LOGIKA: Jurnal Pendidikan Matematika
Vol. 1, No. 2, Oktober 2025, pp. 42-47
eISSN 3110-2506 | https://ejournal.gemacendekia.org/index.php/logika

Literature Analysis on the Effectiveness of the Realistic Mathematics Education (RME) Approach in Improving Students' Understanding of Mathematical Concepts

Lalu Aji Muliardi Akbar [a,1,*], Alvandi Nova [b,2]

[a] Universitas Qomarul Huda Baddarudin Bagu, Indonesia
[b] Pendidikan Teknologi Informasi, Universitas Teknologi Mataram, Indonesia
[1] lalu.ardoth@gmail.com*; [2] alvandi.nova@gmail.com
* Corresponding Author

ABSTRACT

This study aims to analyze the effectiveness of the *Realistic Mathematics Education* (RME) approach in improving students' understanding of mathematical concepts through the synthesis of the latest research results. The main problem behind this study is the low ability of students to understand mathematical concepts, which is shown through difficulties in connecting ideas, explaining mathematical reasons, and applying concepts in new contexts. This study uses the Systematic Literature Review (SLR) approach by examining articles from the Scopus, ScienceDirect, Taylor & Francis, and SpringerLink databases, and verified through Google Scholar. The article selection follows the PRISMA flow, with the inclusion criteria for articles published in 2020–2025, peer-reviewed status, applying RME in learning, and measuring concept understanding. A total of 5 articles were selected and analyzed through thematic synthesis to identify implementation patterns, outcomes, as well as supporting and inhibiting factors for the implementation of RME. The results show that RME consistently effectively improves understanding of mathematical concepts through the use of real contexts, step-by-step modeling, and reflective discussions that encourage the construction of meaning. However, the success of the implementation is greatly influenced by the readiness of teachers and the quality of learning tools. Thus, this study confirms that RME is a relevant approach and needs to be optimized in mathematics learning through teacher training and the provision of supportive learning media.

Article History
Received 2025-08-16
Revised 2025-09-20
Accepted 2025-10-19

Keywords
realistic mathematics education (RME), understanding of mathematical concepts, mathematics learning, thematic synthesis

Introduction

Mathematics learning at various levels of education still faces fundamental problems related to students' low understanding of mathematical concepts. A number of national assessment reports and research results show that students are generally able to do routine problems, but have difficulty interpreting meanings, explaining the relationships between concepts, and applying concepts in real problematic situations (Gunawan & Hadi, 2024; Nugraheni, 2021). This condition is related to learning practices that are still dominated by expository methods, teacher-centered, and emphasizing mechanical procedures without providing space for the process of constructing meaning (Bayu, Fauzan, & Armiati, 2023). As a result, mathematics is often perceived by students as an abstract science and far from everyday life.

Ideally, mathematics learning should allow students to build their own conceptual understanding through mathematical thinking, representation, and modeling activities in real contexts (Freudenthal, 1991; Gravemeijer & Terwel, 2000). The Realistic Mathematics Education (RME) approach was developed on the basis that mathematics needs to be presented as a human activity that departs from contextual phenomena to formal abstraction (Treffers, 1987). A number of recent studies have shown that the application of RME

How to cite: Akbar, L. A. M., & Nova, A. (2025). Literature Analysis on the Effectiveness of the Realistic Mathematics Education (RME) Approach in Improving Students' Understanding of Mathematical Concepts. *LOGIKA: Jurnal Pendidikan Matematika, 1*(2), 42-47. https://doi.org/10.71094/logika.v1i2.215

contributes positively to improving conceptual understanding, representation ability, and mathematical problem solving (Putra, 2024; Rohman et al., 2025; Sutarni, 2024; Prayitno, 2024).

However, despite many findings showing the effectiveness of RME, the results of these studies still show variation. Some studies have noted significant improvements in conceptual abilities, while others have found that the success of RME is influenced by teacher readiness, the quality of context selection, and the ability of students to transition from concrete situations to formal symbols (Hakim, 2024; Scott, 2021). In addition, most previous studies focused more on improving procedural skills, so that the aspect of understanding mathematical concepts has not been comprehensively synthesized (Fajri, 2025; Mahfud, 2022).

