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THE INTEGRATION OF ETHNOMATHEMATICS IN ENHANCING NUMERACY LITERACY: A LITERATURE REVIEW

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Abstrak

Penelitian ini bertujuan untuk menganalisis integrasi etnomatematika dalam pengembangan literasi numerasi melalui studi literatur. Literasi numerasi menekankan kemampuan memahami dan menerapkan konsep matematika dalam konteks kehidupan nyata, sedangkan etnomatematika memanfaatkan budaya lokal sebagai sumber belajar yang kontekstual dan bermakna. Penelitian ini menggunakan pendekatan kualitatif dengan desain *Systematic Literature Review* (SLR). Data berupa artikel ilmiah yang dipublikasikan pada tahun 2020–2025 dan diperoleh dari database akademik seperti Google Scholar, ERIC, serta jurnal nasional terakreditasi. Analisis data dilakukan menggunakan teknik *content analysis* melalui tahap reduksi, kategorisasi, sintesis, dan interpretasi temuan penelitian. Hasil kajian terhadap sembilan artikel menunjukkan bahwa integrasi etnomatematika dalam bentuk modul, e-modul, asesmen, dan model pembelajaran seperti RME dan PMRI dinyatakan valid, praktis, dan efektif dalam meningkatkan literasi numerasi. Pendekatan ini terbukti meningkatkan pemahaman konseptual, kemampuan pemecahan masalah, motivasi, serta keterlibatan siswa dalam pembelajaran matematika. Namun, implementasinya masih menghadapi tantangan berupa keterbatasan pemahaman guru dan minimnya sumber belajar berbasis kearifan lokal. Dengan demikian, etnomatematika berpotensi menjadi strategi pedagogis yang relevan dalam mendukung penguatan literasi numerasi pada era Kurikulum Merdeka.

Keyword:
ethnomathematics, numeracy literacy, contextual learning, local wisdom

Abstract:

This study aims to analyze the integration of ethnomathematics in the development of numeracy literacy through a literature review. Numeracy literacy emphasizes the ability to understand and apply mathematical concepts in real-life contexts, while ethnomathematics utilizes local culture as a contextual and meaningful learning resource. This study employed a qualitative approach using a *Systematic Literature Review* (SLR) design. The data consisted of scientific articles published between 2020 and 2025 and obtained from academic databases such as Google Scholar, ERIC, and accredited national journals. Data analysis was conducted using *content analysis* techniques through the stages of data reduction, categorization, synthesis, and interpretation of research findings. The review of nine selected articles indicates that the integration of ethnomathematics in the form of modules, e-modules, assessments, and instructional models such as Realistic Mathematics Education (RME) and Indonesian Realistic Mathematics Education (PMRI) is valid, practical, and effective in improving numeracy literacy. This approach has been shown to enhance conceptual understanding, problem-solving skills, motivation, and student engagement in mathematics learning. However, its implementation still faces challenges, including limited teacher understanding and the lack of instructional resources based on local wisdom. Therefore, ethnomathematics has strong potential as a relevant pedagogical strategy to support the strengthening of numeracy literacy in the era of the Merdeka Curriculum.

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Introduction

Ethnomathematics and numeracy literacy are two important concepts in mathematics education that have gained increasing attention in modern educational studies. Ethnomathematics views mathematics as part of the social and cultural practices of a community, where mathematical concepts develop and are used within the context of the everyday life of a particular cultural group (Godino et al., 2007). Meanwhile, numeracy literacy refers to an individual's ability to understand, interpret, and effectively use numerical information to solve problems in various life situations (Astuti et al., 2024; Suryaningsih & Nurlita, 2021). These two concepts are closely related because strong numeracy understanding requires not only mastery of formal mathematical concepts but also connections to real contexts that are close to students' experiences.

In the educational context, students' numeracy literacy skills remain a serious challenge. Results from the Programme for International Student Assessment (PISA) indicate that Indonesian students' mathematical literacy achievement is still categorized as low compared to other countries (OECD, 2022). This condition suggests that the mathematics instruction implemented so far has not fully succeeded in developing students' ability to use mathematical knowledge contextually and meaningfully. One contributing factor to the low level of numeracy literacy is the tendency of instructional approaches to be abstract and insufficiently connected to real-life situations and students' cultural backgrounds.

A major issue in mathematics learning in schools is the limited introduction and integration of ethnomathematical practices into the formal education curriculum. Mathematics is often perceived as a subject detached from everyday life, which creates a sense of alienation and reduces students' motivation to learn (Diana et al., 2023; Muslimin & Purwaningsih, 2023). In fact, Indonesia possesses rich cultural diversity that has great potential to be utilized as a source of mathematics learning. Various cultural activities, such as batik patterns, traditional number systems, traditional games, and buying and selling practices in traditional markets, contain mathematical concepts that are relevant to numeracy learning (Astuti et al., 2024; Pramusinta & Dewi, 2023).

