

Trends and Patterns of Mathematical Literacy Research In Indonesia: A Systematic Literature Review

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ABSTRACT

This study aimed to examine trends and patterns in mathematical literacy research in Indonesia, as an essential component of mathematics education. Using a systematic literature review, this study analyzed 18 Scopus-indexed articles published between 2021 and 2025. This study examined the distribution of publications across journal quartiles, years, geographic research sites, research methods, mathematical topics, and educational levels. The results showed an upward trend in publications in recent years, with most studies appearing in mid-tier journals. Among the reviewed studies, qualitative methods were the most frequently employed research approach. The investigated topics were mainly concentrated on shape and space, and most studies focused on the junior high school level, while other levels received less attention. In addition, research sites were unevenly distributed, with concentrations in certain provinces. These findings indicate that mathematical literacy research in Indonesia has developed steadily but remains concentrated in specific contexts, offering opportunities for broader coverage in future studies.

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INTRODUCTION

Mathematical literacy is considered an essential competency in the 21st century, as it involves an individual's capacity to formulate, utilize, and interpret mathematical concepts across a wide range of real-world situations (Genlott & Grönlund, 2016; Herlinawati et al., 2024; Park, 2021). According to the Programme for International Student Assessment (PISA) framework, mathematical literacy refers to an individual's ability to apply mathematical understanding to solve problems, make informed decisions, and explain reasoning effectively (Nisa & Arliani, 2023; OECD, 2023). Several international studies

confirm that mathematical literacy directly contributes to citizens' readiness to face modern economic, social, and technological challenges, leading many countries to make it an important indicator of educational quality (Bolstad, 2023; Kappassova et al., 2025; Manggala & Yuniawatika, 2021).

In Indonesia, mathematical literacy receives special attention because international assessment results indicate that achievement levels remain below average (Atikah et al., 2024; Damanik & Handayani, 2023). The latest PISA report, referenced in various studies, states that Indonesia's mathematical literacy scores remain lagging and that the proportion of students below the minimum proficiency level is high, indicating students' difficulties in solving contextual problems and formulating real-world situations into mathematical models (Baharuddin, 2020; Khotimah, 2021; Matondang et al., 2023). This situation reflects students' insufficient ability to understand and utilize mathematical concepts effectively within everyday real-world contexts (Hakiki & Wijayanti, 2021; Munfarikhatin et al., 2022; Siswandari & Setyani, 2021). This condition aligns with the findings of a national study, which found that students are more accustomed to routine and procedural questions, so they are less prepared to handle non-routine context-based questions, such as those in the PISA format (Afrilina et al., 2022; Hairunnisa et al., 2023). The government has intensified efforts to improve literacy and numeracy through the Minimum Competency Assessment while also promoting the inclusion of contextual problem-solving tasks within the Merdeka Curriculum, creating broader opportunities for research on mathematical literacy across different educational levels (Abidin et al., 2021; Ramadhan et al., 2023).

The development of mathematical literacy research has also shown significant improvement in the number of publications, the diversity of themes, and the range of methodological approaches over the past decade (Afidah et al., 2024; Bremner et al., 2022). These studies include the development of PISA-based instruments, analysis of student abilities at various levels, integration of local cultural contexts, and the use of digital technology to support mathematical literacy learning. Nevertheless, the trends and patterns of mathematical literacy research in Indonesia over the last five years remain limited and fragmented, highlighting the need for a comprehensive systematic literature review to identify thematic focuses, dominant research methods, and existing gaps that may provide a foundation for future studies and educational innovation initiatives (Hidayati et al., 2025).

Despite the growth in research, studies on mathematical literacy in Indonesia remain fragmented and scattered across diverse topics, methods, and regions (Cahyono et al., 2025;

Linuhung et al., 2025). This fragmentation makes it challenging to see general trends, identify gaps, and determine which approaches are most effective in improving students' literacy (Marcq et al., 2024). Therefore, conducting a systematic literature review is urgent, as it can consolidate existing findings, highlight underexplored areas, and provide policymakers, educators, and curriculum developers with guidance to improve mathematical literacy outcomes in Indonesia.

