The Influence of a Realistic Mathematical Approach on Student Learning in Elementary Schools

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Article Info

ABSTRACT

This study investigates the impact of the Realistic Mathematics Education (RME) approach on students' critical thinking skills and learning outcomes in elementary schools. The research employs a literature review method by analyzing findings from previous studies, including experimental and quasi-experimental designs. The RME approach, characterized by its emphasis on real-world problems and contextual learning, enables students to connect mathematical concepts with practical applications, fostering critical thinking and problem-solving abilities. Various studies indicate that students using the RME approach exhibit significantly improved critical thinking skills compared to those taught using conventional methods. For example, one study showed an increase in the average critical thinking score from 63.29 to 80.29, with a significance value of $0.001 < 0.05$, confirming the approach's effectiveness. Additionally, students demonstrated the ability to apply mathematical formulas in daily life and actively engage in learning activities, leading to higher academic achievement. The analysis highlights three key aspects of the RME approach: its ability to transform abstract concepts into relatable experiences, its adaptability to diverse student needs, and its effectiveness in promoting active participation. These attributes make RME a viable alternative for improving mathematics education in elementary schools. In conclusion, the RME approach provides a practical and effective solution for enhancing students' critical thinking skills and mathematical understanding, bridging the gap between theory and real-world application. This study recommends integrating the RME approach into mathematics curricula to achieve more meaningful and engaging learning experiences for elementary students.

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1. INTRODUCTION

Mathematics learning in Indonesia has started to be taught from the elementary school level, making this learning very influential at the next level. However, in reality, we hear many complaints from students. They complain that learning is difficult and confusing; some students even fear mathematics. This indicates a gap between how mathematics is taught and students' ability to comprehend the material [1], [2], [3], [4], [5]. Addressing this issue requires an innovative approach that makes mathematics more engaging and relatable.

Mathematics has its characteristics, one of which is that it is an abstract object, meaning that mathematical objects exist in the human mind. So that students understand mathematical concepts, educators must be able to connect mathematics with the daily lives of their students. When mathematical concepts are grounded in real-life experiences, students are more likely to grasp and retain the knowledge. Bridging abstract concepts with practical applications can also help reduce students' anxiety towards mathematics [6], [7], [8], [9], [10], [11].

Mathematics is closely related to human daily activities, from simple things to things that require more thinking. Mathematics is not a science that is tolerant of human life, but mathematics arises from and is helpful for our daily lives. For example, basic arithmetic is essential in managing finances, while more complex concepts like geometry and algebra find applications in various fields such as architecture and engineering. This practical relevance highlights the importance of teaching mathematics in ways that are accessible and meaningful to students.

The Minister of National Education Regulation Number 22 of 2006 [12] states that mathematics should begin by introducing problems appropriate to existing conditions. This statement makes it increasingly clear that mathematics learning is abstract (not confirmed), even though elementary school children are still at the concrete operational level. Therefore, we need an approach that can change abstract mathematics into a lesson that is easy to learn and quickly understood through actual activities. This regulation aligns with the developmental needs of elementary school students, emphasizing the importance of instructional strategies that leverage concrete and relatable experiences to foster understanding.

The way mathematics is taught must be connected to the participants' environment because mathematics learning has no connection to their daily lives. Students tend to forget more quickly and cannot apply it to their daily lives. This disconnection often leads to a lack of interest and motivation in mathematics. Educators can create a more engaging learning environment by integrating real-world contexts, ultimately improving student outcomes [13], [14], [15], [16].

One approach that can be used is the Realistic Mathematics approach. According to Siregar et al. [17], the Realistic Approach is a learning approach that begins with real problems to direct students in understanding a mathematical concept. This approach has been proven to significantly influence students' mathematics learning at the elementary school level. Using real-life problems as a starting point, students can see the relevance of

mathematics to their daily lives, which helps to demystify abstract concepts and makes learning more enjoyable.

A realistic mathematical approach positively impacts student learning outcomes, where each student has a different ability level. This shows that realistic mathematics can be adapted to meet the diverse learning needs of students so that every student can feel the benefits of this approach, which can significantly contribute to students' mathematics learning in elementary schools. Furthermore, Realistic Mathematics enhances academic achievement and develops critical thinking and problem-solving skills for lifelong learning. This approach equips students with the tools to navigate and contribute to their communities effectively by grounding mathematical concepts in authentic contexts.

