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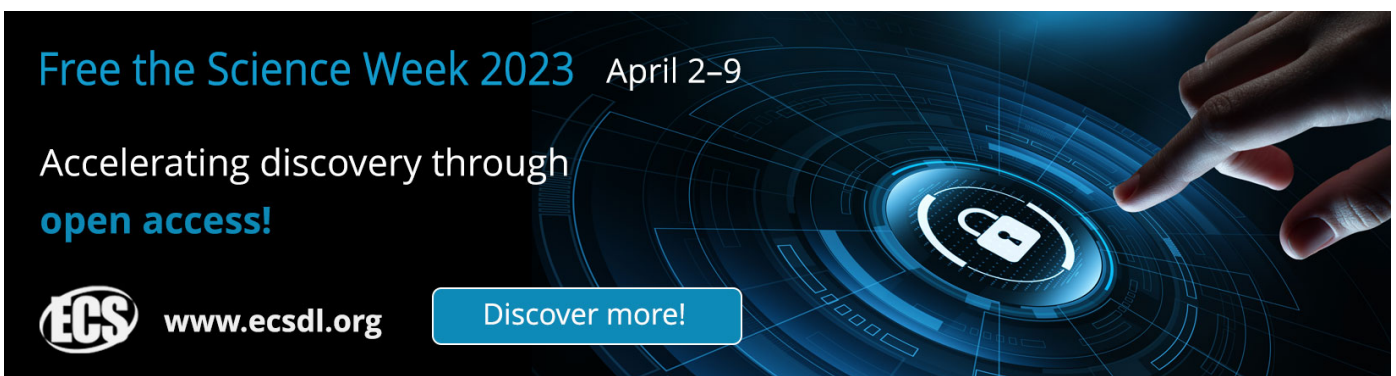
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# Realistic mathematics education approach on teaching geometry in primary schools: Collaborative action research

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**Abstract.** The purpose of this study was to describe the steps of implementing the Realistic Mathematics Education (RME) approach in teaching geometry in elementary schools. This research uses collaborative action research between lecturers, students, and teachers in 2019 at one of the primary schools in Central Java. Data collection techniques through observation, interviews, and tests. The result of the research is that the implementation steps of the RME approach include: (a) Understanding contextual problems. (b) Describing contextual problems, (c) Solving contextual problems, (d) Comparing and discussing answers, and (e) Concluding. The implementation of the RME approach is proven to improve mathematics learning outcomes about geometry.

## 1. Introduction

Mathematics learning objectives are to train students' way of thinking systematically, logically, critically, creatively, and consistently [1]. Furthermore, the National Council of Teachers of Mathematics (NCTM) establishes standards for mathematical abilities such as problem-solving, reasoning and proof, communication, connection, and representation, which students should have [2].

The Ministry of Education stated that the scope of mathematics learning in elementary schools includes aspects such as numbers, geometry, and measurement and data processing [3]. In line with what was stated by NCTM that mathematics material includes number and operations, algebra, geometry, measurement, data analysis and probability [2].

Achieving these learning objectives is not easy, as was found in one school in Central Java. The results of observations of the learning process still use media that tend to be semi-abstract, such as pictures, both printed images, and pictures on the blackboard. Students are also less involved in the use of media. The learning methods used have not varied, namely lectures, questions and answers, assignments, and group discussions. This is reinforced by the results of interviews that during learning, students feel bored, less enthusiastic, most students actively talk and discuss other things. This is in line with the results of Negara research that: 1) teacher-centered learning, students become passive recipients of information, 3) There are no problem-solving activities in groups, 4) Students solve problems using the method according to the way the teacher teaches, 5) Skills developed on the basis of examples and practice questions [4].