This study aims to provide a comprehensive overview of the development of mathematical literacy research in Indonesia, based on Scopus-indexed publications from 2021 to 2025. By identifying publication trends, geographical distributions, research methods, mathematical topics, and educational levels, this review seeks to reveal dominant research patterns and gaps that require further investigation. This review contributes to the field of mathematics education by synthesizing recent evidence on mathematical literacy research in Indonesia. The findings are expected to provide valuable insights for researchers, educators, and policymakers to identify future research directions, strengthen mathematics education practices, and support the development of students' mathematical literacy. Accordingly, this study was guided by the following research question: What trends and characteristics of mathematical literacy research in Indonesia can be identified from Scopus-indexed publications between 2021 and 2025 in terms of journal quartiles, publication trends, geographical distribution, research methods, mathematical topics, and educational levels?

METHOD

This study employed a systematic literature review (SLR) to synthesize empirical and conceptual studies on mathematical literacy in Indonesia. According to Moher et al. (2009), SLR addresses clearly formulated questions and systematically identifies, selects, and analyzes relevant studies. The review followed the guidelines proposed by Petticrew & Roberts (2020) and the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) framework. The stages involved formulating research questions, conducting database searches, implementing inclusion and exclusion criteria, selecting relevant studies, extracting and analyzing data, and synthesizing the results. The overall procedure is presented in Figure 1.

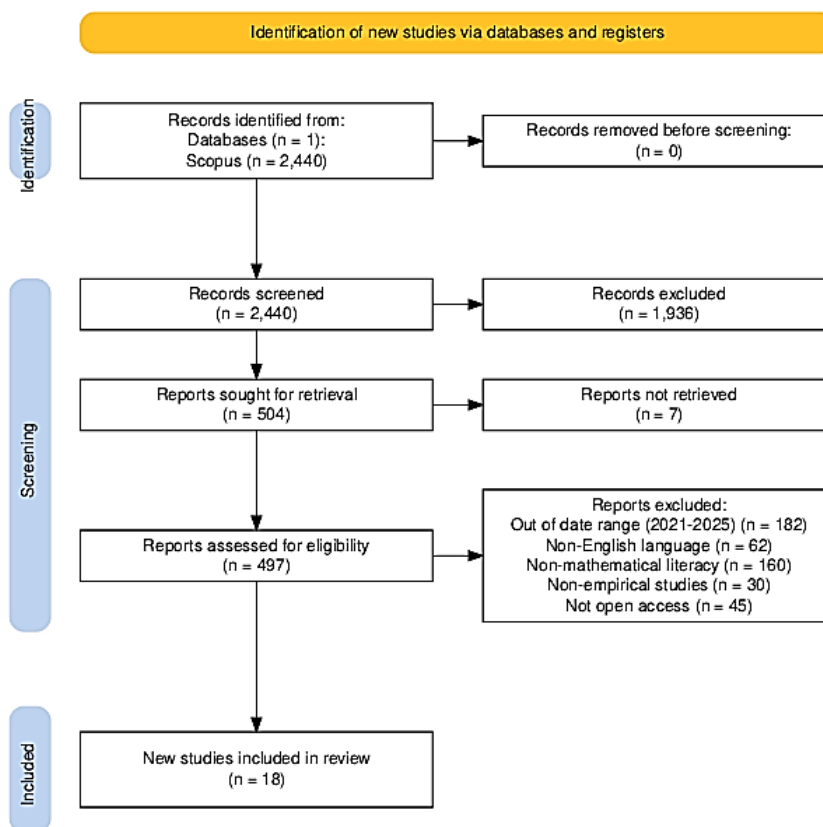


Figure 1. PRISMA Flow Diagram of The Present Review

Figure 1 illustrates the article selection process based on the PRISMA guidelines used in this review. A total of 2,440 articles were initially identified from the Scopus database. During the screening phase, 1,936 articles were excluded based on predefined inclusion and exclusion criteria, leaving 504 articles for further evaluation. Of these, seven articles could not be included, leaving 497 articles to be assessed for eligibility. After a full-text review, 479 articles were excluded for failing to meet the established criteria. Consequently, 18 articles were included in the final review and analyzed to answer the research questions.

