their knowledge and facilitate students to learn to solve problems, so that they become creative in solving mathematical problems (Meutia Rani et al., 2022).

Based on the above, the aim of this research is to determine whether there is an increase in mathematical problem solving abilities through the RME approach in class VIII.3 MTsN 1 Lhokseumawe City students. Where by implementing the RME approach in class VIII.3 MTsN 1 Lhokseumawe, it will be possible to improve students' mathematical problem solving abilities.

RESEARCH METHODS

This research uses a qualitative research approach with the type of Classroom Action Research (CAR) research which is carried out collaboratively and participatively. Classroom action research is an effort to examine the learning activities of a group of students by providing a action(*treatment*) which appeared on purpose. These actions are carried out by the teacher together with students, or by students under guidance and direction teachers, with the aim of improving and enhancing the quality of learning. Classroom action research is also defined as a process of controlled investigation that is recycled and self-reflective in nature carried out by teachers/prospective teachers with the aim of making

improvements, systems, ways of working, processes, content, competencies or learning situations (Herawati Susilo et al., 2011).

The classroom action research model used in this research is the model proposed by Kemmis and Mc Taggart, namely in the form of tools or strands with each tool consisting of four components, namely planning preparation, action implementation, observation and reflection (Kemmis et al., 2014). These four stages carried out in CAR are often referred to as one cycle. This cycle is carried out repeatedly with the same steps starting from cycle 1, cycle 2, and so on. Because, the number of cycles in CAR depends on the problems that need to be solved, which are generally more than one cycle.

This research was carried out at MTsN 1 Lhokseumawe City which is located on Jalan Samudera No.3 Lancang Garam, Banda Sakti District, Lhokseumawe City, Aceh. The subjects of this research were students in class VIII.3 MTsN 1 Lhokseumawe City for the 2023-2024 academic year, with a total of 34 students.

The data collection techniques used by researchers in this research are tests, observations and interviews. According to (Arifin, 2011), a test is a technique or method used to carry out measurement activities, in which there are various questions, statements or a series of tasks that must be done or answered by students to measure aspects of student behavior.

The test given to students in class VIII.3 MTsN 1 Lhokseumawe City consisted of three questions in the form of descriptions of the Pythagorean theorem material after the core activity took place. This aims to find out data about students' mathematical problem solving abilities. The test assessment uses a problem solving ability rubric with the highest score for each question being 4 and the lowest being 0.

According to (Arifin, 2011) Observation is a systematic, logical, objective and rational process of observing and recording various phenomena, both in actual situations and in artificial situations to achieve certain goals. (Tanzeh, 2009) Observation is a data collection method that uses observations of research objects which can be carried out directly or indirectly.

This observation is used to obtain data on the process of student teaching and learning activities during classroom learning. Data collection was carried out by direct observation in class regarding students' conditions. The results of the observations are recorded on an observation sheet in the form of a student affective assessment system.

According to (Sugiyono, 2012), an interview is a meeting of two or more people with the aim of exchanging information and ideas through questions and answers, so that meaning can be constructed on a particular topic. Interviews were conducted to explore and dig up information regarding students' responses to RME learning and to find out students' problem solving in the Pythagorean theorem material and ask about the problems faced by each final action question.

The data analysis technique in this research is qualitative data analysis with the steps (1) reviewing all the data that has been collected, (2) reducing the data which involves categorizing and clarifying activities and (3) concluding the data and verifying it. From this activity, data reduction is then carried out with final conclusions. The CAR cycle will stop if the success indicators are met as in the following table:

Table 1. Research Success Indicators

Aspect	Assessment	Success/Completion Category	Instrument
Process Learning	Teacher Learning Activities	Good ($\geq 80\%$)	Observation
	Student Learning Activities	Good ($\geq 80\%$)	Observation
Mathematical Problem Solving Ability	End of Action Test	$\geq 80\%$ students get a KKM score	Test

RESULTS AND DISCUSSION

Result

This Classroom Action Research (CAR) consists of two cycles with six meetings, namely twice for material with a time allocation for one meeting of 3 x 40 minutes and once for the end of cycle evaluation test with a time allocation of 1 x 40 minutes. The aim of this research is to determine the application of the

RME approach in improving mathematical problem solving abilities on the main material of the Pythagorean theorem in class VIII students at MTsN 1 Lhokseumawe City for the 2023/2024 academic year, totaling 34 students consisting of 12 boys and 22 girls.

