

## Students' Mathematical Literacy with Realistic Mathematics Education (RME) Approach: Systematic Literature Review

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<b>Corresponding author:</b> Farah Ayyun Taqiya, farahayyun385@gmail.com	<b>Abstract</b> This study intends to examine how the Realistic Mathematic Education (RME) learning approach affects students' mathematical literacy skills at the primary, junior, and senior high school education levels. The Systematic Literature Review (SLR) method is employed in this investigation. 11 RME learning study findings on mathematical literacy from indexed journals published between 2016 and 2022 make up the dialysis sample. What factors, such as education level, research year, number of student samples used, or location study, affect students' mathematical literacy skills is the topic of the study. The analysis findings indicate that learning using the RME approach to mathematical literacy is increasing annually. This research is typically conducted on the island of Java with a small sample size of students, specifically less than 30 students, and junior high school students are the target population. Based on the review's findings, it can be concluded that using the RME approach to instruction can enhance or have an impact on students' mathematical literacy abilities.
<b>Keywords:</b> realistic mathematic education; mathematical literacy; systematic literature review	

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### INTRODUCTION

All aspects of human life cannot be separated from mathematics. The facts show that in everyday life, academic or work, everything requires the role of mathematics in the process of thinking or solving problems. Mathematics becomes an important tool that plays a role in shaping the future of individuals. This shows that someone good at mathematics will be successful in life because he can take advantage of the opportunities that exist (Turgut, 2021).

Because of the very important role of mathematics, it is not surprising that at every level of the school, there are mathematics lessons. The primary priorities of math instruction are to equip students to interact with the mathematical needs of daily life, to master fundamental numerical knowledge and skills, and to improve mathematical thinking talents that will enhance their intellectual capacity (Haylock & Thangata, 2007). But, students frequently believe that mathematics is a challenging subject. Therefore, they quit up easier and put out less effort to

comprehend mathematics. Indonesian students continue to struggle with literacy, especially when it comes to science and mathematics, according to a PISA research report (OECD, 2019). PISA results from 2015 showed that students' proficiency in all subject areas, including science, literacy, and maths, has increased in Indonesia. However, Indonesia's ranking did not drastically improve as a result of its PISA index accomplishments. The data demonstrate that Indonesian pupils' mathematics literacy is still low.

Mathematical literacy is essential and it is a fundamental skill that is equally important as literacy. One of the main goals of instructional planning in schools was mathematical literacy. Mathematics instruction in schools aims to enable students to develop mathematical literacy, or their capacity to utilize and apply their knowledge of mathematics in circumstances that arise outside of the classroom. In comparison to substantive mathematics, mathematical literacy has a special quality. The opinion expressed by (Sumirattana et al., 2017), states that while mathematical literacy concentrated on applying mathematics to real-world situations, mathematics in schools concentrated on substantive subjects. Making rational decisions and decisions, understanding the roles played by mathematicians in the world, understanding mathematical concepts, and solving problems presented to students in the context of real-world situations are some activities that can promote mathematical literacy.

To be deemed mathematically literate, pupils must be able to read, analyze, and write mathematical materials (such as numbers, symbols, and images). Through PISA, an OECD examination that started in 2000, mathematical literacy has taken on major importance. Rico (Sáenz, 2009) clarified that PISA, however, revolves around the functional model of mathematics learning through creating abilities that are directly related to the actual world and is frequently not immediately related to the mathematical curriculum given in schools. The application of realistic mathematical notions that are centered on the usage of contextual mathematics is therefore observed to be closely related to this concept.

Even though it has been mentioned that kids are in dire need of mathematical literacy skills, they still do not fully possess this area of expertise. To further apply mathematics to real-world situations, teachers play a crucial role in empowering students' mathematical experiences. (Martin, 2007) also suggested that instructors' instructional techniques, not the subjects they were teaching, were the cause of students' lack of mathematical literacy. The memorization of mathematical principles or formulae that were irrelevant to students' real-world situations or experiences was one of the traditional teaching strategies that failed to improve students' mathematical literacy. Therefore, it was required to look for a better approach or instructional procedure to create and improve students' mathematical literacy. The learning process of pupils is positively impacted by the use of methods and strategies that are based on various approaches. It is possible to say that this circumstance is one of the factors to be considered during the teaching process (Piht & Eisenschmidt, 2008).