Identification

A search of the Scopus database was conducted to identify studies on mathematical literacy. These databases were selected because they index reputable journals, ensuring the retrieval of quality articles. The study identification stage was conducted through a targeted search using keywords such as “*mathematical literacy*” to help researchers locate relevant articles within the database. Using these predefined keywords, 2,440 articles were retrieved from the Scopus database.

Screening

Articles were selected to ensure their relevance and appropriateness for this study, and the inclusion and exclusion criteria were systematically determined based on the research objectives and the scope of the topics examined. The screening stage was conducted by reviewing and selecting articles according to the following criteria: 1) include in the Scopus database, 2) published in scientific journals with peer review to ensure that the selected articles go through high-quality reviews, 3) written in English, 4) relevance to title and keywords, and 5) accessibility of articles.

The inclusion and exclusion criteria in the screening stage are displayed in Table 1 below.

Table 1. Inclusion and Exclusion Criteria Applied During the Screening Stage

Category	Inclusion Criteria	Exclusion Criteria
Publication	Journals indexed by Scopus	Others database
Type of publication	Journal articles only	Non-empirical studies & conference proceeding articles
Paper Language	English	Other Language
Article title & keyword	An appropriate title & keyword that complied with study's requirements	Did not match requirements of study & had an irrelevant title & keyword
Type of article	Open Access	Not open access

Based on the established inclusion criteria, of the 2,440 articles identified in the initial stage, only 497 were retained for screening. In comparison, 1,943 articles were excluded for failing to meet the specified inclusion criteria.

Eligibility

Verification of eligibility is the third step in the systematic search strategy, in which researchers assess the articles remaining after screening. This process involved examining the titles and abstracts of the selected articles. Before starting this stage, researchers ensure there are no duplicate articles. The researchers further reviewed the remaining articles after removing duplicate records by applying the following criteria: 1) released five years ago, from 2021 to 2025, 2) alignment with the research questions; and 3) suitability to the researcher's area of study. The inclusion and exclusion criteria applied during the eligibility stage are presented in Table 2.

Table 2. Inclusion and Exclusion Criteria Applied During the Eligibility Stage

Category	Inclusion Criteria	Exclusion Criteria
Year of publication	Publication from 2021 to 2025	Research published outside the specified inclusion year range
Research method	Qualitative, Quantitative, Mixed Methods, Research and Development (R&D)	Not using qualitative, quantitative, mixed methods, or R&D approaches
Research Focus	Subject Focus solely on studies related to mathematics content in all levels of education	Studies outside the discipline of mathematics content

At this stage, 497 articles were assessed for eligibility. Following a full-text review, 479 articles were excluded for not meeting the predefined criteria, including studies published outside the specified period, studies unrelated to mathematical literacy, studies outside the mathematics discipline, non-empirical studies, and articles that were not open access. Consequently, 18 articles met all eligibility criteria and were selected for further analysis.

Included

The systematic screening process through PRISMA yielded a final selection of 18 articles that met all predefined inclusion criteria. These studies were published across several reputable journals. The distribution based on journal name and Scopus quartile is presented in Table 3 to illustrate the scholarly landscape and showcase the high-quality sources that underpin this systematic review.

