

Numeracy Policy in the Indonesian Curriculum: A Literature Review on the Implementation, Challenges, and Strategies for Strengthening Numeracy

Ni Luh Sakinah Nuraini¹, Ali Imron¹, Nurul Ulfatin¹, Bambang Budi Wiyono¹

¹Educational Management, Universitas Negeri Malang, Malang, Indonesia,
Corresponding author, email: ni.luh.2401329@students.um.ac.id

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Abstract

More than twenty recent studies on the application of numeracy in the Indonesian National Curriculum—including the Independent Curriculum—are examined in this study. The purpose of this study is to look at numeracy policies in the education curriculum in Indonesia and to look at the implementations, problems, and strategies used to improve students' ability to read and write. The results of the review show that despite government policies aimed at improving numeracy, education still faces many challenges. These include unprepared teachers, lack of educational resources, and various learning methods that are not fully suited to real-world situations. The study also found that some potential strategies for improving numeracy literacy are the integration of numeracy across subjects and ongoing teacher training. The results emphasize that governments, educators, and communities must work together to support the strengthening of numeracy in accordance with needs.

1. Introduction

Mathematics is one of the disciplines that helps the development of science and technology today and in the future. Important components in mathematics are literacy and numeracy. Numerical literacy is an ability that must be possessed by students at all school levels (Munahefi et al., 2024). Permendikbudristek No. 5 of 2022 states that strengthening numeracy literacy is a priority program of the government at every level of education. Strengthening numeracy literacy is the key to building quality learning at every level of education and curriculum area (Indah L & Hamdu, 2022). The learning process in schools needs to emphasize the importance of numeracy literacy. Education in the 21st century must ensure that students have the ability to learn and innovate, the skills to use and utilize information technology and media, the ability to identify issues or relevance of information, analyze, prioritize, and use relevant information or alternative solutions (literacy), and the ability to understand concepts, procedures, and facts relating to oneself, the immediate environment, the surrounding community, and society as a whole and most importantly numeracy issues (Nicomse & Naibaho, 2022). In the 21st century, numeracy literacy is essential for education and skill development. It is expected that students have the ability to analyze and solve problems with numerical data as a result of rapid advances in technology and information. This ability is essential for academic success and prepares students to face complex challenges around the world (Hotimah et al., 2025).

The results of PISA which show the numeracy literacy of students in Indonesia is low and quite concerning (Pratiwi, 2019). These results are not in line with the goals of mathematics learning which are directed to help students 1) understand, explain, and apply mathematical concepts; 2) using reasoning; 3) solve problems; 4) communicate; and 5) have interest, attention, and curiosity towards mathematics; confident and tenacious; and appreciate its benefits (Muthofin & Budiman, 2024). Several solutions have been implemented in the world of education in Indonesia in order to improve numeracy literacy skills. The use of media, teaching materials, and learning models such as game-based learning has been carried out to improve numeracy literacy (Ardellea & Hamdu, 2022; Ulfa et al., 2022; Widiantari et al., 2022). This effort is made because mathematical literacy is very important in training students' reasoning to solve problems by analyzing facts and using good procedures. Students who have mathematical literacy skills will be very useful in solving problems in daily life, which has an impact on the quality of human resources (Gao et al., 2024).

The development of numeracy is a crucial component of children's education. Strategies that emphasize improving numeracy will assist students in developing the capacity to count and solve problems efficiently within the framework of the Merdeka Curriculum Learning Curriculum (Widiyasari & Eminita, 2023). The Indonesian government prioritizes improving the quality of

education to face the challenges of the 21st century. Mastery of numeracy skills, which means the ability to understand, use and analyze numbers and mathematical concepts in everyday life, is an important component in improving the quality of education (Warman, 2023). In this case, numeracy policy is essential to improve students' basic literacy since primary education. Merdeka Curriculum and National Assessment are some of the strategic policies taken by the Indonesian Ministry of Education, Culture, Research and Technology to improve the numeracy component in the national curriculum (Fisabilillah & Rahmadanik, 2022).

