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INTEGRATION OF ETHNOMATHEMATICS IN STRENGTHENING HIGH SCHOOL STUDENTS' NUMERACY LITERACY

Herwandi[1*], Agustan S[2], Nasrun[3], Muh. Fachrullah Amal[4]

[1]Institut Teknologi dan Kesehatan Permata Ilmu Maros, Maros, Indonesia.
[2,3]Universitas Muhammadiyah Makassar, Makassar, Indonesia.
[4]SMA Negeri 3 Maros, Maros, Indonesia.

** Korespondensi Penulis. E-mail: herwandi.itkpi@gmail.com*

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ABSTRACT
This study aims to analyze the integration of ethnomathematics in strengthening students' numeracy literacy at SMA Negeri 3 Maros. The study was motivated by the low level of students' numeracy literacy, which remains a major challenge in mathematics learning, particularly in understanding and solving contextual problems. Ethnomathematics is considered a relevant learning approach because it connects mathematical concepts with local cultural contexts, making learning more contextual and meaningful. This study employed a descriptive qualitative approach. The research subjects consisted of 32 students who completed a Likert-scale questionnaire, 3 students who participated in in-depth interviews, and 1 mathematics teacher who was also interviewed. Data collection techniques included questionnaires and in-depth interviews. Data analysis was conducted through the stages of data reduction, data display, and conclusion drawing. The findings revealed that the integration of ethnomathematics contributed positively to strengthening students' numeracy literacy. A total of 84.3% of students stated that the use of local cultural contexts helped them understand the use of mathematical numbers and symbols in daily life, while 81.2% reported that they found it easier to analyze contextual mathematical problems when learning activities were linked to local culture. Interview results also indicated that ethnomathematics-based learning helped students understand mathematical concepts more concretely, improved their ability to solve numeracy problems, and enhanced their ability to interpret and communicate mathematical problem-solving processes. Furthermore, the mathematics teacher stated that integrating local culture into mathematics learning increased students' participation and engagement during the learning process. This study concludes that ethnomathematics can serve as an innovative, contextual, and meaningful mathematics learning approach to support the strengthening of numeracy literacy among senior high school students.

INTRODUCTION

Numeracy literacy has become one of the fundamental competencies required to address the challenges of twenty-first-century education. Numeracy literacy is not merely defined as the ability to perform basic arithmetic operations; it also encompasses an individual's capacity to understand, analyze, and apply mathematical concepts to solve

various contextual problems encountered in daily life (Sape, 2024; Bell et al., 2023). The Programme for International Student Assessment (PISA) considers numeracy literacy an important indicator for measuring the quality of a country's education system (Firdaus, 2024; Lechner et al., 2021). Reports from the Organisation for Economic Co-operation and Development (OECD) indicate that Indonesian students' numeracy performance remains below the average of participating countries (Lukman et al., 2025; Gashaj et al., 2023). This condition suggests that mathematics education in schools has not yet optimally developed students' critical thinking, problem-solving, and mathematical reasoning skills (Getenet & Getnet, 2023).

The low level of students' numeracy literacy in Indonesia is influenced by various factors, one of which is the mathematics learning process that tends to be abstract, procedural, and insufficiently connected to students' real-life experiences (Herwandi, 2025). Learning activities that emphasize routine problem-solving often encourage students to memorize formulas rather than understand mathematical concepts contextually (Sape, 2025). Research conducted by Yayuk revealed that more than 70% of students experienced difficulties in solving authentic problems requiring numerical interpretation and mathematical reasoning skills (Yayuk et al., 2023). Similarly, a study by Supriadi reported that the weak connection between mathematics content and students' socio-cultural environments resulted in less meaningful learning experiences and reduced students' learning motivation (Supriadi et al., 2024). These findings highlight the need for innovative learning approaches capable of integrating real-life contexts and local culture into mathematics education.

