

Does The Realistic Mathematics Education Approach Enhance Students' Mathematical Literacy? A Systematic Literature Review

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ABSTRACT

This systematic review aims to explore the impact of the realistic mathematics education approach on the Mathematical Literacy of students in Indonesia over the last ten years. The systematic literature review (SLR) method is used to search for, evaluate, assess, and explain all relevant research in the field of study or a specific phenomenon, particularly focusing on relevant research questions. The survey was based on secondary data, comprising the outcomes of foundational research concerning mathematical literacy competencies. The research process includes data collection, data analysis, and conclusion. Using the SLR method, a planned examination and identification of relevant articles are conducted, with each step in this process following a predefined protocol. Data collection involves searching for articles and conference proceedings indexed in Scopus and SINTA over the last ten years, using specific keywords such as "Realistic Mathematics Education" and "Mathematical Literacy". Using the SLR approach, it was determined that there was a notable rise in the volume of research conducted over a decade. The analysis revealed that research primarily focused on junior high school students in terms of their grade level. The area was dominated by Java. These results suggest that Indonesian mathematics teachers and lecturers choose the realistic mathematics education approach as one of the best solutions to improve students' Mathematical Literacy in learning Mathematics.

Keywords: mathematical literacy; realistic mathematics education; systematic literature review

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INTRODUCTION

In the 21st century, life has become increasingly intricate due to the emergence of various challenges and requirements across different domains (Ariati et al., 2022; Fardian & Dasari, 2023). Each individual must acquire a range of abilities and competencies. It is essential to acquire Mathematical Literacy (Laamena & Laurens, 2021; Susanta et al., 2023). Additionally, Mathematical Literacy holds distinct importance within the framework of implementing the 2013 Curriculum (Juandi, 2021). Therefore, enhancing mathematical literacy abilities stands as a primary objective in the process of learning mathematics at the school level (Edo & Tasik, 2022; Rusdi et al., 2020). The mathematical literacy abilities of students in Indonesia remain at a suboptimal level (Putri, 2023; Saraseila et al., 2020). Several factors contributing to the low level of mathematical literacy among students include: Insufficient knowledge of mathematical literacy among teachers (Rusiyanti et al., 2022), The teaching approach not being effectively linked to students' everyday life contexts (Putri et al., 2024), Assessment tools not aligning with mathematical literacy objectives, The



absence of integration between the realistic mathematics education approach and the concept of literacy in mathematics teaching, despite its development by researchers, inadequate teaching materials in schools that do not adequately support students' attainment of mathematical literacy (Edo et al., 2013; Putri et al., 2024).

Mathematical literacy in Indonesia is a significant concern due to various factors. One of the main issues is the way mathematics is taught in schools (Yuanita et al., 2018). Educators have acknowledged the importance of students possessing Mathematical Literacy through various research endeavors (Spielman, 2008). Consequently, a solution has been derived by implementing teaching methods aimed at enhancing students' mathematical literacy. One suitable approach is Realistic Mathematics Education (RME) (Fredriksen, 2021). RME is an instructional approach in mathematics education rooted in Freudenthal's perspective, which emphasizes that mathematics is a human activity. RME can be considered as one of the choices for an instructional approach intended to foster students' Mathematical Literacy (Hilaliyah et al., 2019). The effectiveness of RME in enhancing Mathematical Literacy is evident from the outcomes of several key studies, particularly when compared to conventional teaching methods (Rawani et al., 2023).

The outcomes of individual research studies don't offer a definitive assurance regarding the potential effectiveness of RME in the enhancement and cultivation of advanced mathematical skills (Nuraida & Amam, 2019). There is variability among the findings of these studies, and there's a chance that certain studies may exhibit some bias. It appears that a comprehensive examination is necessary to thoroughly describe how RME is employed in the instruction and acquisition of mathematics (Chau Nguyen & Hai Pham, 2023). Consequently, a systematic review was undertaken to investigate the utilization of RME in the enhancement of mathematical literacy (Machaba, 2018). The research approach employed for this was a systematic literature review. In this study, the primary aim is to depict the outcomes of implementing RME for the enhancement of Mathematical Literacy. These results are examined concerning the journal index, the year of the study, educational level, research type, and research demographics. Consequently, a crucial phase of this Systematic Literature Review (SLR) involves gathering data in the form of research findings regarding RME's impact on improving Mathematical Literacy. This research seeks to address the following inquiries: What is the portrayal of the influence of RME on the advancement of mathematical literacy, categorized by the year of the study, educational level, research type, and research demographics?

METHOD

Systematic Literature Review

In this study, a Systematic Literature Review (SLR) was employed as the research methodology. The research procedure encompassed several key steps, which are data gathering, data examination, and drawing conclusions (Juandi et al., 2022). The data collected primarily comprised original research published in national journal articles. This data was sourced from electronic databases that are recognized and indexed by SINTA, Google Scholar, as well as direct web links to both national and international journals. Subsequently, all the identified journals were extracted, and only those articles meeting the specified inclusion criteria were considered for the analysis phase.