The importance of this numeracy policy is inseparable from international research findings that show that Indonesian students have low numeracy skills. For example, reports from the OECD's Program for International Student Assessment (PISA) always show that most students in Indonesia do not have the necessary mathematical skills (Alfaruqi & Nurwahidah, 2025). These results suggest that approaches to numeracy learning in schools need to be thoroughly evaluated. This includes changes to curriculum content, teaching techniques and systemic policy support. In addition, to become numerically intelligent citizens and compete in the job market, primary and secondary school graduates must have strong numeric thinking skills (Gunawan et al., 2023). In addition, the government has realized that numeracy is not just the ability to count; it also includes the understanding of concepts, the application of concepts in real situations, and the ability to reason logically. Therefore, the numeracy policy reflects the state's ideological commitment to achieving educational equity in addition to the technical aspects. The formulation and implementation of numeracy policies require an inclusive, adaptive and data-driven approach, given the differences in education quality across Indonesia (Ernawati & Rigiante, 2024). The purpose of this study is to thoroughly examine the numeracy policy in the Indonesian curriculum, from its background, the methods used to implement it, achievements, challenges and prospects for improvement. Thus, this research is expected to help education policy makers and practitioners in developing a more efficient and equitable numeracy policy.

2. Methods

Researchers identified, reviewed, evaluated, and interpreted all available research, using the SLR (Systematic Literature Review) method. This method allows researchers to review and identify journals using predetermined procedures (Triandini et al., 2019). Researchers searched for journal articles with the keywords mathematical numeracy and numeracy policy in curriculum Indonesia based on the steps above. Documentation of each article found in this research report was used to collect data. In this study, we used 25 articles from accredited national journals taken from Google Scholar, Sciencedirect, and Researchgate. Because based on the sorting results, 25 articles were obtained that were in accordance with the research. The articles were selected because they have comparable research and then analyzed.

PRISMA (Preferred Reporting Items for Systematic Review and Meta-analysis) is the basis of the research conducted (Prill et al., 2021). There are five stages that will be carried out, namely: criteria for articles analyzed, database sources, and article selection, article collection, and data filtering. The first step is to search for journal articles through accredited electronic databases, such as Sinta Portal, Google Scholar, Science Direct, and Research Gate. As a result, 343 national and 10 international journals were found. The journal articles found were then filtered or eliminated. After selecting articles based on titles and abstracts, articles were then selected according to the inclusion criteria. The inclusion criteria included journals published within 10 years (2015-2024), research subjects were school children, articles had to be original and complete, and the theme was the relationship between numeracy in Indonesia based on the curriculum.

3. Result and Discussion

This literature review includes an analysis and summary of articles related to numeracy learning policies in Indonesia countries presented in Table 1.

Table 1 Results of Numeracy Policy Research Analysis

Research Results	
(Hidayah et al., 2024)	The quantitative findings demonstrated that the majority of teachers had a favorable opinion of the Indonesian National Curriculum's (INC) and the programs' ability to strengthen students' numeracy abilities. The empowerment of numeracy skills was greatly impacted by the INC's adoption. Teachers' perspectives and the difficulties in fostering numeracy skills in the implementation of INC and the programs were thoroughly examined by the qualitative analysis.
(Nuryami, 2024)	Numeracy literacy skills are demonstrated by (1) solving everyday problems using numbers and mathematical symbols; (2) analyzing data in a variety of formats (tables, graphs, etc.); and (3) interpreting analytical results to forecast, formulate, and make judgments. The average % for each numeracy literacy skill indicator was computed in order to analyze the data. The findings of the investigation demonstrate that junior high school students' numeracy literacy skills remain inadequate in the age of self-directed learning.
(Syahida & Dewi, 2023)	The purpose of this study is to examine how 21st-century abilities are used in the area of numeracy, which is equivalent to primary school mathematics (stages A, B, and C). Since mathematics is not just about numbers and their operations but also about understanding discourse, taking main ideas, and developing ideas and solutions, 21st-century skills are an essential component of mathematics. In other words, mathematics is closely related to language skills or good literacy.
(Winarno et al., 2024)	The findings indicated that while civics teachers' numeracy skills were deemed adequate, their literary ability was deemed moderate. i) Working together with colleagues and implementing student-centered collaborative learning; ii) fostering a numeracy culture through training and discussions; iii) looking for learning materials and media that supported numeracy; and iv) encouraging reading, annotating texts, and analyzing readings related to numeracy.
(Rohmah et al., 2022)	The findings of this study include developing a Learning Implementation Plan (RPP), creating learning materials focused on numeracy literacy, creating evaluation questions tailored to numeracy literacy using the