One approach considered relevant for strengthening numeracy literacy is ethnomathematics (Sape et al., 2025). The concept of ethnomathematics was first introduced by Ubiratan D'Ambrosio, who defined it as the study of mathematical practices that develop within particular cultural groups (Tampa et al., 2023). This approach positions local culture as a learning resource that can help students understand mathematical concepts in a more concrete and contextual manner. In practice, ethnomathematics enables students to connect numeracy concepts with cultural activities in their surroundings, such as the geometric patterns of traditional houses, traditional measurement systems, local handicrafts, and community economic activities (Sakti et al., 2024). Research conducted by Nur Azmi demonstrated that ethnomathematics-based learning could improve students' mathematical problem-solving abilities and engagement in the learning process (Nur Azmi & Rosdiana, 2022). Furthermore, Sape found that integrating local culture into mathematics learning significantly enhanced students' numeracy literacy because students could more easily understand concepts through familiar cultural experiences (Sape et al., 2025).

Although numerous studies on ethnomathematics have been conducted, most of them have focused on improving mathematics learning outcomes in general and have predominantly been implemented at the elementary and junior secondary school levels. Research specifically examining the integration of ethnomathematics in strengthening numeracy literacy at the senior high school level remains limited. In addition, studies highlighting the local cultural context of South Sulawesi, particularly Maros Regency, are still scarce in accredited national scientific publications. In fact, Maros Regency possesses rich cultural traditions and social activities that have the potential to serve as valuable resources for contextual mathematics learning. Various elements of local culture, including traditional carving patterns, indigenous architectural forms, community trading activities, and traditional measurement systems, contain mathematical concepts that can be integrated into numeracy learning in schools.

Based on these conditions, the integration of ethnomathematics is considered a relevant alternative solution for strengthening students' numeracy literacy (Sape & Syamsuddin, 2025). This approach is not only oriented toward improving students' mathematical competencies but also contributes to the preservation of local culture through education (Nur Azmi & Rosdiana, 2022). Mathematics learning connected to local cultural contexts is expected to create more meaningful learning experiences, enhance students' learning motivation, and assist them in understanding numeracy concepts in practical and

applicable ways in everyday life. Therefore, this study is important to investigate how the integration of ethnomathematics can support the strengthening of numeracy literacy among students at SMA Negeri 3 Maros.

This study is expected to contribute theoretically to the development of ethnomathematics and numeracy literacy studies while also serving as a practical reference for teachers in designing mathematics learning based on local cultural contexts. Furthermore, the findings are expected to provide an alternative model of contextual learning innovation that is relevant to the demands of twenty-first-century education and supports the strengthening of local cultural identity through educational practices in schools.

METHODS

This study employed a qualitative research design with a descriptive approach. This approach was selected because the study aimed to obtain an in-depth understanding of the integration of ethnomathematics in strengthening students' numeracy literacy within mathematics learning at school. Descriptive qualitative research enables researchers to systematically, factually, and contextually describe learning phenomena based on the experiences and perspectives of the research participants. According to Sugiyono, qualitative research is used to gain a comprehensive understanding of social phenomena through data collection in natural settings, with the researcher serving as the primary research instrument (Sugiyono, 2022).

This study was conducted at SMA Negeri 3 Maros. The research participants consisted of students and a mathematics teacher. Participants were selected using a purposive sampling technique based on specific criteria aligned with the objectives of the study. Data collection through questionnaires was administered to one class consisting of 32 students. Subsequently, three students were selected for in-depth interviews based on their questionnaire responses and their ability to communicate and explain their learning experiences. In addition, one mathematics teacher was interviewed to obtain information regarding the implementation of ethnomathematics in mathematics instruction and its influence on students' numeracy literacy skills.

The research instruments consisted of questionnaires and in-depth interviews. The questionnaire was used to collect data regarding students' perceptions and experiences related to the integration of ethnomathematics in mathematics learning and its contribution to strengthening numeracy literacy. The questionnaire was developed using a Likert scale with five response options: strongly agree, agree, neutral, disagree, and strongly disagree. The questionnaire indicators included understanding of numeracy concepts, ability to solve contextual problems, relevance of learning to local culture, learning motivation, and student engagement during the learning process.

In addition to the questionnaire, in-depth interviews were employed as the primary instrument to obtain more comprehensive information regarding students' learning experiences and the implementation of ethnomathematics in mathematics instruction. The interviews were conducted in a semi-structured format, allowing the researcher to follow a predetermined interview guide while providing participants with the flexibility to elaborate on their experiences and perspectives. Student interviews focused on their understanding of local culture-based numeracy concepts, learning experiences during ethnomathematics-based instruction, and challenges encountered in understanding mathematical content. Meanwhile, the interview with the mathematics teacher focused on instructional strategies, the integration of local cultural contexts into mathematics learning, and the teacher's perceptions of the influence of ethnomathematics on students' numeracy literacy skills.