From this condition, a research gap emerged, namely the absence of a systematic literature analysis that summarizes the latest research findings regarding the effectiveness of RME specifically in improving students' understanding of mathematical concepts. Therefore, this study proposes a literature analysis based on 25 international studies published in the 2020–2025 range to map patterns of effectiveness, supporting factors, implementation barriers, and learning implications. Thus, the novelty of this research lies in the preparation of a comprehensive and critical synthesis of the effectiveness of RME in improving students' understanding of mathematical concepts, so as to strengthen the theoretical foundation and provide more targeted pedagogical recommendations for teachers and educational institutions in implementing RME consistently and sustainably.

Method

This study uses the Systematic Literature Review (SLR) approach to examine the effectiveness of *Realistic Mathematics Education (RME)* in improving students' understanding of mathematical concepts. Data were collected from international journal databases (Scopus, ScienceDirect, Taylor & Francis, and SpringerLink) and verified through Google Scholar using the keywords *"Realistic Mathematics Education", "mathematical conceptual understanding", and "students".* Articles were selected based on inclusion criteria, namely published in 2020–2025, peer-reviewed status, applying RME in mathematics learning, and measuring understanding of mathematical concepts, while articles that were irrelevant or not based on scientific research were issued. The selection process followed the PRISMA flow until 25 articles were selected to be analyzed. The data was analyzed using thematic synthesis, by identifying the pattern of RME implementation, its impact on concept understanding, as well as supporting and inhibiting factors for its implementation. Validity is maintained through strict selection, triangulation of findings, and drawing evidence-based conclusions, so that the results of the study are objective, systematic, and accountable.

Results and Discussion

After the literature selection and analysis process is carried out according to the stages in the research method, this section presents the results of a systematic review of articles that have met the inclusion criteria. The presentation of results was focused on mapping the main findings related to the application of the Realistic Mathematics Education (RME) approach and its impact on students' understanding of mathematical concepts. The results are presented in the form of a summary table to provide a comprehensive overview of the characteristics of the study, methods used, and the core conclusions of each study reviewed. Furthermore, the findings were analyzed thematically to identify patterns of effectiveness, implementation trends, and factors influencing the success of RME implementation in various learning contexts. Thus, this part of the results becomes the basis for a more in-depth discussion in the next section.

Table 1. Literature Review Results Five Articles

Yes	Author & Year	Research Title	Methods & Samples	Key Findings
1	Wijaya, A., van den Heuvel-Panhuizen, M., & Doorman, M. (2020)	*Realistic Mathematics Education in Indonesian Classrooms: Implementation and Conceptual Understanding*	Qualitative Descriptive, 2 Schools	RME helps students relate mathematical concepts to real situations thereby improving their understanding of basic concepts.
2	Putra, H., & Abdullah, S. (2021)	*The Effect of RME Approach on Students' Conceptual Understanding in Middle School Mathematics*	Quasi-Experiment, 64 students (experimental vs control class)	Classes with RME showed significant improvements on concept comprehension tests compared to conventional learning.
3	Limbong, A., & Samosir, M. (2022)	*Improving Mathematical Conceptual Understanding through RME-Based Learning Media*	Mixed Methods, 32 students	The use of RME-based media strengthens students' ability to explain the reasons and steps for mathematical solving.
4	Marpaung, D., & Rahmawati, E. (2023)	*RME Strategy to Support Students' Conceptual Reasoning in Elementary Mathematics*	Classroom Action Studies, 2 Cycles	There is a gradual improvement in students' ability to construct relationships between concepts and generalize.
5	Yuliani, T., & Idris, N. (2024)	*Effectiveness of Contextual RME Problem Solving to Strengthen Mathematical Conceptual Skills*	Experiment, 70 students	RME-based problem-solving models improve concept accuracy and the ability to apply concepts in new situations.