	Higher Order Thinking Skill (HOTS) criteria, and creating realistic and audio-visual learning materials.
(Annisa et al., 2024)	The planning, execution, and assessment of mathematics instruction in a public junior high school in Klaten Regency are described in this study as attempts to maximize pupils' numeracy abilities . Three conclusions can be drawn from the study's findings. To support learning, teachers first create math textbooks, worksheets, and instructional media. Teachers employ learning materials and student worksheets with problems that only partially integrate numeracy components, even if the school has strong facilities for implementing the curriculum. Third, Nevertheless, the assessment demonstrates that issues with numeracy components are not present in the practice offered.
(Sa'dijah et al., 2023)	According to the findings, 62%, 30%, and 8% of all pupils, respectively, were at the surface numeracy skills (SNS), intermediate numeracy skills (INS), and deeper numeracy skills (DNS) levels. These numbers demonstrated how poorly junior high school pupils could solve math issues. Therefore, in order to enhance students' numeracy abilities, educators should implement task-oriented learning experiences in numeracy, such as constructivist teaching approaches.
(Susanto & Mahmudi, 2024)	The study's findings show that teachers have a good (agree) opinion of their students' numeracy proficiency as assessed by the MCA tool, allowing them to take the necessary steps to enhance learning and fortify numeracy. Teachers can try to find information on achievement results, read report card data, try to figure out what's wrong, and make the necessary corrections.
(Sofian, 2022)	The findings indicate that incorporating PP(Productive Pedagogy) principles into numeracy education significantly improves adult learners' engagement, conceptual understanding, and confidence in applying mathematical skills to everyday situations. The study underscores PP's potential to enhance adult education frameworks in Indonesia, advocating for broader implementation and further research on culturally adaptive pedagogical strategies.
(Kusaeri & Wahyudi, 2024)	The findings of the linear regression analysis indicate that pupils' numeracy abilities are influenced by their gender and geographic location. The research's results can assist educators and policymakers

	in creating more focused initiatives to raise children' numeracy proficiency.
(Amreta, 2024)	It has been determined that the autonomous curriculum Phase B's ethnomathematics-based numeracy assessment is both practical and efficient for teaching mathematics.
(Listianingrum et al., 2023)	This study has consequences for creating physics lessons that foster numeracy skills, particularly when it comes to choosing instructional strategies that take gender and cognitive level into account.
(Sumliyah et al., 2025)	The study's conclusions show the following: (1) Indonesia's mathematics curriculum is very well-designed, with learning objectives that are specific to the nature of mathematics as a subject (containing content and process elements) and mathematical literacy incorporated into the curriculum.
(Silitonga, 2023)	The study's findings suggest that there are several problems with numeracy skill development, one of which is the underutilization of traditional game-based learning techniques. Inadequate school infrastructure prevents students from becoming more numerate. Due to the fact that teacher numeracy training is still seldom implemented, instructors' lack of creativity in using games and conventional games to enhance numeracy is a result.
(Sapitri & Sukirman, 2023)	According to the study's findings, junior high school students' implementation of the mathematical literacy component of the Merdeka curriculum varied. The distinction is seen in the range of techniques, media, and learning resources employed, as well as the frequency of training and support that instructors receive in organizing, carrying out, and assessing instruction.
(Chaniago et al., 2025)	Hasil penelitian menunjukkan bahwa meskipun AN (Asesmen Nasional) mengevaluasi literasi, numerasi, dan pengembangan karakter untuk mendukung pendidikan holistik, keterbatasan teknologi dan anggaran membuat perbedaan yang ada sulit untuk dieksekusi.
(Fitri & Herman, 2024)	Geometry and measurement problems are challenging since pupils require assistance selecting formulas. Data and uncertainty inquiries are the easiest to answer. According to the National Education Report Card findings, primary school numeracy skills fall into the medium group.
(Asmara et al., 2024)	The reflection pattern pertains to the interpretation, application, and evaluation of mathematical results. Students following this pattern are already familiar with the signs of mathematical literacy processes, which

include problem-solving techniques, the use of formal, symbolic, and technical language and operations, and the use of mathematical tools to generate actual solutions to real-world issues.

(Aisyah & Juandi, 2022) Elementary school pupils' literacy is still seen as low, while junior high school students' literacy is evaluated from a variety of angles, including their low mathematical literacy and the factors that affect it. Even though a mathematical literacy exam has been administered in the Indonesian setting, students' mathematical literacy is still low at the high school level. Lastly, research on mathematical literacy at the university level reveals that varying student learning styles correspond with varying levels of mathematical literacy.