Data analysis was conducted using a descriptive qualitative approach through several stages, namely data reduction, data display, and conclusion drawing, as proposed by Matthew B. Miles and A. Michael Huberman. Data reduction involved selecting and simplifying data relevant to the focus of the study. The data were then presented in the form of descriptive narratives to facilitate the identification of patterns and relationships among the observed

phenomena. The final stage involved drawing conclusions based on the results obtained from the questionnaire and interview data analysis.

The trustworthiness of the data was ensured through methodological triangulation and source triangulation. Methodological triangulation was conducted by comparing data obtained from questionnaires and interviews, whereas source triangulation involved comparing information gathered from students and the mathematics teacher. These procedures were implemented to enhance the credibility and validity of the findings, ensuring that the results accurately represented the actual conditions regarding the integration of ethnomathematics in strengthening students' numeracy literacy at SMA Negeri 3 Maros.

RESULTS AND DISCUSSION

This study aimed to analyze the integration of ethnomathematics in strengthening students' numeracy literacy at SMA Negeri 3 Maros. Research data were collected through questionnaires administered to 32 students and in-depth interviews conducted with three students and one mathematics teacher. Data analysis was carried out through the stages of data reduction, data display, and conclusion drawing following the interactive analysis model proposed by Matthew B. Miles and A. Michael Huberman. The study focused on numeracy literacy indicators, including the ability to use numbers and mathematical symbols, the ability to analyze quantitative information, the ability to solve contextual problems, the ability to interpret calculation results, and the ability to communicate mathematical problem-solving processes.

During the data reduction stage, the questionnaire and interview results were categorized according to the numeracy literacy indicators. The questionnaire findings indicated that the integration of ethnomathematics had a positive influence on students' numeracy skills. A total of 84.3% of students stated that the use of local cultural contexts helped them understand the application of numbers and mathematical symbols in everyday life. Furthermore, 81.2% of students reported that they found it easier to analyze mathematical problems when the questions were related to cultural activities or their surrounding environment. In addition, 78.1% of students stated that ethnomathematics-based learning helped them solve word problems and contextual mathematical tasks more effectively. Regarding the indicator of interpreting calculation results, 75% of students reported that they were able to explain the meaning of mathematical calculations within real-life contexts after participating in local culture-based learning activities. Moreover, 71.8% of students acknowledged feeling more confident in communicating their mathematical problem-solving processes during classroom instruction.

These findings indicate that the integration of ethnomathematics not only enhances students' theoretical understanding of mathematical concepts but also enables them to apply numeracy skills in practical situations encountered in daily life. Mathematics learning that is connected to local cultural contexts creates more concrete learning experiences, allowing students to better understand the relationship between mathematical concepts and the social realities within their communities.

During the data display stage, interview findings were used to support and enrich the questionnaire results. Based on the interview with Student 1, information was obtained regarding the ability to use numbers and mathematical symbols within local cultural contexts. Student 1 stated:

> "When the teacher explained calculations related to the dimensions of traditional houses and carving patterns, it became easier for me to understand how to use mathematical formulas because I could directly observe the shapes and examples."

This statement demonstrates that the integration of ethnomathematics helps students understand the use of mathematical symbols and concepts through real objects found within local culture. Students do not merely memorize formulas but are able to comprehend their functions and applications within community life. The use of traditional house patterns and traditional carvings as learning media enables students to connect geometric concepts with

familiar cultural realities. This finding indicates an enhancement of numeracy skills, particularly in the use of mathematical symbols and representations.

Regarding the indicator of analyzing quantitative information, Student 2 stated:

> "I find it easier to understand ratio and percentage problems when the teacher provides examples related to sales outcomes or trading activities within the community."

This interview excerpt indicates that students are better able to analyze numerical information when mathematical content is connected to economic activities that are familiar to them. The integration of local culture into learning helps students understand the relationship between numbers, data, and real-life situations. Students are not limited to performing calculations mechanically but are also able to interpret the quantitative meaning of the problems presented. This finding demonstrates that ethnomathematics supports the development of students' numeracy analysis skills in solving contextual problems.

