

INTEGRATION OF REALISTIC MATHEMATICS EDUCATION (RME) APPROACH IN MATHEMATICS LEARNING TO IMPROVE CRITICAL THINKING OF ELEMENTARY SCHOOL STUDENTS

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Abstract

This study aims to describe the implementation of the Realistic Mathematics Education (RME) approach in mathematics learning and its impact on improving the critical thinking skills of elementary school students. The method used is descriptive qualitative with data collection techniques through observation, interviews, and documentation. The research subjects consisted of teachers and grade V students in one of the elementary schools in Medan City. The results of the study show that the RME approach is implemented through the stages of presenting contextual problems, mathematical modeling, and reflection. This approach encourages students' active involvement in the thought process and group discussions. The consistent implementation of RME results in improvements in students' critical thinking indicators, such as the ability to identify problems, provide logical reasons, evaluate solutions, and draw conclusions. In addition, students show higher enthusiasm and motivation to learn because the learning material is considered more relevant to their lives. These findings suggest that the integration of the RME approach can be an effective strategy in developing students' critical thinking skills early on, as well as supporting meaningful learning in accordance with the principles of a competency-based and character-based curriculum.

Keywords: *Realistic Mathematics Education, critical thinking, mathematics learning, elementary school students, contextual approach.*

INTRODUCTION

Mathematics education at the elementary school level has a strategic role in building a logical and systematic thinking base for students (Marsini et al., 2022). In the early days of formal education, students began to be introduced to abstract concepts that demanded a deep understanding, not just memorization. Therefore, a learning approach is needed that not only conveys material, but also fosters critical thinking skills (Marsini, 2023). Critical thinking is an essential skill of the 21st century that is urgently needed in facing global challenges. (Paul & Elder, 2006) states that critical thinking is an active and skilled thinking process to understand and evaluate information logically. In the context of basic education, these abilities can be developed through teaching strategies that encourage students to question, analyze, and draw conclusions (Marsini, 2025). Mathematics, as a discipline that demands logical reasoning, has great potential to be a forum for practicing critical thinking (Wahyuni et al., 2018). However, in reality, mathematics learning in many elementary schools still focuses on giving formulas and practice routine problems, so students are not used to thinking deeply and reflective of the problems they face.

Realistic Mathematics Education (RME) is present as one of the relevant approaches in overcoming these problems. This approach was developed in the Netherlands by Freudenthal, who believed that mathematics should be linked to the reality and life experiences of students (Afriansyah, 2016). (Freudenthaler & Neubauer, 2005) emphasizing that "mathematics must be connected to reality and be seen as a human activity". In the RME approach, students are encouraged to build their own mathematical knowledge through the exploration of real-world situations. This is in accordance with the constructivist view, as put forward by (Piaget, 1976), that children build their knowledge through active interaction with their environment. The learning process in RME starts from meaningful contextual problems, then students are guided to model the problem mathematically, until they find generalizations or formal concepts. Thus, the student's thinking process is honed through concrete stages towards abstract. One of

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the important aspects of RME is the principle of guided reinvention, where students are guided to "rediscover" existing mathematical concepts, through exploratory activities. This principle encourages students to not only accept formulas directly, but to experience them procedurally. The emphasis on exploration and modeling in RME indirectly shapes students' critical thinking. According to (Disch, 2020), critical thinking includes the ability to identify problems, search for relevant information, evaluate arguments, and make logical decisions—all of which can be cultivated through RME learning. In elementary school, the application of RME is important because it can relate mathematical concepts to everyday activities that are familiar to students. For example, measuring the length using a ruler when crafting, or counting the amount of money when playing trade, makes math no longer unfamiliar or scary. RME also facilitates the process of discussion and collaboration between students, which strengthens arguments and justifications in solving problems. Activities like these encourage students to question solutions, evaluate strategies, and respect other people's perspectives.

In the context of the Indonesian curriculum, the integration of RME is in line with the scientific approach recommended by the Independent Curriculum and the 2013 Curriculum. Both emphasize observation, reasoning, and hypothesis testing in learning, as well as strengthening high-level thinking skills (HOTS) (Muslimin, 2023). Many studies have shown the effectiveness of RME in improving concept understanding and critical thinking skills. (Afriansyah, 2016) In his research, it was stated that students who were taught with the RME approach showed better achievement in solving mathematical problems than students with the conventional approach. In addition, the RME approach is considered to be able to increase students' motivation and confidence in learning mathematics. When students feel that mathematics is relevant to their lives, they are more engaged and courageous in trying to solve problems with their own approach. However, challenges in implementing RME in the field remain, such as limited teachers' understanding of this learning model, as well as limited time and resources. Therefore, intensive training and mentoring are needed so that teachers can implement it effectively.