In cycle I, 3 meetings were held, namely twice for material with a time allocation for one meeting of 2 x 40 minutes and once for the end of cycle evaluation test with a time allocation of 1 x 40 minutes. The material students study is to prove the truth Pythagorean theorem, determining the length of one side of a right triangle if the lengths of the other two sides are known, applying the Pythagorean theorem in solving problems on flat figures, using the Pythagorean theorem to determine the distance between two points on a geometric figure. As stated in the LKPD for meeting 1 cycle I and LKPD for meeting 2 cycle I.

The results of the activities in cycle I can be described by researchers based on the results of the final test of action I and the results of observations of the activities of both teachers and students which can be seen in the following table.

Table 2. Assessment Results in Cycle I

Aspect	Assessment Side	Complete Category	Cycle I Results	Information
Learning Process	Teacher (researcher) learning activities	Good	87%	Complete
	Student learning activities	Good	89%	Complete
Results Students' mathematical problem solving abilities	Final test of cycle I	Enough	76%	Not Completed

Based on the table above, it can be seen that all activities in cycle I of the learning process have reached the expected criteria level. However, the students' mathematical problem solving abilities have not yet reached the expected level. Therefore, teachers who are also researchers need to make improvements to aspects of learning activities, especially student understanding.

Table 3. The Results of Reflection in Cycle I

NO	Disadvantages of Cycle I	Cycle II Improvement Plan
1	From the final test of cycle I, it was seen that students did not fully understand it. Students' mastery of material is still 76%	In cycle II learning, the teacher places greater emphasis on the Pythagorean theorem material and provides exercises at home to better understand the material
2	There are still students who do not play an active role in the group	The teacher tries to give special attention to students who do not play an active role in the group
3	Students are busy themselves during the discussion	The teacher provides supervision to students to be more focused in the discussion
4	Students do not pay attention when other groups are presenting their group's results	The teacher emphasized more to other groups to pay more attention to the group that was presenting

The implementation of actions in cycle II is the result of reflection in cycle I, so that in cycle II it is hoped that improvements will occur as expected. The success of activities in cycle II can be described by researchers based on the results of the final test of action II and the results of observations of activities by both teachers and students which can be seen in the following table.

Table 4. Assessment Results in Cycle II

Aspect	Assessment Side	Category	Cycle II Results	Information
Learning Process	Teacher (researcher) learning activities	Very good	94%	Complete
	Student learning activities	Very good	93%	Complete
Results Students' mathematical problem solving abilities	Final test of cycle I	Very Good	94%	Complete

Based on the table above, it can be seen that all activities in cycle II in the learning process have achieved the expected completeness and experienced better improvement compared to cycle II.

From the results of the researcher's observations, at the 1st cycle II meeting, students no longer experienced difficulties as in the first cycle meeting.

When the LKPD was distributed, they already understood what they had to do. They no longer ask the teacher many questions so the atmosphere is more conducive. At the second meeting in general, all groups worked together with their members in finding concepts, were able to organize steps to solve problems correctly, namely writing down what they knew, asking questions, planning solutions and completing and providing conclusions from the answers that had been obtained so that the results of each discussion -Each group looks optimal and satisfying.

Based on the success indicators, this research stopped in cycle II because the ability to solve mathematical problems for each step is 1) Ability to understand problems at least 75%, 2) Ability to plan problem solving strategies at least 75%, 3) Ability to solve problems at least 75%, 4) The ability to interpret the solution is at least 75%, and classical completeness of at least 80% has been achieved. Based on the reflection explained above, it can be concluded that research activities can only be completed until cycle II, and do not need to be continued to the next cycle, namely cycle III.

Discussion

The improvement in action research is increasing students' problem solving abilities in class VIII.3 MTsN 1 Lhokseumawe City through the application of the RME approach. The research results showed that there was an increase in action activities through the RME approach, both carried out by students and carried out by teachers from cycle I to cycle 2. This is in line with the results of Naiheli, M., et al (2024) research, where a realistic mathematics education approach can improve students' mathematical problem solving abilities.