Table 3. Distribution of Selected studies by journal source and Scopus quartile

No.	Journal Name/ Source Title	Scopus Quartile	Frequency
1.	Heliyon	Q1	1
2.	Mathematics Education Journal	Q2	3
3.	Eurasia Journal of Mathematics, Science and Technology Education	Q2	1
4.	Infinity Journal	Q3	3
5.	Journal of Engineering Science and Technology	Q3	3
6.	Journal on Mathematics Education	Q3	2
7.	Journal of Education and e-Learning Research	Q3	2
8.	STEM Education	Q3	1
9.	Journal of Higher Education Theory and Practice	Q3	1
10.	Jurnal Ilmiah Ilmu Terapan Universitas Jambi	Q4	1

RESULT AND DISCUSSION

This section presents the findings from the analysis of 18 articles that satisfied the inclusion criteria and were retrieved from the Scopus database through the Systematic Literature Review framework. We will discuss trends and developments in publications on mathematical literacy during the period 2021–2025, the geographical distribution, the research methods used, the topics investigated in research on Mathematical Literacy, the educational levels.

Table 4. Demographics of the included studies

No	Author (s)	Province	Research Method	Math Topics	Education Level
1	Hidayati et al. (2025)	West Java	Qualitative	Space and Shape	Uni
2	Leton et al. (2025)	East Nusa Tenggara	Research and Development	Quantity	JHS
3	Cahyono et al. (2024)	Central Java	Mixed Method	Space and Shape	JHS
4	Hamidah et al. (2025)	West Java	Qualitative	Change and relationships	JHS
5	Lestari et al. (2025)	Special Region of Yogyakarta	Qualitative	Change and relationships	JHS
6	Susanta et al. (2025)	South Sumatra	Quantitative	Multiple Content	ES
7	Gustiningsi et al. (2024)	South Sumatra	Research and Development	Data and Uncertainty	SHS
8	Kusmaryono et al. (2024)	Central Java	Mixed Method	Change and relationships	JHS
9	Risdiyanti et al. (2021)	Maluku	Qualitative	Space and Shape	Uni
10	Fauzi et al. (2025)	West Nusa Tenggara	Research and Development	Change and relationships	SHS
11	Prabowo et al. (2025)	Special Region of Yogyakarta	Research and Development	Space and Shape	JHS
12	Tandililing et al. (2025)	Papua	Quantitative	Space and Shape	Uni
13	Linuhung et al. (2025)	Lampung	Qualitative	Quantity	JHS
14	Murni et al. (2025)	West Java	Qualitative	Space and Shape	JHS
15	Rahmawati et al. (2023)	Jakarta	Qualitative	Change and relationships	Uni
16	Pujiastuti et al. (2023)	Banten	Quantitative	Space and Shape	JHS
17	Islamirta et al. (2022)	South Sumatra	Research and Development	Data and Uncertainty	JHS
18	Komaruddin et al. (2024)	Lampung	Quantitative	Quantity	JHS

Note: ES = Elementary School; JHS = Junior High School; SHS = Senior High School; Uni = University

Table 4 summarizes the characteristics of the selected studies. The following section discusses trends and characteristics of research on mathematical literacy in Indonesia, beginning with the distribution of journals by quartile.

- **How are journal quartiles distributed in mathematical literacy research in Indonesia indexed in Scopus?**

This analysis examines the distribution of journal quartiles of mathematical literacy research in Indonesia indexed in Scopus, providing an overview of the publication outlets, as shown in Figure 2.

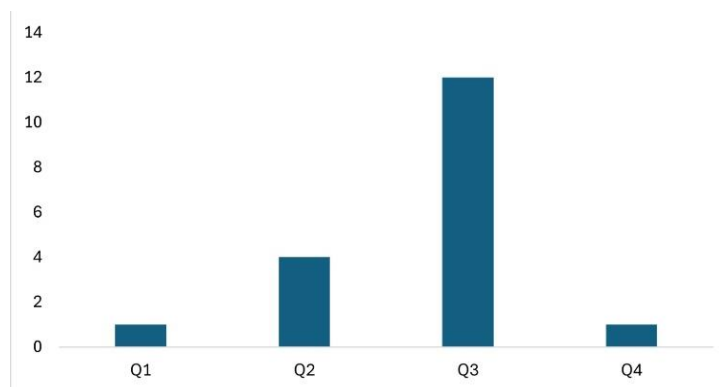


Figure 2. Journal Quartile Distribution

Figure 2 presents the distribution of journal quartiles in mathematical literacy research in Indonesia indexed in the Scopus database. The results show an uneven distribution of publications across journal quartiles, with most studies published in mid-tier journals. Specifically, twelve articles were published in Q3 journals and four articles in Q2 journals, while publications in other quartiles were limited to one article each.