Teachers play an important role in orchestrating RME-based learning. As stated by (van den Heuvel-Panhuizen, 2001), teachers are not only as material presenters, but as facilitators who guide the student learning process actively and reflectively. Thus, the integration of RME in mathematics learning is not only an alternative approach, but a necessity in creating meaningful and transformative learning. Moreover, in the information-laden digital era, critical thinking skills are a key competency that every individual must have. Through RME, students not only learn to count, but also learn to think, consider, and decide. It is an important foundation in producing a generation that is ready to face the complexities of the future. In addition, RME integration can also support the achievement of the Pancasila Student Profile, especially in terms of critical reasoning and independence (Marsini, 2024). Both characters can only grow if students are used to thinking reflectively in learning from an early age. Therefore, this study is important to examine the extent to which the integration of the RME approach is able to improve the critical thinking skills of elementary school students. This study can also provide practical recommendations for educators in designing more meaningful mathematics learning. With this background, the researcher is interested in exploring and analyzing the integration of the Realistic Mathematics Education approach in mathematics learning as a strategic effort in improving the critical thinking skills of elementary school students, both theoretically and implementively.

RESEARCH METHODS

The research method used in this study is a qualitative research method with a descriptive approach (Sutopo, 2002). This approach was chosen because the researcher wanted to describe in depth how the integration of the Realistic Mathematics Education (RME) approach is applied in mathematics learning to improve the critical thinking skills of elementary school students. Qualitative research provides space for researchers to explore phenomena naturally and contextually, according to their views (Miles, M. B., & Huberman, 1994)) that qualitative research aims to understand the meaning, processes, and social interactions in a given situation. The subjects in this study are classroom teachers and grade V students in one of the elementary schools in the city of Medan who have applied the RME approach in their learning process. The selection of subjects was carried out purposively, taking into account that the teachers involved have experience in implementing RME and are open to learning innovation. Students involved in learning were also selected heterogeneously in terms of academic ability to obtain a comprehensive picture of the impact of learning on critical thinking. Data collection was carried out through observation, interviews, and documentation. Observations are made during the mathematics learning process in the classroom, focusing on the strategies used by the teacher, interactions between students, and student responses in solving contextual problems. In-depth interviews were conducted with teachers and some students to explore their perceptions, experiences, and reflections on RME-based math learning. Meanwhile, documentation is used to obtain supporting data, such as learning tools, student worksheets, and evaluation results.

To ensure the validity of the data, the researcher used source triangulation techniques and triangulation techniques. Source triangulation is carried out by comparing data from teachers, students, and learning documents, while technical triangulation is carried out by combining data from observations, interviews, and documentation. This step aims to obtain a valid and objective picture of the RME integration process and its influence on students' critical thinking. Data analysis was carried out qualitatively through three stages according to (Miles, M. B., & Huberman, 1994), namely data reduction, data presentation, and conclusion drawn. Data reduction is carried out by selecting and simplifying relevant data, data presentation is carried out in the form of descriptive narratives and thematic matrices, while drawing conclusions is carried out by looking for patterns or relationships between learning strategies and critical thinking indicators shown by students. The critical thinking indicator in this study refers to the framework (Ennis, 1996), which includes the ability to identify problems, provide reasons, evaluate arguments, and draw logical conclusions. Each indicator is observed during the learning process and analyzed thematically according to the learning activities carried out by students. Through this method, the researcher hopes to provide a complete description of how the RME approach can be effectively integrated in mathematics learning, as well as how this approach is able to develop the critical thinking skills of elementary school students in a real and meaningful context. This research is also expected to contribute to the development of learning strategies that are more contextual and oriented towards the formation of high-level thinking skills from an early age.

RESULTS OF RESEARCH AND DISCUSSION

1. Implementation of the RME Approach in Mathematics Learning in the Classroom

Based on the results of observation and documentation in one of the elementary schools in the city of Medan, the implementation process of the Realistic Mathematics Education (RME) approach is carried out in three main stages: context recognition, mathematical modeling process, and reflection on solutions. Teachers begin learning by presenting contextual problems that are close to students' lives, such as calculating the amount of money during buying and selling activities in the school canteen or measuring the length and area of the classroom table. These contextual issues manage to grab students' attention and spark their curiosity. Students are seen actively discussing in small groups to find solutions, showing collaboration and exchange of ideas. The teacher facilitates by providing a triggering question that encourages students to explain the reason for their answer. This stage supports the principle of guided reinvention that is characteristic of RME, where students gradually rediscover mathematical concepts with the guidance of the teacher.

The results of the study show that the Realistic Mathematics Education (RME) approach has been successfully implemented systematically in the mathematics learning process in grade V of elementary school. The teacher's strategy in starting learning with a real context such as buying and selling activities or measuring objects around students reflects the application of the principle of contextual problems in RME, as stated by (Freudenthaler & Neubauer, 2005), that mathematics should not be taught in the abstract, but rather should be close to the reality and life experiences of students. The learning steps taken by teachers range from introducing context, encouraging students to model problems mathematically, to reflecting on solutions in line with the principle of guided reinvention. In this principle, students are not given formulas directly, but are directed to "rediscover" mathematical concepts through an exploratory process. This supports the view of constructivism (Piaget, 1976), which states that students build knowledge through experience and active interaction with their learning environment.