The integration of ethnomathematics into mathematics instruction is believed to be one solution to improving students' numeracy literacy. This approach enables students to understand mathematical concepts through cultural contexts that are familiar to their lives, making learning more meaningful and contextual. The integration of cultural values into mathematics learning can enhance student engagement and positively impact mathematics learning outcomes (Setiawan et al., 2024). These findings align with the view that learning relevant to students' social and cultural contexts can help develop numeracy literacy skills that are not only academic in nature but also applicable in everyday life (Astuti et al., 2024; Munawwarah, 2025).

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Although various studies have demonstrated the potential of ethnomathematics in mathematics education, comprehensive studies that specifically examine the integration of ethnomathematics in the development of numeracy literacy, particularly within the Indonesian educational context, remain limited. Therefore, this literature review aims to provide a systematic overview of concepts, practices, and research findings related to the integration of ethnomathematics in the development of numeracy literacy. Through an in-depth analysis of relevant literature, this study is expected to contribute both theoretically and practically to educators and education policymakers in designing contextual, meaningful, and locally grounded numeracy learning. In addition, this review seeks to identify effective strategies or instructional models for improving students' numeracy literacy skills while respecting and integrating local cultural values (Astuti et al., 2024; Diana et al., 2023; Pramusinta & Dewi, 2023).

Method

This study employed a qualitative approach using a library research design structured as a Systematic Literature Review (SLR). This approach was selected to obtain a comprehensive overview of the integration of ethnomathematics in the development of numeracy literacy based on previously published research findings. A qualitative approach was considered appropriate because the focus of this study emphasizes an in-depth analysis of concepts, findings, and research trends that are interpretatively relevant (Al Hadi et al., 2024; Fauzi & Fadilah, 2024).

The data used in this study were secondary data derived from scientific articles, reputable national and international journals, conference proceedings, and educational policy documents related to ethnomathematics and numeracy literacy. The analyzed articles were limited to publications from 2020 to 2025 to ensure the relevance and recency of the review (Amri et al., 2024; Iasha et al., 2024). Data sources were obtained through academic databases such as Google Scholar, ERIC, Scopus (if available), as well as accredited national journal portals (SINTA). The literature search was conducted using keywords such as ethnomathematics, numeracy literacy, culture-based learning, and other related keyword combinations (Aisyah & Hartono, 2024; Ardiwanata & Lestari, 2025).

The data collection procedure was carried out through several stages, beginning with the identification and retrieval of literature using predetermined keywords across various academic databases. The retrieved articles were then screened based on inclusion and exclusion criteria, including relevance to the topics of ethnomathematics and numeracy literacy, being empirical research or theoretical studies published in scientific journals, availability of full-text access, and publication within the specified timeframe. Articles that passed the initial screening were further assessed for eligibility through an in-depth review to ensure alignment with the research focus. Subsequently, data extraction was conducted by recording important information from each article,

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including research objectives, methods used, research subjects, findings, and instructional implications (Fitri & Herman, 2023).

Data analysis in this study employed content analysis techniques with a descriptive-analytical approach. The analysis process began with data reduction to identify and select information relevant to the focus of the study. The data were then categorized and coded into specific themes, such as forms of ethnomathematics integration in learning, its impact on numeracy literacy, its influence on student motivation and engagement, and the instructional models or strategies applied (Silitonga et al., 2025). The next stage involved data synthesis and interpretation, which were conducted by organizing the analysis results into descriptive-analytical narratives to identify patterns, trends, and research gaps.

Conclusions were drawn based on the synthesis of the literature to provide a comprehensive overview of the contribution of ethnomathematics to the development of numeracy literacy (Dewi & Defitriani, 2024; Pramudita Irianti et al., 2023). Through this method, the study is expected to provide new insights into the integration of ethnomathematics in numeracy literacy, as well as generate recommendations that can serve as references for educators and policymakers in implementing locally grounded numeracy learning in Indonesia (Pramudita Irianti et al., 2023; Sa et al., 2024).

Results and Discussion

Results

Based on the analysis of relevant articles, an overview was obtained regarding the forms of ethnomathematics integration, the research methods employed, and their impact on the development of students' numeracy literacy. A summary of the analysis results is presented in Table 1.