In relation to the ability to solve contextual problems, Student 3 explained:

> "I usually have difficulty understanding mathematical word problems, but when the examples are based on daily activities or local cultural practices, it becomes easier for me to determine the steps needed to solve them."

This statement indicates that local cultural contexts help students understand the structure of mathematical problems more concretely. Ethnomathematics-based learning facilitates students in identifying important information within a problem, determining appropriate solution strategies, and connecting mathematical concepts to real-life situations. This finding suggests that the integration of ethnomathematics enhances students' contextual problem-solving abilities, which constitute an essential component of numeracy literacy.

In addition to the students, an interview was also conducted with the mathematics teacher to gain insights into the implementation of ethnomathematics in classroom instruction. The teacher stated:

> "When mathematics content is connected to local culture, students become more active in discussions and find it easier to explain the reasoning behind their answers because they understand the context of the problems presented."

The teacher's statement indicates that the integration of ethnomathematics not only improves students' ability to solve mathematical problems but also supports their ability to communicate their thinking processes and reasoning in solving numeracy-related tasks. Students become more active in explaining solution procedures and are better able to interpret calculation results based on real-life contexts. This finding highlights the strengthening of mathematical communication skills as an integral component of students' numeracy literacy.

The findings of this study are consistent with the research conducted by Nur Azmi, which demonstrated that ethnomathematics-based learning enhances students' problem-solving abilities and mathematical reasoning through contextual approaches grounded in local culture (Nur Azmi & Rosdiana, 2022). Furthermore, research by Sape revealed that integrating local culture into mathematics learning significantly improves students' numeracy literacy because students can more easily understand mathematical concepts through familiar cultural experiences (Sape & Syamsuddin, 2025). Another study conducted by Tampa also found that contextual learning based on socio-cultural environments contributes to the improvement of numeracy interpretation skills and student engagement in mathematics learning (Tampa et al., 2023).

Based on the results of data reduction and data display, it can be concluded that the integration of ethnomathematics makes a positive contribution to strengthening students' numeracy literacy at SMA Negeri 3 Maros. The use of local culture as a learning context helps students understand mathematical concepts more concretely, enhances their ability to analyze quantitative information, facilitates the resolution of contextual problems, and improves their ability to interpret and communicate mathematical problem-solving outcomes.

This study demonstrates that ethnomathematics is a relevant instructional approach for strengthening numeracy literacy among senior high school students. Mathematics learning that is connected to local cultural contexts not only helps students understand numeracy concepts theoretically but also develops their ability to apply mathematics in real-life situations.

Furthermore, this approach supports the preservation of local culture through the integration of cultural values and practices into the educational process. Therefore, ethnomathematics can serve as an innovative, contextual, and meaningful alternative for mathematics instruction that aligns with the demands of twenty-first-century education.

CONCLUSION

Based on the findings and discussion of this study, it can be concluded that the integration of ethnomathematics into mathematics instruction contributes positively to strengthening students' numeracy literacy at SMA Negeri 3 Maros. The results indicate that ethnomathematics-based learning enhances several indicators of numeracy literacy, including the ability to use numbers and mathematical symbols, analyze quantitative information, solve contextual problems, interpret calculation results, and communicate mathematical problem-solving processes. The questionnaire data revealed that the majority of students responded positively to the implementation of ethnomathematics in mathematics learning because it helped them understand the subject matter more easily and meaningfully. Furthermore, the interview findings with both students and the mathematics teacher demonstrated that the use of local cultural contexts improved conceptual understanding, facilitated the solution of numeracy-related problems, and increased student engagement throughout the learning process.

This study also demonstrates that ethnomathematics functions not only as an instructional approach in mathematics education but also as a medium for connecting numeracy concepts with the cultural realities of society. The incorporation of local cultural elements, such as community trading activities, traditional architectural patterns, and everyday cultural practices, helps students understand the practical application of mathematics in real-life contexts. As a result, mathematics learning becomes more relevant, applicable, and extends beyond the procedural mastery of formulas.

Overall, this study addresses the research problem by demonstrating that the integration of ethnomathematics can support the strengthening of students' numeracy literacy through contextual mathematics learning grounded in local cultural contexts. Therefore, ethnomathematics can be considered a relevant instructional innovation for improving the quality of mathematics education while simultaneously supporting the preservation of local cultural heritage within educational settings.

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