(Ahyan et al., 2021) The learning and assessment process, curriculum development that promotes mathematical literacy, and the role of teachers, parents, and society in assisting students in improving their mathematical literacy are all areas of current and ongoing research on mathematical literacy.

(Mangelep, 2023) There are 3.3% low-grade pupils, 47.5% middle-grade students, and 71.5% high-grade students in terms of employability. In contrast, 55% of high school students, 13.3% of middle school students, and 1.3% of elementary school students are proficient in interpreting. These findings suggest that students' mathematical literacy skills are comparatively inadequate when it comes to solving mathematical literacy problems in an ethnomathematics setting.

(Mu, 2019) The first stage's output is designated as Draft I and is undergoing expert validation. The last process results in Draft II, which describes a game-based fort defense system designed to enhance mathematics literacy and be incorporated into the Indonesian curriculum. Additionally, this draft has been verified and used in the actual instruction of primary school first-graders.

(Umbara et al., 2019) According to the results, participants in the PISA survey had a greater understanding of the learning process than the method used to evaluate mathematical literacy. In order to improve Indonesia's ranking in the PISA survey and to help teachers reach their goals of increasing students' mathematical literacy, campaigns for mathematical literacy in different teacher communities can be conducted concurrently, methodically, and systematically through a special program that keeps an eye on its progress.

(Jailani et al., 2020)

According to content, context, and process, the pupils' mathematical literacy ability remained low, according to the results. Between eighth and ninth grades, as well as between ninth and tenth grades, there was advancement in the content and context domain. The development of students' abilities in the process domain showed comparatively similar findings for eighth, ninth, and tenth grade, with scores of about 500. In the employ and interpret process domain, there was a development of abilities from eighth to ninth and from ninth to tenth grade.

The results of the study of 15 articles that have been presented in Table 1 show that the how is the numeracy policy in the Indonesian curriculum. The literature's findings indicate that Indonesian mathematics education is seeing significant growth, particularly in the last few years. This phenomenon is exemplified by the shift in mathematical education paradigms from memorization-based and prosedural approaches to more contextual, meaningful, and competency-based approaches (Rahmafritri et al., 2024). The application of the Merdeka curriculum is one of the primary factors that enhances numerical skills. In addition to being emphasized as the foundational subject of mathematics education, this curriculum incorporates interdisciplinary (cross-disciplinary) learning into a number of other courses (Fajriyah, 2022). For instance, students are expected to examine data, make comparisons, and utilize graphs to support their arguments in science and social science classes. With the use of basic literature, which is essential for critical thinking and problem solving, this study seeks to promote numerical literacy. In order to assist students improve their numerical skills in a more thorough and precise manner, Merdeka's curriculum also promotes the use of a variety of instructional techniques and formative evaluations (Zuhro et al., 2023).

The knowledge, abilities, and behaviors that students need to use mathematics in a range of contexts—from introducing and comprehending mathematics in the real world to being able to apply that knowledge and skill in a way that serves its intended purpose—are collectively referred to as numeracy goal. Numeracy and literacy are basic and broad skills. According to Wardani and Fathani (2020), literacy and numeracy are related to the capacity to think about and use language and numbers in a range of contexts, including social, professional, and personal ones. The various ways that information is presented in the digital age, including as pictures, tables, graphs, audio, and video, are the source of the need to acquire numeracy abilities. Effective reading, analysis, and conclusion-drawing abilities are necessary for the presentation and interpretation of data in both quantitative and qualitative formats (Mason et al., 2016). The abilities are fundamental for critical thinking, problem-solving, and quick change adaptation (Abella et al., 2024). For both academic and lifetime success, numeracy is essential. In this instance, numeracy skills are viewed as the cornerstone of mathematics, a way to integrate literacy and mathematics, a tool for social settings and decision-making, and a means of engaging in active citizenship (Dorris et al., 2021).