The increase in students' problem-solving abilities can be seen from the results of cycle I and Cycle 2 scores. In cycle I, students' problem-solving abilities have not reached the specified indicators of success, based on the results of reflection during cycle I learning, this is because the teacher in conveying learning objectives was less than optimal, supervision, guidance for study groups needs to be improved as a group as well as the lack of student participation in discussions.

In cycle I during group discussions, cooperation within the group was not well established because there were still group members who were passive and there were students who were not paying attention and joking around on their own. In the first cycle, it was discovered that 8 students (24%) scored below the minimum completeness category (KKM 75) and 26 students (76%) achieved completeness. So that in Cycle I, students' problem solving abilities had not yet reached the specified success indicator, namely 80% or the equivalent of 28 students completing individually.

In Cycle 2, 32 students completed their studies (94%), higher than the specified success indicator, namely 80% of students completed their studies. In Cycle 2, students' problem solving abilities have reached the specified success indicator, namely 80%. This is supported by changes in actions taken by teachers and students where students no longer experience difficulties as in the first cycle meeting. When the LKPD was distributed, they already understood what they had to do. They no longer ask the teacher many questions so the atmosphere is more conducive. And in general, all groups work together with their members in finding concepts, being able to develop steps to solve problems correctly. In this second cycle of learning, students are also getting used to interpreting the solutions obtained by summarizing the answers. However, the results in Cycle 2 showed that there were still 2 students who had not finished.

After conducting interviews with the class teacher and observing during learning, it can be seen that the two students in their daily learning indeed have a low ability to absorb learning material compared to their friends.

Apart from improving problem solving abilities, the RME approach in learning mathematics, especially Pythagorean theorem material, also improves teacher performance and student activity. In cycle I, teacher performance was in the good category. After implementing improvements in Cycle 2, teacher performance increased to very good.

The results of this research support research conducted by Laila, Alfi (2015). RME Learning to Improve Critical Thinking Ability of Class VII-B Students at Al Huda Middle School, Kediri City. Where the percentage of teacher

activity observation test results increased by 87.94% in cycle I to 98.28% in Cycle 2.

Kairuddin, K. & Br. Sinaga, W (2023) also stated that there was an increase in students' problem solving abilities through PMR. At the classical initial test 1 (3.7%) On cycle I experienced an improvement of the classically acquired 23 (71%) students of a rigorous. In the II cycle experienced improvements classically acquired 28 (87,5%).

Apart from supporting the two previous research results, the results of this research also support theoretical statements about the RME approach. RME is a model of mathematics learning in schools which starts from things that are *real* for student life. What is meant by realistic in this case is school mathematics which is carried out by placing students' reality and experiences as the starting point for learning.

By applying the syntax of the RME approach correctly, and taking into account the characteristics of the students, then dividing the tasks and roles of the students as the home team and the expert team as well as solving the problems found in the idea, it turns out that the RME approach is able to increase the completeness of students' problem solving in mathematics subjects. Pythagorean theorem material for students in class VIII.3 MTsN 1 Lhokseumawe City, Semester II 2023/2024 Academic Year.

CONCLUSION

Based on the description of the research results and discussion, it can be concluded that by using the RME approach in the Pythagorean Theorem material for class VIII-3 MTsN 1 Lhokseumawe City, students' ability to solve mathematical problems increases. Increasing students' ability to solve mathematical problems classically is the proof. Only 76% of the 26 students who completed the final exam in cycle I increased to 94% of the 32 students who completed cycle II studying the Pythagorean Theorem. Thus, using the RME method on the Pythagorean Theorem material for class VIII-3 MTsN 1 Lhokseumawe City shows that applying the RME approach can improve students'

mathematical problem solving abilities. According to observers at meetings 1 and 2, the results of the first cycle of observations of teacher activities reached an average of 87%. Meanwhile, the results of observation in cycle II of teacher activities according to observers at meetings I and II increased by an average of 93%. This score has reached the very good category and is considered to have completed the research activities. Meanwhile, the results of observation in cycle I of activities according to observers at meetings 1 and 2 reached an average of 89% and there was an average increase of 94% in cycle II. The results of this improvement have reached the very good category and are considered complete for student activities.

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