Implementation of Realistic Mathematics Education in Indonesia

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ABSTRACT

This research explores how Realistic Mathematics Education (RME) has been applied within the Indonesian context. Employing a Systematic Literature Review (SLR) approach, the study involves identifying, examining, critically evaluating, and interpreting scholarly articles from multiple perspectives. The data set comprises 15 peer-reviewed international publications from the Scopus database through the Publish or Perish tool, covering 2005 to 2022. These articles originate from various countries, including Indonesia, the Netherlands, Vietnam, Turkey, Greece, Norway, the United States, and Italy. The study examines the application of RME across different nations, focusing on Indonesia, and identifies the key elements that facilitate its implementation. Findings indicate that the integration of RME in Indonesia contributes to improving students' conceptual understanding.

Keywords: Conceptual Understanding, Indonesia, Learning Strategy, Mathematics, Realistic, *RME*

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INTRODUCTION

RME, initially developed by Freudenthal, positions learners as active participants who construct mathematical understanding through real-world contexts. It emphasizes mathematics learning as a process grounded in real-life experiences and contexts [1]. Approach *Realistic Mathematics Education* is an ability that can provide real things in various student problems. According to Freudenthal, students are not passive recipients in the learning process [2]. *Realistic Mathematics Education provides* mathematical modeling using the students' environment to make it easier to understand. This also includes evidence that mathematics is necessary for the lives of students. Approach *Realistic Mathematics Education* (RME) is an approach that plays a role in students' experiences and real life [3]. Approach *Realistic Mathematics Education* enables students to discover and construct a fundamental

understanding of mathematical concepts through the teacher and themselves, making them more relevant to students' thinking. *Realistic Mathematics Education is* applied to improve the performance of concepts and student learning outcomes. This statement is reinforced by various studies, which state that RME is very effective in increasing understanding of mathematical concepts [4]-[8]. Apart from that, RME is very effective in improving student learning outcomes [9]-[11]. This proves that *Realistic Mathematics Education is* essential to implement for students [3], [12]-[15].
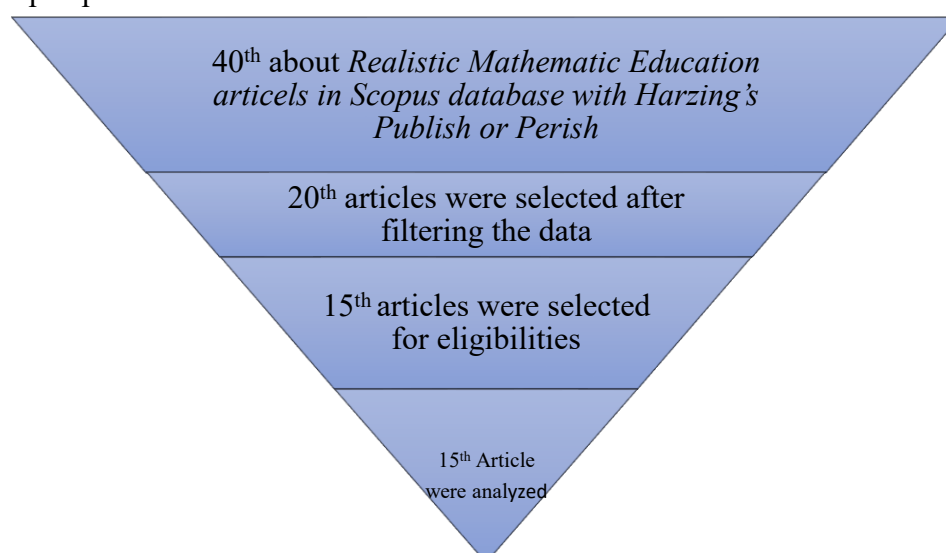
Many studies examine RME from various sides and countries as follows [16]-[41]. The research above is research conducted from 2005 to 2022—the results of the research conducted above as a whole discuss related realistic *Mathematic Education* (RME). The discussion is about how the implementation is applied to countries other than Indonesia.