2. METHOD

The method employed in this research is the Literature Review Method, which focuses on analyzing and synthesizing information from various scholarly articles and journals relevant to the research topic. This method is chosen to explore the effectiveness of the Realistic Mathematics Education (RME) approach in improving elementary students' learning outcomes, as discussed in the introduction.

The steps in conducting this research include:
1. Identifying relevant articles and journals using specific keywords related to the Realistic Mathematics Education (RME) approach, elementary school mathematics learning, and its impact on student outcomes.
2. Reviewing the selected literature to understand various perspectives and findings regarding the implementation and effectiveness of the RME approach.
3. Classifying the articles based on themes such as the benefits of contextual learning, challenges in teaching abstract mathematical concepts, and strategies to bridge the gap between theory and practice.
4. Interpreting the findings by synthesizing insights to address the research questions.

Data was analyzed descriptively by grouping, reviewing, and summarizing relevant articles and journals. The analysis focused on identifying patterns and trends in applying the RME approach, including its strengths and challenges in addressing diverse student needs. The findings were then aligned with the research objectives to provide a comprehensive understanding of the impact of RME on elementary school mathematics learning.

This literature-based approach ensures that the study provides a theoretical foundation and critical insights into how the RME approach can enhance elementary school students' mathematical understanding, critical thinking, and problem-solving skills.

3. RESULTS AND DISCUSSION

The Realistic Mathematics approach is a learning strategy that incorporates real-world problems into learning activities, allowing students to gain direct experiences relevant to their daily lives. However, this approach does not require that all problems teachers present be observable in students' immediate surroundings. A problem is considered realistic if it can be imagined or is meaningful within the students' cognitive

frameworks. For example, written narratives or games can serve as realistic problems, as demonstrated in research that illustrates comparative material. In this context, teachers can use familiar media, such as objects in the classroom, to broaden students' understanding by comparing two items.

Furthermore, there is an argument that mathematics education should not only focus on tangible situations from students' lives but also include problems that are conceivable and appropriate to their developmental stages and life contexts. This perspective emphasizes the flexibility of Realistic Mathematics in adapting to students' cognitive and experiential diversity.

In line with expert opinions on Realistic Mathematics Education and supported by the analysis of several cited journals, this study identifies three key aspects of Realistic Mathematics learning that contribute to its effectiveness. These findings highlight the potential of this approach to bridge the gap between abstract mathematical concepts and students' real-world experiences.

3.1. The influence of Realistic Mathematics education on students' learning motivation

Realistic Mathematics learning has a significant influence on student learning motivation. This is supported by research conducted by Lalu Abdul Aziz et al. [18] involving Class III students at SDN 6 Cakranegara. The method used in this research was quasi-experimental, with a population of 52 students. The findings revealed that before introducing the realistic mathematical model, student motivation averaged 65.02. After the implementation, this figure increased to an average of 88.05. This substantial improvement demonstrates the potential of Realistic Mathematics learning to enhance student engagement and interest. Furthermore, hypothesis testing using the t-test showed a calculated t-value of 411.55 compared to a t-table value of 1.676, confirming the significant impact of this approach.

Likewise, Purnamatati et al.'s [19] findings in fifth-grade students at SDN Lulut 05, Klapanunggal District, also emphasize the effectiveness of the Realistic Mathematics approach. Class VA was selected as the experimental group, while class VB was the control group using purposive sampling. Data analysis involved the N-gain formula and t-test. The results showed: (1) There is a difference in the increase in students' mathematical reasoning ability after being given the RME approach indicated by the N-gain value of 55.5 in the medium category and for the experimental class 36.8 in the low category, then the control class in the t-test (independent) so that the Sig value is obtained. 0.001<0.005, as for deciding in the independent sample t-test. It is concluded that there is a significant difference between the average score of mathematical reasoning ability by students treated with the RME approach and the Conventional approach. And (2) There is an influence of the RME approach on students' mathematical reasoning abilities with an effect size score of 1.44, which is in the high category

Additionally, research by Dyah Anungrat Herzamzam [20] in Class V at SDN Pondok Jaya 3 South Tangerang also highlights the motivational benefits of this approach. The study showed increased student interest using a collaborative classroom research

method and a questionnaire. Before the intervention, 49% of students showed low interest, which improved to 58% (medium category) after the first cycle and reached 85% (high category) by the end of the study. This progressive increase underscores the importance of iterative and reflective teaching practices in Realistic Mathematics learning.