Discussion

An analysis of five studies showed consistent evidence that the Realistic Mathematics Education (RME) approach significantly contributed to improving students' understanding of mathematical concepts compared to conventional learning practices. Quasi-experimental and experimental studies (Putra & Abdullah, 2021; Yuliani & Idris, 2024) reported an increase in concept comprehension post-test scores in the RME group, while the class action and mixed-methods studies (Marpaung & Rahmawati, 2023; Limbong & Samosir, 2022) show gradual improvements in students' ability to explain mathematical reasons, build relationships between concepts, and make generalizations. Qualitative descriptive findings from the Indonesian context (Wijaya, van den Heuvel-Panhuizen, & Doorman, 2020) reinforce the quantitative evidence by showing how learning that links concepts to real-life situations makes mathematical meaning more accessible to students. Cumulatively, this evidence supports the claim that RME is not just a strategy to improve procedural skills, but also effective in building

deep conceptual understandings that allow transfer to new situations (Putra & Abdullah, 2021; Yuliani & Idris, 2024).

The pedagogical mechanisms that emerge consistently include four main paths. First, contextualization: RME initiates learning from meaningful everyday situations so that students can build relevant mental representations (Wijaya et al., 2020). Second, modeling and dual representation: media use and visual/concrete activities (Limbong & Samosir, 2022; Study management) helps the transition from the concrete to the symbolic so that abstraction becomes more structured. Third, instructional scaffolding: RME combined with scaffolding or guided discovery strategies accelerates students' ability to formulate mathematical generalizations (Putra & Abdullah, 2021; Marpaung & Rahmawati, 2023). Fourth, active engagement: RME-based learning enhances students' discussion, argumentation, and reflection processes that are crucial for the internalization of concepts (Marpaung & Rahmawati, 2023; Wijaya et al., 2020). The combination of these pathways explains why RME is able to deepen understanding, rather than simply improve calculation routines.

Although the results are positive, reviews show variations in effectiveness that cannot be ignored. Differences in study design (quasi-experimental vs PTK vs mixed-methods), variations in instruments for measuring concept understanding, and differences in intervention duration are the main sources of heterogeneity. Several studies (Putra & Abdullah, 2021; Yuliani & Idris, 2024) reported significant effects after a structured intervention over several weeks, but not all studies used the same measure for "concept understanding" and some assessed explanatory ability, some used written conceptual tests, and some assessed transfer to new contexts. This non-standardization limits the ability to estimate the magnitude of the effect in aggregate and makes it difficult to generalize across educational contexts. In addition, implementation factors such as teacher readiness, real-context design quality, and availability of educational media appear repeatedly as moderator variables that determine success (Limbong & Samosir, 2022; Wijaya et al., 2020).

Another important methodological criticism to note is the tendency of the study sample to be relatively small and the use of control groups that are not always random, so the threat of selection bias persists in some quasi-experimental studies. Classroom action studies provide strong evidence of changes in students' learning processes and argument development, but are generally less robust for broad population causal inference. Therefore, although the initial evidence strongly supports RME, the strength of the evidence for generalization claims still needs to be corroborated by larger-scale RCT studies, the use of contextually validated conceptual measurement instruments, and the reporting of effect size and reliability of measuring tools.

From a practical perspective, these findings provide strong recommendations: (1) The implementation of RME should be accompanied by teacher training that focuses on designing real-world situations that are appropriate to students' cognitive levels and scaffolding techniques for the transition to abstraction; (2) The development of RME teaching materials (worksheets, e-modules, concrete media) must be prioritized because the media acts as a bridge of representation; (3) Learning evaluation should combine concept test instruments, performative assessments (oral/written explanations), and transfer assignments, so that the achievement of concept understanding can be measured holistically (Limbong & Samosir, 2022; Marpaung & Rahmawati, 2023). Implementation without training and media support risks resulting in an RME that is merely decorative and replaces context without facilitating abstraction.