This distribution indicates that mathematical literacy research in Indonesia is predominantly disseminated through journals with moderate international visibility. The pattern suggests that the field is still in a developmental phase, in which researchers are increasingly engaging with international publication outlets while continuing to strengthen the scope and depth of their studies (Kappassova et al., 2025). The limited representation across some quartiles may be influenced by factors such as journal focus, publication standards, or the alignment between research topics and journal's scope. Overall, the presence of publications across different journal quartiles demonstrates that mathematical literacy research from Indonesia has been disseminated through a range of Scopus-indexed journals, highlighting opportunities for future studies to enhance research quality, methodological rigor, and international reach.

These findings indicate that mathematical literacy is increasingly gaining attention as a major field of research and is contributing to the dissemination of evidence to improve mathematics teaching and learning (OECD, 2023). However, the limited number of publications in high-impact journals highlights the need for stronger theoretical and methodological contributions to enhance the international impact of mathematics education research in Indonesia (Khotimah, 2021).

- **What are the Trends and Developments in Mathematical Literacy in the Scopus database from 2021 to 2025?**

This analysis examines the annual distribution of mathematical literacy research in Indonesia indexed in the Scopus database to illustrate publication trends over time. The distribution of publications from 2021 to 2025 is shown in Figure 3.

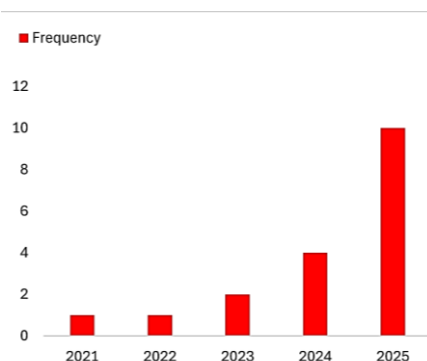


Figure 3. Number of Articles by Year of Publication (2021–2025)

Figure 3 illustrates the yearly distribution of mathematical literacy research in Indonesia, as indexed in the Scopus database, from 2021 to 2025. Overall, the findings indicate a clear increasing trend in the number of publications over the observed period. In the early years, research output was relatively limited, with only one article published in both 2021 and 2022. The most substantial growth occurred in 2025, with 10 articles, representing more than half of the total studies reviewed ($n = 18$).

This pattern suggests that scholarly attention to mathematical literacy in Indonesia has intensified in recent years (B & Rais, 2023). The sharp increase in publications in 2025 may reflect growing awareness of mathematical literacy as a crucial competency in mathematics education, particularly in response to international assessments and national educational reforms (Kappassova et al., 2025; Khotimah, 2021). Trends in research articles on mathematical literacy indicate that it has become an increasingly important field of research in Indonesia, contributing to a better understanding of students' mathematical literacy and providing insights into the development of more effective mathematics teaching and learning practices.

- **How are the research locations geographically distributed?**

The analysis of research locations provides an overview of how mathematical literacy studies are distributed across different regions in Indonesia.



Figure 4. Geographical Distribution of Mathematical Literacy Research Sites in Indonesia

The geographical distribution of research sites shows that mathematical literacy studies in Indonesia are conducted across 11 provinces, with a clear concentration in certain regions. Research sites are mainly located in West Java and South Sumatra, each contributing several studies and indicating these provinces as key centers of research activity. Central Java, Yogyakarta, and Lampung show a moderate level of research presence. In contrast, studies in other provinces such as Banten, Jakarta, Maluku, East Nusa Tenggara, West Nusa Tenggara, and Papua are relatively limited, with only a small number of publications (Munfarikhatin et al., 2022).