Table 1. Summary of Research Findings on the Integration of Ethnomathematics in the Development of Numeracy Literacy

No.	Author & Year	Type of Research	Cultural / Ethnomathematics Context	Main Findings Related to Numeracy Literacy
1	Amaliyah et al. (2025)	Research and Development (ADDIE)	Kudus local wisdom (locally-based fraction concepts)	The ethnomathematics-based electronic module was declared feasible (79.04%) and has the potential to improve numeracy literacy through contextual learning.
2	Amreta (2024)	Research and Development (4D)	Tuban local wisdom	The ethnomathematics-based numeracy assessment was effective in improving

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No.	Author & Year	Type of Research	Cultural / Ethnomathematics Context	Main Findings Related to Numeracy Literacy
				learning outcomes with an N-Gain of 0.715 (high category) and very positive student responses (83%).
3	Hajerina et al. (2025)	Mixed Methods (Explanatory Sequential)	Agricultural activities & traditional buildings of Sigi	The majority of students were still in the basic category, indicating that numeracy learning is not optimal when not linked to local cultural contexts.
4	Rahmadeni et al. (2023)	Research and Development (Plomp)	Rejang Lebong culture	The local culture-based numeracy literacy module was declared valid, practical, and effective, with learning mastery reaching 83.3%.
5	(Rediani et al., 2023)	Quasi-experimental	Sasi local wisdom	The local wisdom-based e-module significantly improved scientific literacy, which is relevant as a foundation for strengthening contextual numeracy literacy.
6	Yudianto et al. (2024)	Literature Review	Implementation of the School Literacy Movement (GLS) in Indonesian elementary schools	Numeracy and scientific literacy were most frequently developed through contextual approaches and innovative media based on students' learning environments.
7	Abidah & Ardani (2024)	Quasi Experiment	Ethnomathematics-based Realistic Mathematics Education (RME) (solid geometry linked to local culture)	Fhitung 65,89 > Ftabel 4,225; coefficient of determination 71,8%; thitung 7,2216 > ttabel 2,015 → significantly improves numeracy literacy.
8	Oktarisa et al. (2025)	Research & Development (4D)	Numeracy literacy questions based on the Pacu Jalur Lopek tradition	Validity: 0.910 (very valid); 22 out of 24 items are valid; reliability: 0.79 (good category).

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No.	Author & Year	Type of Research	Cultural / Ethnomathematics Context	Main Findings Related to Numeracy Literacy
9	Adiningsih et al. (2023)	Quasi Experiment (ANOVA dua arah)	PMRI assisted by ethnomathematics-based worksheets	PMRI combined with ethnomathematics-based worksheets is more effective than conventional PMRI; students' high learning interest leads to better numeracy literacy.

Based on the analysis of the nine reviewed articles, it was found that the integration of ethnomathematics into mathematics instruction and assessment makes a significant contribution to the development of numeracy literacy. The analyzed studies employed various research methods, including Research and Development, quasi-experimental designs, mixed methods, and literature reviews, which collectively provide a comprehensive perspective on the role of cultural contexts in numeracy learning.

Findings from development research indicate that ethnomathematics-based learning and assessment tools are feasible, valid, and effective for use. Amaliyah et al. (2025) reported that an electronic module based on Kudus local wisdom achieved a feasibility level of 79.04% and has the potential to improve numeracy literacy through contextual learning. In line with these findings, Amreta (2024) showed that an ethnomathematics-based numeracy assessment within the cultural context of Tuban led to a significant improvement in learning outcomes, with an N-Gain value of 0.715 (high category), and received very positive responses from students. Similar results were also reported by Rahmadeni et al. (2023) and Oktarisa et al. (2025), who stated that locally based cultural modules and numeracy literacy items were valid, reliable, practical, and effective in supporting students' mastery of numeracy literacy.

In experimental studies, the integration of ethnomathematics was proven to have a significant effect on improving numeracy literacy. Abidah & Ardani (2024) found that ethnomathematics-based Realistic Mathematics Education (RME) had a significant impact on numeracy literacy, as indicated by test statistics exceeding critical values. Meanwhile, Adiningsih et al. (2023) demonstrated that PMRI supported by ethnomathematics-based worksheets was more effective than PMRI without ethnomathematics, and also revealed that students' learning interest played an important role in enhancing numeracy literacy skills.

However, not all studies showed optimal results when numeracy learning was not strongly integrated with local cultural contexts. Hajerina et al. (2025) reported that the majority of students remained at a basic level of numeracy ability when instruction was not explicitly linked to local

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cultural activities, such as agricultural practices and traditional buildings. These findings emphasize the importance of integrating cultural contexts into numeracy learning so that students can develop a more contextual and applicable understanding.

Furthermore, the literature review conducted by Yudianto et al. (2024) reinforced the empirical findings by showing that the development of numeracy and scientific literacy in Indonesian elementary schools is most effective when implemented through contextual approaches and the use of innovative media closely related to students' learning environments. This highlights that ethnomathematics functions not only as a pedagogical approach but also as a strategy for creating numeracy learning that is relevant to students' everyday lives.