The problem is ignored, it will have a negative impact on Mathematics learning activities. through the application of appropriate approaches and learning media in accordance with the characteristics of students are expected to solve these problems. So that students are active to create effective and meaningful learning. The Realistic Mathematic Education (RME) approach results in students learning to gain knowledge directly through what they experience or do. Ariyanti stated that RME is a theory in mathematics education which is based on the idea that mathematics is a human activity and mathematics must be connected significantly to the context of students' daily life as a source of development and as an area of application through both horizontal and vertical mathematical processes [1,5]. With the RME approach, students play an active role in constructing mathematical knowledge, namely by utilizing the reality and environment they understand so that mathematics learning becomes more meaningful [5-7].

Many studies show that the RME approach can effectively improve students' mathematical abilities. Wahyudi et.al research RME research can improve students' mathematical abilities [8]. Then, Fitriani & Maulana's research explains that learning using the RME Approach can improve elementary school students' mathematical understanding and problem-solving abilities [9].

Based on the problems and alternative solutions, researchers collaborated with teachers to improve learning by applying the RME approach. The purpose of this study was to describe the steps of implementing the Realistic Mathematics Education (RME) approach in teaching geometry in elementary schools.

## 2. Methods

This research is a classroom action research in the form of collaboration. Researchers used the approach developed by Kurt Lewin, namely classroom action research which was carried out in four stages, namely: (1) planning, (2) implementation of action, (3) observation, and (4) reflection [10]. The planning stage is the stage of compiling an action plan. The implementation stage of the action is the application of the contents of the action design in the classroom. The observation stage is the observation by the observer by documenting the implementation of the action. The last stage, namely the reflection stage, is a means to restate the actions that have been carried out on the research subject and have been recorded in the observation stage.

This research was conducted in a school in Kebumen Regency, Central Java Province. The location of this school is quite strategic and the conditions of the facilities and infrastructure at this school are quite good. The number of students in this school is 115 students. There are 12 teaching and administrative staff at this school. The research was conducted from January to May 2019. Researchers chose to carry out research at this school for various reasons including: (1) having problems related to mathematics learning patterns, (2) teachers and principals are open and willing to collaborate, (3) student conditions This school is potential enough to apply RME.

There are two kinds of research data, namely quantitative data in the form of student learning outcomes and qualitative data in the form of information about the implementation of Mathematics learning by applying RME. This study uses data collection techniques, namely observation, learning outcomes tests and interviews. Data analysis models according to Miles and Huberman include data reduction, data display, and conclusion drawing [11].

## 3. Results and discussion

This section discusses the implementation of RME and student learning outcomes for three cycles. The implementation discussion focuses on the RME learning steps, namely: (a) Understanding contextual problems. (b) Describing contextual problems, (c) Solving contextual problems, (d) Comparing and discussing answers, and (e) Concluding. Then, learning outcomes will focus on improving learning outcomes on geometry material.

### 3.1. Implementation of the RME approach

The application of the RME approach has experienced various improvements in the learning process to achieve maximum results. The comparison between the intercycle observations can be seen in the following table.

**Table 1.** The development of the implementation of the RME approach by teachers and students.

Research Subject	Cycle I		Cycle II		Cycle III	
	1 <sup>st</sup> meet	2 <sup>nd</sup> meet	1 <sup>st</sup> meet	2 <sup>nd</sup> meet	1 <sup>st</sup> meet	2 <sup>nd</sup> meet
Teacher (%)	86,06	87,15	88,19	89,00	90,11	93,00
Student (%)	85,48	86,16	87,37	88,23	89,12	91,10

Based on table 1, the application of RME by teachers and students has increased in each cycle. Learning in the first cycle the average percentage of the teacher's step score reached 86.60% and the students were 85.82%. The results of the implementation of cycle II teacher scores reached 88.59% and student scores 87.80%. The percentage of observation scores in the third cycle, namely the teacher's score reached 91.55% and the student's score was 90.11%. Overall cycle III went very well. This increase is in line with the results of research conducted by Soraya et.al, that the RME exposure carried out by teachers has increased [12].

The RME approach was implemented according to Shoimin and Ningsih through steps: (a) Understanding contextual problems, (b) Describing contextual problems, (c) Solving contextual problems, (d) Comparing and discussing answers, and (e) Concluding [5,13]. Details of the implementation of these steps are as follows.