Discussions surrounding the implementation of Realistic Mathematics Education (RME) have largely remained limited to specific topics across various educational levels, from elementary to higher education. Therefore, a more comprehensive analysis is required to understand how RME is applied throughout the Indonesian education system. To address this need, the present study was conducted using a Systematic Literature Review (SLR) methodology to examine the application of RME in Indonesia. The SLR approach assessed and synthesized existing research findings from Indonesia and other countries. This study seeks to achieve the following objectives.

1. Describe the results of RME research from various countries.
2. Describe the implementation of RME in Indonesia.

METHOD

This study adopts a Systematic Literature Review (SLR) approach, through which existing research is systematically identified, analyzed, evaluated, and interpreted from multiple perspectives [42]. This study adopts a Systematic Literature Review (SLR) approach, through which existing research is systematically identified, analyzed, evaluated, and interpreted from multiple perspectives.

40th about *Realistic Mathematic Education articels in Scopus database with Harzing's Publish or Perish*

20th articles were selected after filtering the data

15th articles were selected for eligibilities

15th Article were analyzed

Fig 1. Reporting Options for Systematic *Literature Review*

Based on Figure 1, the research reviewed by international journals was taken from the database *Scopus* through the application *Publish or Perish.* The selected study is from 2005 to 2022. Research that will be given treatment is searched for with the keywords "*Realistic*

Mathematics Education". Based on these keywords, 15 articles or research-related articles were selected, including *Realistic Mathematics Education* (RME) in elementary schools, both international articles from foreign countries and Indonesia.

RESULTS AND DISCUSSION

The findings regarding implementing Realistic Mathematics Education (RME) across various contexts reveal successful outcomes and certain limitations. This is evidenced by several studies and research results, as summarized in Table 1 below.

Table 1. Realistic Mathematics Education in various countries

No	Article	Journal Name	Country	Research Result
1	[43]	*International Journal of Education and Practice*	Vietnam	*Realistic Mathematics Education* (RME) in Vietnam has not been effective due to constraints related to human resources, and very little related to training on RME
2	[32]	*Journal New ICMI Study Series*	Italy	Students have applied Realistic Mathematics Education (RME) without excluding real experience in observation and reasoning.
3	[38]	*International Journal of Mathematical Education in Science and Technology*	USA	Students can provide learning using their concepts through the application of Realistic *Mathematics Education* (RME)
4	[15]	*Early Childhood Education Journal*	Greece	Application of *Realistic Mathematics Education* (RME) makes a significant contribution to the ability of students' mathematical competence.
5	[44]	*International Journal of Science and Mathematics Education*	Norway	Application Application *Realistic Mathematic Education* (RME) provides a contributing role both in the classroom and outside the classroom.
6	[33]	*International Journal of Engineering Pedagogy*	Greece	Guided E-learning and Realistic *Mathematics Education* (RME) can improve elementary school students' understanding of mathematics.
7	[23]	*Jounal Elementary Online*	Türkiye	RME helps students understand decimal fractions
8	[29]	*International Journal of Scientific and Technology Research*	Vietnam	RME helps students understand the cosine theorem.
9	[18]	*Journal Encyclopedia of Mathematics Education*	Dutch	The RME journey is considered unfinished and ongoing, even though it has been 40 years of travel.
10	[45]	*International Journal of Science and Mathematics Education*	Indonesia and the Netherlands	The implementation of RME in Indonesia and the Netherlands has similarities and differences. The culture of the country influences the differences that occur.

No	Article	Journal Name	Country	Research Result
11	[25]	*Journal on Mathematical Education*	Vietnam	There is a significant influence on the teacher's positive regard for using RME in the teaching process.
12	[26]	*Journal of Physics*	Indonesia	RME affects the motivation of elementary school students
13	[36]	*Journal of Physics*	Indonesia	RME is effectively used in learning the Pythagorean theorem material for junior high school students
14	[34]	International Journal of Engineering and Technology (UAE)	Indonesia	RME can improve mathematical understanding and junior high school learning outcomes
15	[27]	Eurasia Journal of Mathematics, Science and Technology Education	Indonesia	The application of RME is better in the use of conventional learning approaches.