Learning Realistic Mathematics Education (RME), which is intended to inspire students' excitement for learning so that, in the end, it is predicted to be able to increase students' literacy abilities, is one strategy that can be used to improve students' mathematical literacy. RME is one of the strategies that molds mathematics instruction. The Freudenthal Institute furthered the RME paradigm of mathematics instruction proposed by Dutch mathematician Hans Freudenthal (Treffers, 1993). RME learning's basic tenet is that pupils need to have the chance to revisit mathematical ideas. It is thus a viable model that combines open problem-based learning, teamwork in the classroom, error analysis, and problem-solving in the real world (Hidayat & Iksan, 2015). Because learning is built on the idea of respecting each other's opinions when solving mathematical problems, RME can be seen as an approach that prioritizes social processes.

As previously mentioned, this study will give an overview of the analysis of mathematical literacy skills in students using the Realistic Mathematics Education (RME) approach. Teachers can utilize the research findings as a guide and reference to figure out the effect of Realistic Mathematical Education (RME) learning on mathematical literacy abilities.

Therefore, gathering data is a crucial SLR stage. The researcher developed numerous pertinent questions using the research information gathered, including the following:

1. How does the description of RME's impact on students' mathematical literacy depend on the academic year?
2. How does the description of RME's impact on students' mathematical literacy depend on the level of study?
3. How does the description of RME's impact on students' mathematical literacy depend on the sample size?
4. How does the description of RME's impact on students' mathematical literacy depend on the search of location?.

## **RESEARCH METHOD**

A Systematic Literature Review (SLR) was employed as the methodology. A quantitative descriptive survey-based research methodology was used (Littell, Corcoran, & Pillai, 2008). A survey on literacy mathematics and realistic mathematical education methods was conducted using secondary data from primary research. The SLR aims to synthesize all research results based on several specific questions using an orderly and clear procedure. And (Juandi, 2021) has shown that a decent SLR takes the necessary procedures to reduce bias and mistakes. Because bias can be present in both the original study and the publications, as well as being cumulative, this is particularly crucial in research synthesis.

This study is divided into three phases: data gathering, data analysis, and conclusion-making. Indexed journal articles are sources of information from published primary studies. Direct journal URLs are also used in the data collection process along with indexed electronic databases like Google Scholar, Research

Gate, and Publish or Perish. To find the most pertinent items, the entire collection was removed. The analysis stage will begin with all extracted articles.

### **Inclusion Criteria**

Utilizing the inclusion criteria, the data were chosen. A study subject must complete inclusion requirements in order to be considered a representative of research samples (Notoatmodjo, 2012). Following are the selection standards that have been established:

1. The research used to write this essay was on mathematics instruction.
2. From 2016 to 2022, the article will be published.
3. The Realistic mathematics education paradigm is the source of the study on enhancing students' mathematical literacy.
4. Elementary school, junior high, and senior high school studies are the samples used.

### **Research Instrument**

A checklist for observations or data pertaining to the inclusion criteria served as the research tool. Criteria include those based on the year of the study, the level of study, the sample size, the research site, the learning model utilized, and the required statistical data including the standard deviation and the mean of the post-test results.

### **Population and sample**

All experimental research on the Realistic Mathematic Education approach in students' mathematical literacy makes up the population of this study. 2 relevant article samples were obtained that met the criteria for inclusion.