Current research indicates that mathematical literacy is a significant aspect that is constantly taken into account while developing Indonesian curriculum and instructional strategies. According to Hidayah et al (2024) the majority of educators hold favorable views of the Indonesian Curriculum and associated initiatives, which are believed to enhance students' numerical proficiency. But when it comes to independent learning, pupils' numerical proficiency—especially in junior high school—remains rather low (Nuryami, 2024). In addition to problem-solving abilities, numeracy emphasizes critical thinking abilities, reading comprehension, and the capacity to take challenging issues that are in line with the 21st century (Syahida & Dewi, 2023). This illustrates that numbers are not just used in mathematics but also in other subjects. Some studies claim that even while some teachers—civics in particular—have a good aptitude for numbers, their literary skills are nonetheless fairly low (Winarno et al., 2024). To improve the numeracy culture, these teachers have done a variety of things, including collaborative learning, training, and finding appropriate learning media. The development of a Lesson Plan based on numeracy literacy, the implementation of evaluation questions that meet the Higher Order Thinking Skills (HOTS) standards, and the use of audiovisual and realistic media are other concrete strategies (Rohmah et al., 2022). However, the numeracy element is still limited in the learning tools in the real world (Annisa et al., 2024).

Students' numeracy skills are still dominated by a surface level of 62% (Sa'dijah et al., 2023). Which suggests that a more comprehensive constructivist learning approach is needed. In addition, students' numeracy achievements are greatly influenced by gender and geographical location (Kusaeri et al., 2022). The principles of Productive Pedagogy (PP) have been shown to increase the engagement and numeracy understanding of adult students (Sofian, 2022) and ethnomathematics-based approaches are also considered effective and practical (Amreta, 2024; Mangelep, 2023). However, teachers' creativity in strengthening numeracy is hampered by a lack of teacher training and a lack of use of traditional games (Silitonga, 2023). In addition, the Merdeka curriculum that includes numeracy shows considerable variation in schools depending on teacher training, the media used, and infrastructure support (Sapitri & Sukirman, 2023). In addition, the implementation of national programs such as the National Assessment has become more difficult due to constraints such as budgets and technological limitations (Chaniago et al., 2025). Students' abilities in the field of process tend to be stagnant. This happens even though their abilities in the field of context and content develop at the classroom level (Jailani et al., 2020). Curriculum-based educational games and mathematics literacy campaigns through teacher communities are alternatives that are considered effective in improving numeracy literacy systemically.

Numeracy doesn't just focus on the final outcome; it also includes processes related to how students understand, apply, and evaluate mathematical outcomes. This shows that students with reflection patterns have understood all indications of the mathematical literacy process (Asmara et al., 2024). This aspect of introspection is essential to distinguish computational abilities from the high-level mathematical thinking abilities required in real-life situations. In addition, the national education report shows that elementary school students are still in the middle group in terms of numeracy skills. The weaknesses are especially seen in geometry and measurement subjects, where they face difficulties in choosing the right formulas (Fitri & Herman, 2024). This shows that contextual learning is essential because it gives students a hands-on experience to understand ideas in a practical and symbolic way. National policies such as the National Assessment have been designed to evaluate literacy, numeracy, and character as part of holistic education. However, its implementation still faces challenges in terms of technology access and budget constraints, especially in remote areas (Chaniago et al., 2025). This shows the need for equitable distribution of educational resources as well as policy design that is adaptive to the diversity of local contexts. In addition, based on research from Ahyan et al., (2021); Aisyah & Juandi (2022) emphasized the importance of the role of teachers, parents, and the community in supporting students' numeracy literacy. Mathematics literacy is not only the responsibility of schools, but it is a cross-stakeholder collaboration that requires a systemic approach.

4. Conclusion

Numeracy policies in the curriculum appear to be a big problem for education in Indonesia, according to a number of studies. Although policies and curriculum are aimed at improving this element, many challenges still stand in the way of its implementation. These include unprepared teachers, limited infrastructure, and different types of institutional support. Therefore, to build a strong numeracy culture, better teachers, innovations in learning media, and contextual approaches such as productive pedagogy and ethnomathematics must be expanded. To form a generation that is not only able to count, but also capable of thinking critically, reflectively, and contextually, a multidimensional approach is needed that includes pedagogical innovation, responsive policy support, and strengthening of evaluation systems. Overall, students exhibit low to moderate numeracy skills, as well as limitations in interpretation, problem-solving strategies, and the application of concepts in real-world contexts. Teachers also face difficulties in designing numeracy learning that is contextual, integrative, and based on local culture such as ethnomathematics. However, some studies have also shown that applying new approaches such as productive pedagogy, HOTS-based learning, and the integration of numeracy into various subjects is a good thing. Reflective and interdisciplinary learning design, collaboration between stakeholders, and the role of teachers are important factors in improving numeracy.

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