2. Student Response and Involvement in the Learning Process

The results of the interviews showed that students felt more interested and less afraid of math lessons when the RME approach was applied. They feel that the problems given are easier to understand because they relate to everyday experiences. In addition, most students stated that they prefer to study in groups because they can help each other and discuss. Critical attitudes begin to appear when students respond to each other's answers and try to give reasons for their chosen solutions. In a learning session about measurement, for example, students show the courage to correct their friend's mistakes and provide logical explanations based on the results of real measurements in class. This activity shows that RME provides space for students to think actively and critically about the information they acquire. Learning that starts from real life has been proven to increase students' interest and participation in learning mathematics. The positive response of students to RME learning shows that this approach is able to reduce the fear of mathematics lessons which have often been considered difficult and abstract. This is in line with the opinion (van den Heuvel-Panhuizen, 2001), which states that through RME, students will be more motivated because they feel that mathematics is relevant and useful in their lives. The active involvement of students in group discussions and their courage to correct or respond to a peer solution shows that learning has gone according to the RME's objective, which is to encourage students to think critically and argue logically. The process of dialogue and interaction in groups

creates space for students to learn from each other and foster confidence in expressing opinions. This is in line with the critical thinking indicator according to (Ennis, 1996), which is the ability to evaluate arguments and provide in-depth reasoning on a problem.

3. Indicators of Critical Thinking That Emerge During Learning

From the results of the analysis of observations and student worksheets, it can be concluded that there is an increase in critical thinking skills in students during the learning process with the RME approach. This increase can be seen from the emergence of various indicators of critical thinking, such as the ability to identify problems, give reasons for the choice of answers, evaluate strategies, and draw conclusions from group discussions.

Table 1. Summary of Achievement of Students' Critical Thinking Indicators Based on Observation Results at Three Different Meetings

Critical Thinking Indicators	Meeting 1	Meeting 2	Meeting 3
Identify issues	65% of students	75% of students	85% of students
Giving a reason for the answer	50% of students	68% of students	80% of students
Evaluating strategies/solutions	35% of students	60% of students	72% of students
Draw logical conclusions from discussions	40% of students	55% of students	70% of students

From the table above, it can be seen that there is an increasing trend in each critical thinking indicator along with RME-based learning. This shows that this approach not only makes students more active, but also more reflective and systematic in thinking. The results of observations that show an increase in each of the students' critical thinking indicators are proof that the RME approach is effective in fostering critical thinking skills from an early age. This improvement does not only occur in the aspect of identifying problems and giving reasons, but also in the evaluation of strategies and logical conclusions that students build after discussion. This fact shows that learning mathematics with the RME approach provides enough space for students to think reflectively, rather than just memorizing and solving routine problems. Theory (Paul & Elder, 2006) which mentions that critical thinking is an active process to understand, evaluate, and organize information logically is very visible in student activities during learning. When students are faced with real situations, they are not only asked to answer questions, but also challenged to formulate their own problems, choose strategies, and account for the answers. This activity reflects the involvement of high-level cognitive processes (HOTS) as emphasized in the Independent Curriculum (Muslimin, 2023). Furthermore, improvements in indicators such as strategy evaluation and conclusion drawing show that students are increasingly able to see the effectiveness of a solution method and are no longer fixated on one way of thinking. In the long term, this kind of ability is needed in dealing with complex problems, both in daily life and at the next level of education.

CONCLUSION

Based on the results of research conducted on the implementation of the Realistic Mathematics Education (RME) approach in mathematics learning in elementary schools, it can be concluded that this approach makes a positive contribution to improving students' critical thinking skills. The RME approach, which starts from contextual problems, provides space for students to be actively involved in modeling and solving problems based on their real-world experiences. This process not only enhances conceptual understanding, but also fosters students' logical sensitivity and reasoning power. The implementation of RME carried out by teachers in accordance with the main principles of this approach, such as guided reinvention and mathematics as a human activity, has been proven to be able to create meaningful and enjoyable learning. Students are more involved in learning because the material delivered is inseparable from their daily lives. They are encouraged to think, discuss, reason, and critically evaluate ideas. The results of the observation showed that there was a significant increase in four critical thinking indicators,

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namely the ability to identify problems, give logical reasons, evaluate strategies, and draw conclusions. Students' positive responses to RME learning also show that this approach can reduce anxiety about math and increase confidence in solving problems. Teachers play an important role as facilitators who guide students in building an independent understanding of mathematics, in accordance with the constructivist view that underlies this approach. Thus, RME can be used as an alternative effective learning strategy to improve students' critical thinking skills from an early age. This approach is not only relevant to the demands of the Independent Curriculum which focuses on strengthening higher order thinking skills (HOTS), but also supports the achievement of the Pancasila Student Profile that prioritizes independence and critical reasoning. This study suggests that the RME approach be more widely applied and developed in mathematics learning, especially at the primary school level, with adequate training support for teachers.

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