### **Data collection technique**

The Realistic Mathematic Education method in students' mathematical literacy was the focus of publications utilized as data gathering approaches in this study. Using the keywords "RME and Literacy Mathematics", "Realistic Mathematic Education and Literacy Mathematics", "PRMI dan Literasi Matematika", and "RME dan literasi Matematika" as many as 27 articles were discovered. The following stage was to choose 23 publications that met the research questions. 11 particular publications with research questions and inclusion standards were located in the last phase.

## **RESULTS AND DISCUSSION**

The research findings that have been adjusted in accordance with the data are presented in this part. Tables and graphs can be used in research presentation to visually display the findings. The research's findings are consistent with the issues raised, allowing for the sub-sectionalization of this section's explanation. The author's review of the study's findings is included in the discussion. The foundation for this study comes from earlier research and theories that go along with it. On the

basis of this, the research's findings can be revealed and explained by comparing or validating them.

Table 1. Research results related to realistic mathematic education approach to mathematics literacy

Authors, Year, Vol(No), and ResearchSite	Sample Size (students)	Year of the Study	Level of Education	Research Result
Septi Dini Lestari dkk, 2019, 8(2), in Java (Lestari, 2019)	< 30	2018	Junior High School	The study's findings discovered that: (1) Team Assisted Individualization learning with RME approach recitation has good quality; (2) students with high mathematical dispositions master the components of communication, mathematizing, reasoning & argumentation, and devising strategies very well; (3) the components of using symbolic, formal, and technical language and operation were well mastered; (4) and the other two components are quite well mastered.
Andi Permana Sutisna dkk, 2018, 6(1), in Java (Sutisna et al., 2018)	< 30	2018	Elementary School	The impact of the RME technique on mathematical literacy shows that it is irrelevant to enhancing mathematical literacy skills.
Sunisa Sumirattana dkk, 2017, 38(2), in Thailand (Sumirattana et al., 2017)	> 30	2017	Junior High School	Students in the experimental group demonstrated more mathematical literacy than those in the control group, demonstrating that the DAPIC problem-solving method and realistic mathematics instruction may both improve students' mathematical literacy.
Novita Sari dkk, 2022, 8(2), in Sumatra (Sari et al., 2022)	< 30	2022	Junior High School	Regarding the high level of SRL, students' ML improvement was higher for those who received blended learning based on RME than for those who received traditional learning, and viceversa at the low level. Additionally, after receiving mixed learning based on RME, students' ML development was marginally higher for those with high SRL than for those with

				low SRL, and the opposite was true after receiving traditional learning.
Uba Umbara dkk,2019, 8(2), in Java (Umbara & Nuraeni, 2019)	< 30	2019	Junior High School	It's conceivable that the RME learning, which is based on Adobe Flash Professional CS6 and always emphasizes self-regulated learning, is responsible for improving students' mathematical literacy skills.
Marita Eka Istianadkk, 2020, 8(3), in Java (Istiana et al., 2020)	< 30	2020	Elementary School	Obtained Sig. (2-tailed) 0,000. Because of Sig. (2-tailed) 0,000 < 0,05 then H0 is rejected. It suggests that students taught using the realistic mathematics education model had greater mathematical literacy skills than those taught using the TPS paradigm.
R Fauzana dkk, 2020, -, in Java (Fauzana et al., 2020)	< 30	2020	Junior High School	The mathematical literacy of students who were taught utilizing the RME technique can be enhanced. It is well known that the pupils' mathematical literacy skills fall into the intermediate category according to N-Gain data. Conclusion: The teaching-learning process using this RME approach can be used repeatedly on the right material to maximize the development of mathematical literacy abilities.
Ayunis dkk, 2021, 5(6), in Sumatra (ayunis & Belia, 2021)	< 30	2021	Elementary School	Obtained sig < 0.05, then Ho is rejected. It means that conceptual understanding of students taught by RME is higher than the conceptual understanding of students taught by conventional learning.
Wa Sudi dkk, 2022,3(2), in Sulawesi (Wa Sudi, Jafar, Kadir, 2022)	< 30	2019	Junior High School	The application of an effective realistic mathematics learning approach to students' mathematical literacy, this can be seen from the average mathematical literacy of the experimental class students is higher than the average mathematical literacy of the control class students
Prastika Istiqomah dkk, 2021, 10(4), in	< 30	2021	Junior High School	The RME learning model is more effective in influencing mathematical literacy skills