Inclusion Criteria

Following the research goals, this study defined the subsequent inclusion criteria for data collection:

1. Publications must come from research in the field of mathematics education.

- 2. The research must be conducted in Indonesia and must be published between 2013 and 2023.
- 3. The research should address RME and mathematical literacy.
- 4. In the process of systematic review study selection, primary investigations that did not satisfy the inclusion criteria were omitted from consideration.

Research Instruments

The research instruments consisted of observation sheets or protocols associated with inclusion and exclusion criteria based on journal indices, year of publication, educational level, research location, and research methodology. The primary study selection process involved four stages following the PRISMA guidelines: identification, screening, eligibility, and inclusion (Juandi, 2021). The utilization of the PRISMA guidelines has demonstrated a beneficial influence on the quality and comprehensive reporting of systematic reviews, as established by previous research (Page & Moher, 2017). Investigations examining the adoption and consequences of the PRISMA statement have revealed its capacity to enhance transparency and thoroughness in the presentation of systematic reviews. Scholars who faithfully adhere to the PRISMA guidelines exhibit a higher propensity to furnish in-depth explanations of their methodologies, outcomes, and constraints, thereby augmenting the trustworthiness and utility of their systematic reviews (Page & Moher, 2017).

Population

The study's population encompasses all research articles about both Realistic Mathematics Education (RME) and mathematical literacy published in journals that are indexed in 2013-2023. A search utilizing a search engine led to the identification of a sample of 19 articles.

RESULT AND DISCUSSION

In the search for scholarly articles, researchers initially focused on a single criterion: the keyword "Realistic Mathematics Education" resulting in a total of 200 articles that matched this specific search term. Subsequently, researchers narrowed down their search scope by including "Realistic Mathematics Education" and "Mathematics Literacy Skills" as keywords, which resulted in the identification of 21 articles related to the topic. Following this initial selection, researchers conducted a comprehensive analysis of each article, employing a rigorous process to refine the selection criteria with the primary goal of reducing the potential for errors in the research. As a result, 19 articles meeting the inclusion criteria for analysis were obtained.

Through the application of inclusion criteria to pertinent research, a more detailed analysis is conducted based on five moderating variables: journal index, publication year, educational level, research location, and research methodology. Table 1 presents the descriptive data.

Table 1. The count of studies is based on specific criteria.

Name	Description	Frequency
Journal of Index	Q4	2
	S1	0
	S2	6
	S3	2
	S4	4
	S5	2
	S6	0
	Google Scholar	3

Name	Description	Frequency
Year of Study	2023	3
	2022	3
	2021	4
	2020	6
	2019	2
	2018	1
	2017	0
	2016	0
	2015	0
	2014	0
	2013	0
	SD	6
Level of Study	SMP	11
	SMA	2
Research Demographic	Sumatra	7
	Java	12
	Qualitative	3
Type of Research	Quantitative	10
	RnD	5
	Mix Method	1

Journal of Index

The number of articles about realistic mathematics education and Mathematical Literacy indexed in Scopus, Sinta, and Google Scholar can be seen in Figure 1.

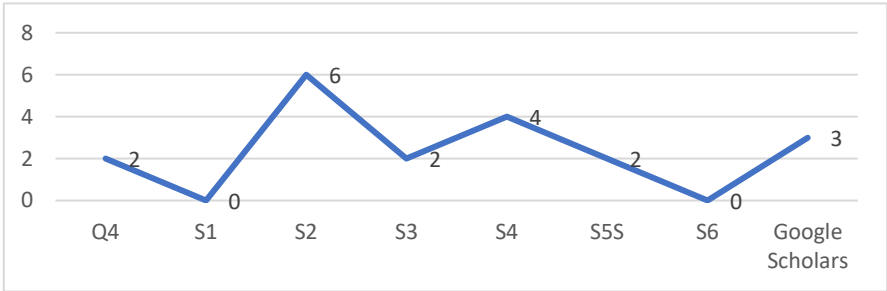


Figure 1 Data categorized according to the journal index

From Figure 1, it can be seen that the results of studies related to RME and Mathematical Literacy were mostly published in journals indexed by Sinta 2, whereas they were not found in journals indexed by Sinta 1 and 6. This can be a consideration for authors to be able to publish related articles in journals indexed by Sinta 1 and 6.

Year of Study

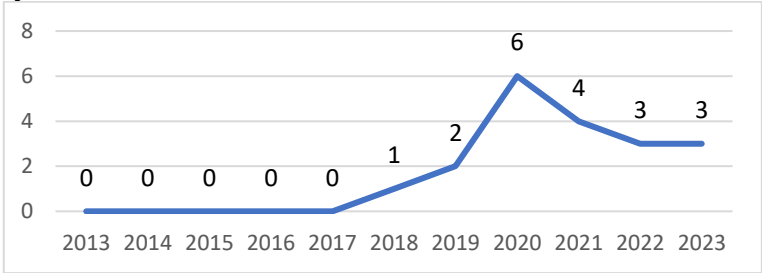


Figure 2 Data categorized according to the study's year

Based on Figure 2, it can be seen that the number of publications that occur increases every year. The highest number of research publications on RME and Mathematical Literacy in 2020 were 6 national and international articles. The increasing number of publications each year can mean that RME research and students' mathematical literacy in mathematics learning are considered important.