The first step is to understand the contextual problem through a flat shape framework. In this step, the teacher provides contextual problems for students to understand. Giving trouble to himself [13]. The provision of contextual problems is carried out using media, namely a flat frame. The teacher uses the media, namely a flat frame. The teacher introduces the flat structure media by demonstrating it so that students know how to use it.

The second step of giving contextual problems using media causes students to be better able to understand the learning material. Students are divided into four groups heretogenously. This is in accordance with Huda's explanation that the variation of the four groups has several advantages, namely that they are easy to split into pairs, more ideas emerge, more tasks can be done, and teachers are easy to monitor [14]. Students who have difficulty or do not understand the problem are given the opportunity to ask the teacher.

The third step is solving contextual problems by using a flat shape media framework. Students discuss to solve the questions given by the teacher using the flat structure media provided by the teacher. Through discussion allows students to foster collaboration in groups and be responsible [14].

The fourth step is to compare, discuss, and complete the answers. The teacher signals the end of the discussion activity. After students discuss with their groups to solve problems, the activity is continued with class discussions. It is appropriate that after the group discussion the process is continued with a class discussion which begins with the presentation of the results [15]. The teacher appoints the group to present the results of the group discussion in front of the class. Other students pay attention to other groups' presentations while comparing the results of their respective group discussions. The teacher asks about the results of different group discussions and then discusses them.

The fifth step is concluding. The teacher responds to the results of group discussions that have presented the results of the discussion in front of the class. The teacher provides the opportunity for students to ask questions, then the teacher gives the opportunity for students to ask questions, then the teacher explains the formal steps in solving the problem then guides the students to conclude the discussion results using a flat-shaped frame media. This is consistent with Setyono that the learning process is that students try various strategies to solve problems both individually and in groups and

present the results of the discussion in front of the class. After that students draw conclusions from the current learning [1].

### 3.2. Mathematics learning outcomes in geometry material

Student learning outcomes data obtained from the results of evaluations carried out at the end of each learning meeting in cycles I, II, and III are listed in the following table.

**Table 2.** Improved mathematics learning outcomes in geometry material.

Aspect	Cycle I		Cycle II		Cycle III	
	1 <sup>st</sup> meet	2 <sup>nd</sup> meet	1 <sup>st</sup> meet	2 <sup>nd</sup> meet	1 <sup>st</sup> meet	2 <sup>nd</sup> meet
Completed (%)	87,50	87,50	87,50	93,75	93,75	93,75
Incompleted (%)	12,50	12,50	12,50	6,25	6,25	6,25
Average	77,50	78,00	78,75	79,00	80,00	82,00

Based on table 2, it is found that the learning outcomes in cycle I were 87.50% of students who completed with an average value of 77.75. In the second cycle the percentage of student completeness was 90.62% with an average value of 78.87. And in the third cycle the percentage of student completeness was 93.75% with an average value of 81.00. Overall learning outcomes have increased from the pre-test to the post-test evaluation results. The rise and fall of the percentage completeness and the average value between cycles is caused by different levels of material difficulty in each cycle.

The assessment of mathematics learning outcomes about flat shapes increases. This is in line with research conducted by Wahyudi et.al that RME can effectively improve students' mathematical abilities [8]. This was also done by Fitriani & Maulana who explained that learning using the RME Approach could improve the ability of elementary school students to understand and solve mathematical problems [9].

## 4. Conclusion

The steps for implementing the RME approach in improving mathematics learning about geometry include: (a) Understanding contextual problems, (b) Describing contextual problems, (c) Solving contextual problems, (d) Comparing and discussing answers, and (e) Concluding. With these steps, the RME approach has been proven to improve mathematics learning about geometry. Suggestions for teachers who will implement the RME approach are expected to focus on concrete media and further increase the ability to stimulate students to ask questions so that students are more active in learning activities.

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