Sumatra (Prastika Istiqomah, Kamid,2021)				compared to conventional learning, and self-efficacy in the high and medium categories influences more mathematical literacy skills than the self-efficacy of students in the low category. Two-way anova test results on the first hypothesis shows that the significance value is $0.000 < 0.05$ . it means that there is the influence of the realistic mathematics education (RME) learning model.
Nisvu Nanda Saputra dkk, 2021, 14(1), in Java (Saputra et al., 2021)	< 30	2021	Junior High School	Significant value (2-Tailed) $< 0.05$ . Thus, pupils who learn utilizing the RME method module with Banten cultural values have greater mathematical literacy skills than those who learn conventionally. This study demonstrates that the RME approach module that integrates literacy stages with Banten cultural values can enhance students' mathematical literacy abilities.

### Criteria-based data

The inclusion criteria will be categorized in the table that follows based on four moderating variables: the year of research, the depth of the research, the location of the research, and the sample size. In table 2, descriptive data are shown. Tabel 2. Criteria-based data

	Criteria	Frequency
<b>Year of Study</b>	2015-2016	0
	2017-2018	3
	2019-2020	4
	2021-2022	4
<b>Level of Education</b>	Elementary School	3
	Junior High School	8
<b>Sample Size</b>	> 30	1
	< 30	10
<b>Research Location</b>	In Java island	6
	Outside Java island	5

Table 2 shows the results of research related to the RME approach to mathematical literacy skills that have been analyzed. Most of the studies analyzed were quasi-experimental studies that met the inclusion criteria of 11 studies. Obtained from various sources such as Google Scholar, Scopus or other search tools. Related articles are articles indexed by Sinta or Scopus. Research related to the

effect of RME on mathematical literacy skills is increasing and developing every year. The research was conducted in primary schools and junior high schools involving a sample of students of less than 30 to more than 30. Research has also been carried out both on the island of Java, outside Java and even abroad.

### Year of study

Research related to the use of the RME approach in learning mathematics has been carried out in recent years in Indonesia (Ningsih, 2014). Research develops and multiplies every year. This can be known based on the results of a meta-analysis by (Tamur et al., 2020). However, research related to the RME implementation approach with other learning models is still rarely carried out by researchers in Indonesia, such as those conducted by (Istiana et al., 2020; Maslihah et al., 2021; Saputra et al., 2021; Sari et al., 2022; Sutisna et al., 2018). Some of these studies show the results of research using the RME approach to students' mathematical literacy.

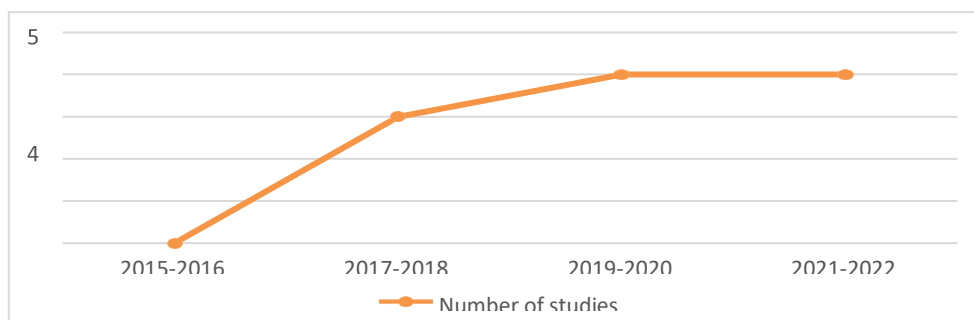


Figure 1. Study criteria based on the year of research

Based on Figure 1, information shows that there is an increase in research trends related to learning with the RME approach to mathematical literacy. This is supported by the curriculum in Indonesia which is developing according to the demands of expertise expected by the Program for International Student Assessment (PISA) to be able to master mathematical literacy as a basis for mastering other skills.