This distribution indicates that mathematical literacy research in Indonesia remains uneven, concentrated in provinces with stronger academic and research infrastructure (Manggala & Yuniawatika, 2021; Marcq et al., 2024). The limited number of studies in eastern and less-represented regions suggests the need for broader geographical coverage in future research better to capture regional diversity and contextual differences in mathematical literacy.

- **How can the findings of mathematical literacy studies be described based on the research methods employed?**

Research methods play an important role in shaping how research findings are produced and reported. This study examines the distribution of research methods used in mathematical literacy research in Indonesia, as shown in Figure 5.

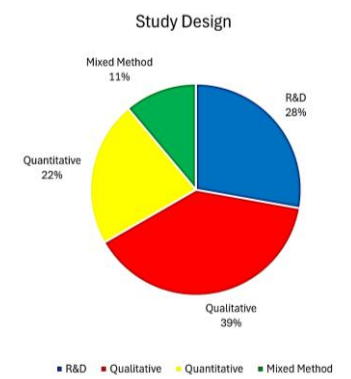


Figure 5. Research Methods Distribution

Figure 5 illustrates the distribution of research methods employed in mathematical literacy studies conducted in Indonesia. The results show that qualitative research dominates, accounting for 39% of the reviewed studies. Followed by research and development (R&D) approaches at 28%, quantitative methods at 22%, and mixed methods at 11%.

The predominance of qualitative research indicates that mathematical literacy studies in Indonesia largely focus on exploring learning processes, students' reasoning, instructional practices, and contextual interpretations of mathematical literacy. This finding is consistent with Utama et al. (2024), which highlights the suitability of qualitative approaches for investigating students' mathematical thinking and problem-solving processes. The substantial proportion of R&D studies reflects a strong emphasis on developing instructional models, learning materials, or assessment instruments related to mathematical literacy. Similar trends have been reported in previous studies of B & Rais (2023), which emphasised the need for innovative learning resources and assessment tools to support mathematical literacy development. At the same time, fewer quantitative studies assess students' mathematical literacy and examine relationships among variables. Meanwhile, the relatively limited use of mixed methods suggests that integrated approaches combining qualitative and quantitative evidence remain underutilized. Overall, this methodological diversity contributes to mathematics education by providing insights into students' mathematical thinking and serving as a foundation for the development of teaching and assessment practices that support mathematical literacy. Future research could benefit from the broader application of integrated methodological approaches.

- **Which mathematical topics are most frequently explored in studies related to mathematical literacy?**

This section explores the mathematical topics examined in studies on mathematical literacy in Indonesia. Identifying the distribution of these topics helps illustrate which areas

of mathematics are most commonly discussed in the reviewed research. The topic distribution is presented in Figure 6.

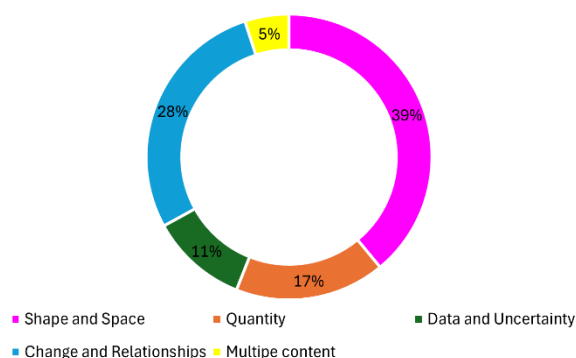


Figure 6. Mathematical Topics in Mathematical Literacy Research

Figure 6 shows that mathematical literacy research in Indonesia is concentrated on a limited number of mathematical topics. Studies focusing on shape and space form the largest portion of the reviewed literature, indicating a strong emphasis on geometry-related content. This finding is consistent with Hairunnisa et al. (2023), who reported that geometry provides rich opportunities for connecting mathematical concepts with real-world situations and visual reasoning, both of which are central to mathematical literacy. Research addressing change and relationships also appears frequently, reflecting attention to patterns, functional thinking, and relationships between variables in real-world contexts. Topics related to quantity are moderately represented, while studies on data and uncertainty are less common. Research that integrates multiple mathematical content areas is rare.