Research conducted in multiple countries—including Indonesia, the Netherlands, Vietnam, Turkey, Greece, Norway, the United States, and Italy—indicates that Realistic Mathematics Education (RME) remains a relevant and applicable approach within various educational settings. Research results [18] state that the development of RME has not been completed and is still ongoing in the Netherlands. The Netherlands is the country of origin for RME throughout the world. This is proven by research from various countries. The implementation of RME in Italy is based on research results [32] states that with RME, learning in schools can make students use more real experiences with observations and reasoning made.

Furthermore, the results of research conducted in Vietnam [40] with RME have not been used optimally because they are related to resources and training that can support this application. On the other hand, [25] stated that there was a positive influence given by the teacher by implementing RME, and [29] stated that RME helped students understand the Cosine Theorem material. This is also in line with research from the United States [38], Greece [15] and [33], Norway [44], and Turkey [23] which states that RME can increase students' understanding. Based on this analysis, there are differences in research results, namely, RME has an influence and increases awareness, and there are obstacles experienced in implementing RME. The success of RME is influenced by supporting factors, and one of them is the culture of implementing RME in a country, including Indonesia.

Based on Table 1. Implementation of RME in Indonesia: There are five studies. RME implementation in Indonesia was implemented in 1998 [46] and is still being implemented today. We can see the difference in the results and implementation of RME from the results of research [24] which shows changes and differences in the implementation of RME in the Netherlands and the implementation of RME in Indonesia. The Netherlands, as the originating country of RME, makes personal experience a source of learning for students, while in Indonesia, learning mathematics focuses on procedures taught or given by the teacher.

Differences in the application of RME do not weaken the implementation of RME in Indonesia. The good application of RME in Indonesia is proven by research conducted by [26] regarding students' learning motivation, which RME can increase. Furthermore, the results of research conducted by [34], [36] state that it is effectively used to improve students' understanding. Moreover, the research results [27] state that RME is more effectively used in learning mathematics than conventional. Students exposed to RME approaches tend to show increased attention and engagement in mathematics classes. They appreciate the relevance of

mathematics to real-life situations, which enhances their overall learning experience [47], [48]. This proves that implementing RME has a positive impact on learning mathematics.

The application of Realistic Mathematics Education (RME) has demonstrated beneficial effects on mathematics learning in diverse educational environments. By connecting mathematical concepts to real-world contexts, RME fosters greater student engagement and enhances their appreciation for the subject. For instance, students in a Mathematical Modeling course using RME paid more attention in class and performed well in group tasks, ultimately reflecting a greater appreciation for mathematics[49]. Several studies indicate that RME significantly enhances students' problem-solving abilities[50]. Another study in Vietnam showed that RME positively impacted students' skills in statistical content[51]. RME also positively influences students' attitudes towards mathematics and their self-efficacy. For example, a study in Indonesia demonstrated that RME effectively developed students' self-efficacy[52], [53].

Based on the analysis of the research results above, several things can impact the implementation of *Realistic Mathematics Education* in Indonesia as follows. The resources here are very influential in implementing RME in Indonesia because they are the main thing. The resources in question are teachers in teaching and directing students, and Indonesian Culture, being one of the factors that can support the successful implementation of RME [24] Indonesian culture can be used to strengthen contextual learning in RME through various objects that can be linked to learning, such as buildings, art products, etc.

CONCLUSION

Based on the above discussion, it can be concluded that the implementation of Realistic Mathematics Education (RME) is widely adopted in mathematics instruction across Indonesia. Its development in the country is evidenced by the establishment of the Indonesian Realistic Mathematics Education Centre (PRMI), which continues to operate today. The application of RME in Indonesia has been shown to enhance students' motivation and comprehension of mathematical concepts. Furthermore, this approach has proven more effective than traditional teaching methods. Several factors influence the successful implementation of RME, including local educational resources and cultural context. Therefore, further exploration is needed to understand how these factors can be leveraged to impact teaching and student learning outcomes positively. Future research should explore the integration of digital RME tools within local curricula.

CONFLICT OF INTEREST

The authors declare that there is no conflict of interest.

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