### Level of Education

Based on the meta-analysis research conducted by (Tamur et al., 2020) shows that RME has been implemented at all levels of education from primary school to senior high school. However, in the primary studies analyzed by the researchers in this article, only the implementation of RME was found on mathematical literacy at the primary school and junior high school levels.



The implementation of the RME approach to mathematical literacy tends to be carried out at the junior high school level and the primary school level, as can be seen in Figure 2. There are more studies at the junior high school level than at the primary school level. This is supported by Piaget's theory regarding the stages of cognitive development of students, in which junior high school students are in the formal operational stage, namely at the age of eleven to fifteen years or known as adolescence. Teenagers at this age think in a more idealistic, critical and logical way. While RME learning is an approach that is carried out with the aim of developing idealistic, logical and critical patterns in solving problems which is in line with constructivism theory which emphasizes student activities to be able to practice and apply what has been learned and build their own concepts. According to (Bunga et al., 2016) the RME approach is closely related to constructivism theory in which learning emphasizes real contexts that surround everyday life. The RME approach requires students to build their own knowledge to make it more meaningful.

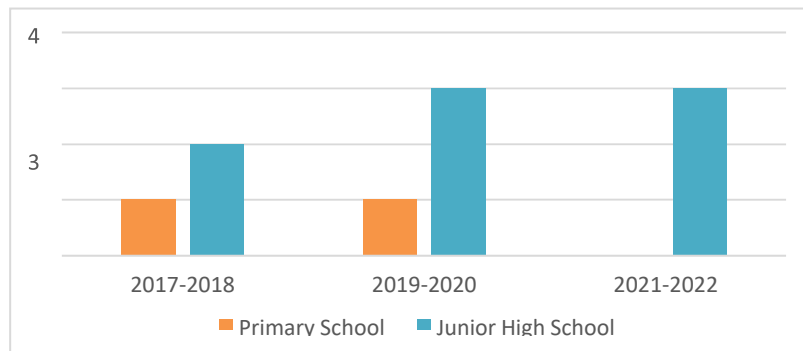


Figure 2. Study criteria based on the level of education

### Sample Size

The sample size criteria used in this study were less than or more than 30 students. The results of the analysis are shown in Figure 3.

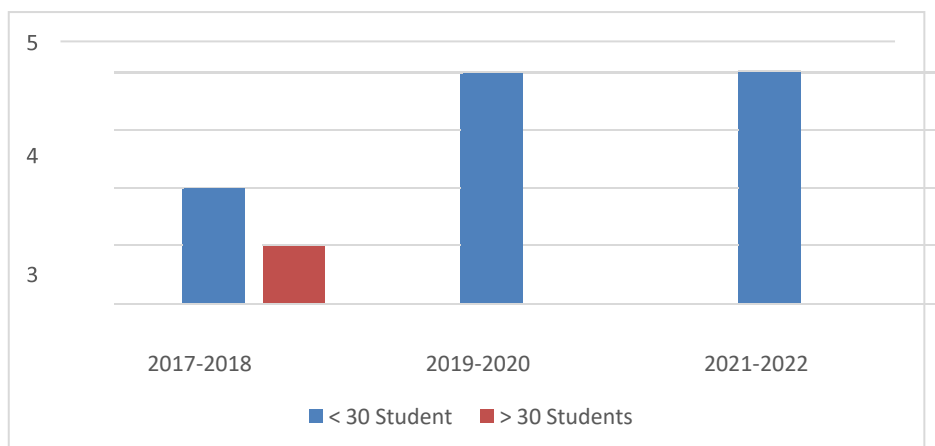


Figure 3. Study criteria based on the sample size

Based on the results of research that has been reviewed in recent years such as research by (Istiana et al., 2020; Sari et al., 2022; Sumirattana et al., 2017; Sutisna et al., 2018; Umbara & Nuraeni, 2019), The dominant sample size distribution used in RME learning research on mathematical literacy is a sample with a small scale or less than 30 students. This indicates that the RME approach is more effectively applied to small class sizes so that the goal of increasing mathematical literacy can be achieved properly.