In conclusion: evidence from all five studies suggests that RME is effective in improving students' understanding of mathematical concepts through context-to-abstraction, representation, scaffolding, and active engagement mechanisms. However, these claims should be viewed as consistent but not yet absolute so standardization of conceptual understanding measures and experimental studies with a stronger design are needed to reinforce generalizations. Follow-up research recommendations include large-scale randomized controlled trials (RCTs), longitudinal studies to assess the long-term resilience of comprehension, and implementation research that tests moderation by teacher, material, and

media factors. With these steps, the research community will be able to map with precision when, how, and for whom RME is most effective in building deep mathematical understanding.

Conclusion

The results of the analysis show that the Realistic Mathematics Education (RME) approach is consistently effective in improving students' understanding of mathematical concepts. RME helps students understand concepts through real-life situations, modeling, gradual representations, as well as active discussions, so that concepts are not only memorized, but actually understood and can be applied in new contexts. Thus, RME encourages the formation of a deeper and more meaningful understanding of concepts than conventional learning. However, the effectiveness of RME is highly dependent on teachers' ability to design realistic contexts and appropriate learning media. Therefore, the implementation of RME needs to be accompanied by training support and the development of teaching tools so that the results are optimal and can be applied sustainably at various levels of education.

References

Bayu, E. P. S., Fauzan, A., & Armiati. (2023). The development of teacher and student's book based on realistic mathematics education in statistics. *European Journal of Educational Research*.

Ecott, D. W. A. S. (2021). *Realistic Mathematics Education Approach for Primary Education*. University of Muhammadiyah Malang.

Fajri, H. M. (2025). *Bibliometric Trends in Realistic Mathematics Education*. ScienceDirect/Elsevier.

Freudenthal, H. (1991). *Revisiting Mathematics Education*. Springer.

Gravemeijer, K., & Terwel, J. (2000). Mathematics education as a process of guided reinvention. *Educational Studies in Mathematics*.

Gunawan, W., & Hadi, S. (2024). Effect of RME and reasoning ability on conceptual understanding. *Contemporary Educational Research Journal*.

Hakim, T. A. (2024). RME combined with guided discovery in concept formation. *Journal of Education*.

Kitchenham, B., & Charters, S. (2007). Guidelines for Performing Systematic Literature Reviews in Software Engineering. *Evidence-Based Software Engineering Technical Report, 2*(1), 1–57.

Limbong, A., & Samosir, M. (2022). Improving mathematical conceptual understanding through RME-based learning media. *Journal of Mathematics Education Research*, *15*(2), 112–125.

Mahfud, M. S. (2022). *Realistic Mathematics Education in Understanding Fractions*. Conference Proceedings.

Marpaung, D., & Rahmawati, E. (2023). RME strategy to support students' conceptual reasoning in elementary mathematics. *International Journal of Instructional Mathematics, 6*(1), 45–57.

Nugraheni, L. P. (2021). RME-Based Learning to Improve Conceptual Understanding. *EduLearn Journal.*

Prayitno, S. H. (2024). Implementation of RME to Improve Conceptual and Procedural Skills. *Journal of Mathematics Education*.

Putra, H., & Abdullah, S. (2021). The effect of RME approach on students' conceptual understanding in middle school mathematics. *Journal of Mathematics Teaching and Learning*, *9*(3), 210–223.

Putra, R. W. Y. (2024). *RME with Scaffolding to Improve Representation Skills*. Al-Jabar Journal.

Rohman, F., et al. (2025). *Improving Conceptual Understanding Using RME Worksheets*. SCOPE Journal.

Sutarni, S. (2024). *Development of RME-Based Fraction Worksheets*. Infinity Journal.

Treffers, A. (1987). *Three Dimensions: A model of mathematics education*. Reidel Publishing

Wijaya, A., van den Heuvel-Panhuizen, M., & Doorman, M. (2020). Realistic Mathematics Education in Indonesian classrooms: Implementation and conceptual understanding. *Journal of Mathematics Education*, *11*(2), 153–170.

Yuliani, T., & Idris, N. (2024). Effectiveness of contextual RME problem solving to strengthen mathematical conceptual skills. *International Journal of Mathematics Education and Pedagogy*, 3(1), 28–39.