Level of Study

Research on RME and mathematical literacy is carried out at every level of education. From Figure 3, we can see that research on RME and mathematical literacy is mostly researched on junior high school students (Nuraida & Amam, 2019) and still rarely studied in senior high school students. This could be a reference for further research to research at the senior high school level or elementary school (Ayunis & Belia, 2021).

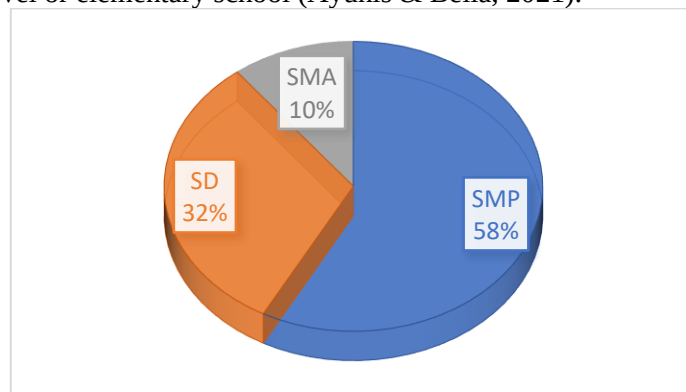


Figure 3 Data categorized according to the level of study

Research demographics

From Figure 4, it is known that research on RME and mathematical literacy is mostly carried out on the island of Java. Meanwhile, in other areas such as Papua, Nusa Tenggara, and Sulawesi it is still rarely found. This is in line with research on students' mathematical abilities which was mostly conducted in Java, while there is still little research in Papua (Ariati et al., 2022). Related to research by Ariati et al. (Ariati et al., 2022) conducted a comprehensive meta-analysis and confirmed that the impact of implementing the RME approach on students' mathematical literacy showed variability depending on the demographic attributes of the student population. This observation alludes to the idea that the efficacy of the RME approach is potentially influenced by factors influencing the students studied.

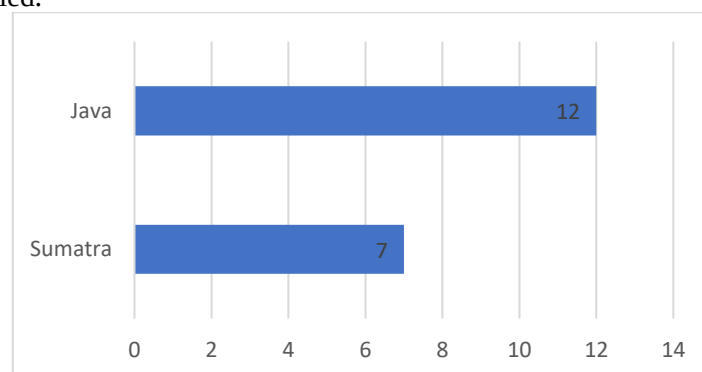


Figure 4 Data categorized according to research demographics

Types of Research

From an examination of 19 studies, it is evident that systematic literature review (SLR) data can be extracted by employing various research designs when investigating Realistic Mathematics Education (RME) and Mathematical Literacy. These research designs encompass experimental research, developmental research, qualitative research, and mixed-method research. In the context of the 19 studies addressing RME and Mathematical Literacy, Figure 5 presents the specific research designs employed.

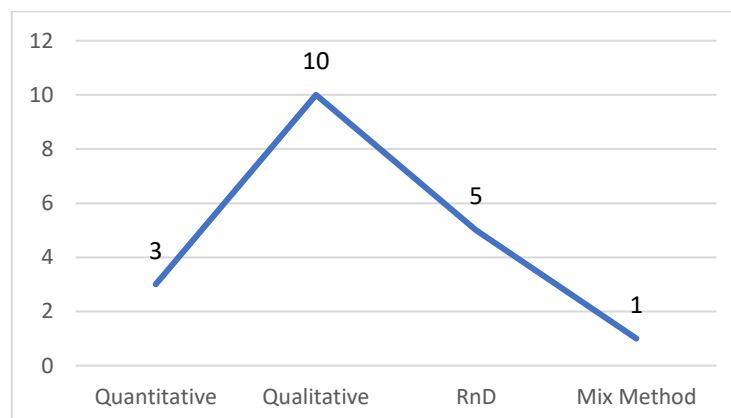


Figure 5 Data categorized according to Types of Research

CONCLUSION

Based on the results of the systematic literature review conducted on Realistic Mathematics Education (RME) and Mathematical Literacy, One can draw the inference that Realistic Mathematics Education (RME) exerts a discernible effect on the enhancement of mathematical literacy proficiency. Research on the relationship between RME and mathematical literacy has received considerable attention, especially in recent years. Publications on the number of RME research and Mathematical Literacy experienced an average increase in 2020. The majority of these studies were conducted at the junior high school level. Studies are also dominated by the Java area. Suggestions for educators or researchers to do more research on Mathematical Literacy from the elementary school level and in areas outside Java. Researchers are advised to do more research regarding the proof aspect in mathematical literacy because the proof aspect is still very minimally researched.

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