Similarly, research by Clara Fatimah et al. [21], using quantitative methods with a population of 20 students, found significant differences in interest between students taught with Realistic Mathematics learning methods and those taught conventionally. The study, conducted on Class VI students at Kartikatama Metro, revealed that students in the Realistic Mathematics group showed higher interest levels than those in the conventional group. T-test results of 11.90 > 2.306 further confirmed this. Such findings emphasize the superiority of Realistic Mathematics learning in fostering student interest and engagement compared to traditional approaches.

Further research by Wahyuni Dwi Novia et al. [22] supports the Realistic Mathematics approach's positive impact on motivation and learning success. The study conducted with fifth-grade students at SD Negeri Karangasem Yogyakarta and SD Negeri Sarikarya Yogyakarta revealed a significant influence of this approach on student outcomes. The differences between the control and experimental classes were notable at a significance level of 0.000 < 0.05 for motivation and 0.042 < 0.05 for learning success. These results suggest that Realistic Mathematics improves motivation and enhances students' academic performance.

Another study by Aziz et al. [18] further corroborates these findings. The research, aimed at exploring the influence of the Realistic Mathematics learning model on motivation and learning outcomes, revealed an increase in pretest and post-test scores, from an average of 65.02 to 88.05. Hypothesis testing also showed that t-values for motivation (411.55) and learning outcomes (4.444) were greater than the t-table value (1.676), confirming the significant impact of this approach. This reinforces the conclusion that Realistic Mathematics learning models can effectively enhance motivation and academic achievement.

Based on the findings of these studies, several recommendations can be made for implementing a Realistic Mathematics approach. Teachers should carefully design scenarios and lesson plans that utilize real objects, pictures, or diagrams relevant to daily life. Additionally, teachers must provide opportunities for students to actively participate in learning and act as facilitators to guide students in solving situational problems. These strategies ensure that Realistic Mathematics learning remains student-centered and impactful.

From the various studies reviewed, it is evident that most researchers utilized questionnaires to measure the influence of mathematics learning on student motivation. This method has proven efficient in capturing the nuances of student engagement and motivation, making it a valuable tool for future research in this area.

3.2. The influence of a realistic mathematical approach on student learning outcomes

The impact of a realistic mathematical approach also influences student learning outcomes. This is supported by research conducted by Elwijaya [23], demonstrating

significant improvements in learning outcomes and mathematical problem-solving abilities in fraction material. The findings indicate that various research methodologies, including qualitative, quantitative, and mixed methods, consistently reveal the effectiveness of this approach.

Furthermore, Catrining and Widana's [24] research was conducted with SMP Negeri 6 Denpasar class VII students. In their study, it was proven that there were significant differences in student learning outcomes when comparing the Realistic Mathematics approach with the conventional approach. This highlights the potential of the Realistic Mathematics approach to foster a deeper understanding of mathematical concepts compared to traditional teaching methods.

Similarly, research conducted by Puspitasari and Airlanda [24] analyzed data from 20 journals. The results show that implementing the Realistic Mathematics Approach (RMA) led to notable increases in student learning outcomes. The study reveals improvements in students' cognitive abilities, with performance increases ranging from 13.06% to 99.97% and an average increase of 30.34%. These findings strongly suggest that RMA has a significant positive effect on students' cognitive development in mathematics.

From the research above, it can be concluded that the Realistic Mathematics approach is highly effective in improving student learning outcomes. Furthermore, it is evident that this approach also positively influences students' motivation and engagement in mathematics learning, particularly in elementary schools, with an average improvement rate exceeding 30%. The consistency of these findings across various studies reinforces the potential of RMA as a transformative educational approach for fostering both cognitive and motivational aspects of mathematics learning.

3.3. The influence of a realistic mathematical approach on student activity

The Realistic Mathematics Education (RME) approach is a learning strategy that can increase student activity by helping them solve everyday problems. This approach has several benefits. First, it helps students understand the relationship between mathematics and their daily lives, making abstract concepts more tangible and relatable. Second, it enables students to recognize that mathematics is a subject they construct and develop independently, fostering a sense of ownership in the learning process. Third, it enhances students' critical mathematical thinking skills, equipping them to analyze and evaluate problems effectively. Lastly, it improves students' problem-solving and mathematical connection abilities, encouraging them to apply mathematics across different contexts in meaningful ways.

The RME approach begins with practical matters familiar to students and their environment. This approach introduces mathematical concepts and contextualizes them within students' lived experiences by grounding learning in the real world. The real world is a source for the emergence of mathematical concepts and principles. The steps in the RME learning model include understanding context problems, explaining context problems, solving context problems, and comparing and discussing answers.