This pattern suggests that mathematical literacy research in Indonesia tends to prioritize topics closely connected to contextual problem-solving and visual or relational reasoning, which are widely recognized as important components of mathematical literacy (Herlinawati et al., 2024). Meanwhile, data-related topics and integrative approaches across multiple content areas remain underexplored, a finding that aligns with previous studies highlighting the limited attention given to data literacy within mathematics education research (Bolstad, 2023). These findings indicate potential directions for future research to broaden topic coverage, particularly by incorporating data literacy and multi-topic perspectives to provide a more comprehensive view of mathematical literacy.

- **What is the development of research in mathematical literacy considering the educational levels?**

To examine the development of mathematical literacy research across different educational levels, this study analyzes the distribution of the reviewed publications based on their educational context.

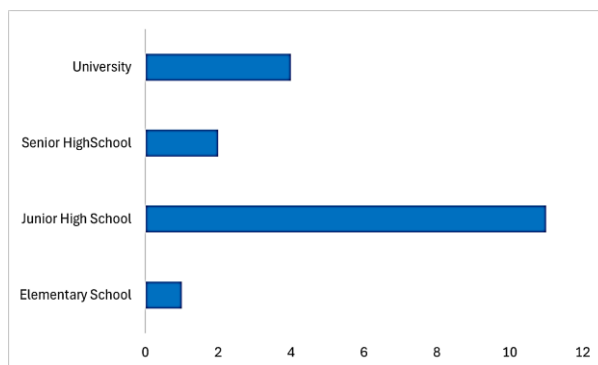


Figure 7. Distribution of Mathematical Literacy Research by Educational Level

The distribution of mathematical literacy research across educational levels shows that the majority of studies are conducted at the junior high school level, making it the primary focus of this field. This emphasis reflects the importance of developing mathematical literacy during early adolescence, a stage often marked by curriculum transitions and increasing cognitive demands (Hakiki & Wijayanti, 2021). This finding is relevant with previous studies indicating that junior high school students frequently become the focus of mathematical literacy research because they are close to the target age group assessed in international studies such as PISA and are considered to be in a critical stage for developing higher-order mathematical thinking (OECD, 2023; Stacey & Turner, 2015).

In contrast, research at the elementary and high school levels remains limited, suggesting that the previous studies have similarly shown that mathematical literacy research is concentrated at the middle school level, while elementary and upper secondary levels remain underrepresented (Abidin et al., 2021). This finding highlights a significant research gap in mathematics education, as understanding how mathematical literacy develops from elementary through secondary school is crucial for designing coherent learning pathways. Therefore, future research should investigate mathematical literacy across various educational levels to provide an empirical foundation for age-appropriate teaching and assessment practices, as well as to support the continuous development of students' mathematical literacy.

CONCLUSION

This study provides a comprehensive overview of mathematical literacy research in Indonesia, based on Scopus-indexed publications, identifying current trends and underexplored areas that warrant further investigation. The findings indicate that research in this field has shown gradual progress, with a steady increase in publications from 2021 to 2025. Most studies were published in Q2 and Q3 journals, employed qualitative and research and development (R&D) methods, focused on shape and space, and were conducted primarily at the junior high school level. Additionally, research locations were concentrated in a few provinces, indicating an uneven geographical distribution.

These findings suggest that mathematics literacy research in Indonesia continues to evolve but remains concentrated within specific educational contexts and levels. Based on these findings, future research is recommended to expand its geographic scope, include underrepresented educational levels, and employ more diverse and rigorous research designs. Strengthening the quality of international publications and fostering interregional collaboration can further enhance the contribution of Indonesian mathematics literacy research to the global academic community.

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