Overall, the results of this literature review indicate that the integration of ethnomathematics into mathematics education has great potential to enhance students' numeracy literacy. The utilization of local cultural contexts makes learning more meaningful, increases student engagement, and helps students connect mathematical concepts with real-life situations. These findings underscore the urgency of developing ethnomathematics-based numeracy learning as an innovative strategy in mathematics education in Indonesia.

Discussion

The results of the literature review indicate that the integration of ethnomathematics into mathematics instruction and assessment makes a significant contribution to the development of students' numeracy literacy. These findings align with the conceptual framework of numeracy literacy, which emphasizes the importance of the ability to understand, interpret, and apply mathematical concepts in real-life contexts. Ethnomathematics serves as a bridge between abstract mathematical concepts and students' concrete experiences by utilizing local culture as a learning resource.

Studies employing the Research and Development (R&D) approach demonstrate that ethnomathematics-based instructional and assessment tools are valid, practical, and effective. This indicates that the integration of cultural contexts is not merely conceptual but can also be realized in the form of structured learning products that are empirically tested. High N-Gain scores, along with strong validity and reliability levels, show that ethnomathematics-based learning can significantly improve numeracy literacy achievement. Therefore, this approach is relevant in supporting the implementation of the Minimum Competency Assessment (AKM), which emphasizes contextual thinking and problem-solving skills.

Findings from experimental studies further reinforce the effectiveness of the ethnomathematics approach. Learning models such as RME and PMRI combined with local cultural contexts have proven to be more effective than models that do not integrate cultural elements. This suggests that

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students' mathematical understanding improves when learning is connected to familiar social experiences and environments. Theoretically, these findings support the constructivist view that knowledge is constructed through interaction between real experiences and individuals' cognitive structures.

On the other hand, research results indicating that the majority of students remain at a basic numeracy level when instruction is not linked to local culture highlight a gap between formal mathematics learning and students' real-life contexts. This condition is consistent with PISA reports showing the low level of Indonesian students' mathematical literacy in solving contextual problems. Therefore, the integration of ethnomathematics can be viewed as a strategic approach to addressing the issue of low numeracy literacy through more relevant and meaningful learning.

In addition to cognitive aspects, several studies also reveal positive impacts on affective aspects, such as increased motivation, learning interest, and student engagement. Culture-based learning provides a more enjoyable learning experience and fosters a sense of ownership in the learning process. This is important because numeracy literacy is not only related to computational skills but also to developing positive attitudes toward mathematics.

However, the implementation of ethnomathematics still faces several challenges, including limited teacher understanding, a lack of locally based cultural learning resources, and the absence of systematic integration of this approach into the curriculum. Therefore, strengthening teacher competencies through training, developing modules based on local wisdom, and providing educational policy support that encourages contextual learning innovation are necessary.

Overall, this discussion affirms that ethnomathematics is not merely an alternative approach but a relevant pedagogical strategy for developing numeracy literacy in Indonesia. The integration of local culture into mathematics learning has the potential to enhance conceptual understanding, problem-solving skills, and student engagement holistically. Thus, the development of ethnomathematics-based numeracy literacy can serve as a strategic solution to improving the quality of mathematics education in the era of the Merdeka Curriculum.

Conclusion

Based on the results of the literature review conducted, it can be concluded that the integration of ethnomathematics into mathematics instruction and assessment makes a significant contribution to the development of students' numeracy literacy. The use of local cultural contexts as learning resources is able to bridge abstract mathematical concepts with students' real-life experiences, making learning more contextual, meaningful, and relevant to everyday life.

The findings indicate that various ethnomathematics-based instructional approaches and learning tools such as modules, e-modules, assessments, and student worksheets are considered valid,

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practical, and effective in improving numeracy literacy skills. This approach not only enhances students' cognitive abilities in understanding and applying numeracy concepts but also contributes to increased motivation, learning interest, and student engagement in the mathematics learning process.

Nevertheless, this literature review also identifies several challenges in the implementation of ethnomathematics, including limited teacher understanding of the concept and its application, a lack of locally based cultural learning resources, and the suboptimal integration of ethnomathematics into the curriculum and educational policies. Therefore, systematic efforts are needed, including strengthening teacher competencies, providing instructional materials based on local wisdom, and implementing supportive policies that encourage innovation in contextual numeracy learning.

Overall, ethnomathematics can be viewed as a promising and relevant pedagogical strategy to support the development of numeracy literacy in Indonesia, particularly within the context of the Merdeka Curriculum. The integration of local cultural values into mathematics learning is expected to improve the quality of numeracy education while fostering students' appreciation of local wisdom as part of the nation's cultural identity.

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