### Research Location

Based on the research location, there are two groups: Java and outside Java. The data shown in Figure 4 were acquired as follows.

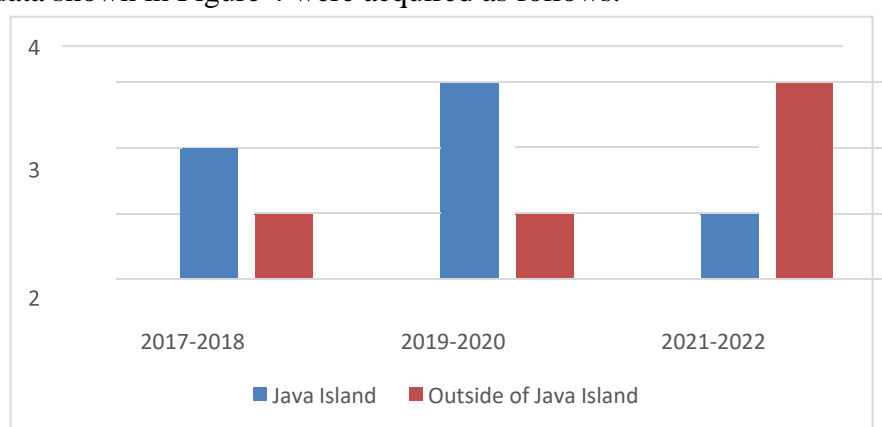


Figure 4. Study criteria based on the research location

Based on Figure 4 it can be interpreted that research on RME and mathematical literacy has been carried out on the island of Java or outside Java and even abroad. However, most research is carried out on the island of Java, such as research conducted by (Fauzana et al., 2020; Saputra et al., 2021; Umbara & Nuraeni, 2019). While research outside Java and abroad has also been carried out by several researchers such as (Sari et al., 2022; Sumirattana et al., 2017; Wa Sudi, Jafar, Kadir, 2022). This can be a reference for other researchers to be able to maximize further research outside Java to maximize the effectiveness of the RME approach to increasing mathematical literacy.

### The effectiveness of the RME approach to students' mathematical literacy abilities

The primary studies analyzed provide information that the RME approach in learning mathematics is quite effective and has an influence on improving mathematical literacy skills (Fauzana et al., 2020; Larasaty et al., 2018; Lestari, 2019; Prastika Istiqomah, Kamid, 2021; Purwanti, 2019; Saputra et al., 2021; Sari et al., 2022; Sumirattana et al., 2017; Sutisna et al., 2018; Suyitno et al., 2018; Umbara & Nuraeni, 2019; Wa Sudi, Jafar, Kadir, 2022). This research can be a reference for teachers in improving students' mathematical literacy skills by using the RME approach in the learning process. As for the use of the RME approach to

students, namely Mathematics feels more relevant, meaningful, and interesting, not too abstract and not too formal then this approach prioritizes "learning by doing" learning and takes into account the level of student's abilities so that students are able to construct mathematical concepts through their experiences and activities in see the real context that surrounds everyday life

## **CONCLUSION**

Studies discussing Realistic Mathematical Education (RME) learning on students' mathematical literacy abilities for six periods, especially in 2017-2022 it has increased every year. This shows that RME has received a lot of attention to be studied and studied further in improving mathematical literacy skills as the demands on students must be met. The research above is research indexed by Google Scholar, SINTA, and Scopus are still minimal. Research on the problem-based learning model was mainly carried out at the junior high school level outside Java with a sample size of 30 people or more. The results of the analysis of these 11 articles show that learning with the RME approach can increase or influence the increase in mathematical literacy skills.

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