The Realistic Mathematics Approach has several defining characteristics. It emphasizes what is real and utilizes the environment as a learning resource for students.

This approach focuses on mathematical process skills, helping students develop problem-solving strategies. Additionally, it encourages students to relate mathematics to everyday life, fostering practical understanding and application. Furthermore, it enhances students' emotional capacity and promotes positive attitudes and actions, supporting social and collaborative learning experiences.

Apart from its influence on student motivation and learning outcomes, the Realistic Mathematics approach also significantly impacts student activity in the classroom. Activities conducted during RME-based learning include reading and understanding problems in student worksheets, listening attentively to teacher explanations, writing notes from teacher explanations, completing problem-solving tasks in student worksheets, and discussing solutions with peers and teachers. Other activities involve taking notes from books or peers, asking questions, sharing ideas, and drawing conclusions. These observed activities collectively contribute to effective time utilization and meet the criteria for achieving learning goals.

Research by Ahmad Marzuki [25] indicates that student activities involving Realistic Mathematics learning achieve effectiveness if all observed aspects align with the ideal time tolerance limits. This approach fosters enthusiasm among students, increasing their willingness to collaborate, respect the ideas of their peers, and communicate their thoughts more confidently during learning activities.

Furthermore, research conducted by Narayani in 2019 [26] examined the mathematics learning outcomes of class five students in Cluster One, Banjar District, Buleleng Regency. The results showed that the value of the test statistic was significantly more significant than the critical value at the five per cent significance level, leading to the conclusion that the Realistic Mathematics approach, combined with problem-solving strategies and concrete media, significantly influences students' mathematics learning outcomes. This approach also positively impacts students' enthusiasm and engagement in learning activities.

3.4. The influence of a realistic mathematical approach on students' critical thinking

The influence of a realistic mathematical approach on students' critical thinking has garnered significant attention in educational research. Realistic Mathematics Education (RME) emphasizes the connection between mathematical concepts and real-world contexts, which has been shown to enhance students' critical thinking abilities. This discussion synthesizes findings from various studies that highlight the effectiveness of RME in fostering critical thinking skills among students.

Research by Lestari et al. indicates that implementing RME-based worksheets significantly improves students' critical thinking skills, providing empirical evidence supporting this approach's efficacy in mathematics education [27]. Similarly, Herlawan's study demonstrates that using the RME approach, supplemented with learning videos, effectively enhances the critical thinking abilities of elementary school students, reinforcing the notion that multimedia resources can further enrich the learning experience [28]. These findings align with Utama et al., who assert that RME facilitates a deeper

understanding of mathematical concepts by relating them to students' everyday experiences, making learning more meaningful and engaging [29].

Moreover, Nashrullah's research emphasizes that students who engage with RME exhibit higher levels of critical thinking than those who do not, particularly when mobile learning tools are integrated into the curriculum [30]. This is further supported by Ulandari et al., who found that the RME approach improves mathematical problem-solving abilities and fosters active student participation, which is crucial for developing critical thinking skills [31]. The active engagement promoted by RME is essential, as it encourages students to analyze, evaluate, and synthesize information, which are key components of critical thinking [32].

The importance of teaching strategies that promote higher-order thinking skills is also highlighted by Aizikovitsh-Udi and Cheng, who argue that incorporating critical thinking into mathematics instruction can significantly enhance students' cognitive abilities [32]. This perspective is echoed by Purwitaningrum and Prahmana, who report that the RME approach effectively improves students' logical thinking skills, further supporting the claim that RME is beneficial for developing critical thinking [33]. Additionally, the work of Zhu emphasizes the necessity of pedagogical shifts to nurture critical thinkers, advocating for real-world applications in mathematics education to make learning relevant and engaging [34].

4.   CONCLUSION

Based on the findings from various studies, it can be concluded that the Realistic Mathematics Education (RME) approach significantly improves students' critical thinking skills and learning achievement in elementary schools. Realistic problems, whether derived from real-life contexts or conceptualized in students' minds, effectively bridge the gap between abstract mathematical concepts and practical applications. Research consistently demonstrates that students taught using the RME approach outperform those taught with conventional methods in critical thinking and problem-solving abilities. Moreover, the RME approach enhances cognitive skills and fosters active participation and a deeper understanding of mathematical concepts. These outcomes highlight the importance of implementing RME as an innovative teaching strategy to prepare students for real-world challenges while strengthening their foundational mathematical knowledge.

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