Malaysian Journal of Mathematical Sciences 20(1): 275–291 (2026)
https://doi.org/10.47836/mjms.20.1.14

Malaysian Journal of Mathematical Sciences

Journal homepage: https://mjms.upm.edu.my

The Effectiveness of Student Worksheets Based on Integrated Mathematics Literacy Local Wisdom of Maluku Culture Through Ethnomathematics in Improving the Quality of Learning

Sopamena, P. * [1], Latuconsina, A. [1], Kadir, E. [1], Assagaf, G. [2], and Sehuwaky, N. [2]

[1]*Mathematics Study Program, Postgraduate, UIN AM Sangadji Ambon, Ambon 97128, Maluku, Indonesia*
[2]*Mathematics Education Study Program, Faculty of Tarbiyah and Teacher Training, UIN AM Sangadji Ambon, Ambon 97128, Maluku, Indonesia*

E-mail: patma.sopamena@iainambon.ac.id
**Corresponding author*

Received: 31 October 2024
Accepted: 28 July 2025

Abstract

This study aims to develop and evaluate the effectiveness of student worksheets (SW) centered on mathematical literacy, enriched with elements of Maluku's cultural wisdom through an ethnomathematics approach. The integration of local culture into mathematics instruction aims to enhance students' understanding of mathematical concepts while cultivating an appreciation for Maluku's cultural heritage. The development of the SW followed the 4-D model, which consists of four stages: definition, design, development, and dissemination. Subsequently, a descriptive quantitative method was employed to assess the product's quality, involving fifth-grade students from SD Cendekia Ambon, Indonesia. The SW was evaluated based on its validity, practicality, effectiveness, and impact on learning outcomes. Data analysis was performed to measure the effectiveness and improvement in students' learning achievements using percentage calculations. The results indicate that ethnomathematics-based SW was highly effective in improving student learning outcomes, with notable improvements observed in both conceptual understanding and mathematical literacy skills. In addition, the SW facilitated more contextualized and meaningful learning experiences. Thus, this culturally integrated worksheet shows potential as a valuable tool to enhance the quality of mathematics education at the elementary school level.

Keywords: student worksheets; mathematical literacy; local wisdom of Maluku culture; Ethnomathematics; student learning outcome.

1 Introduction

This study is grounded in the theoretical framework of ethnomathematics (D'Ambrosio, 1985), which emphasizes the role of culture in shaping mathematical understanding [44, 8]. The integration of local wisdom from Maluku into mathematics learning aligns with the principles of contextual teaching and learning (CTL), where knowledge is located within the lived experiences of students. Additionally, the development of mathematical literacy aligns with the OECD definition, focusing on students' ability to formulate, apply, and interpret mathematics in diverse contexts.

The application of elementary school mathematics learning that is oriented towards students' daily life problems is an essential aspect for educators to address, particularly from the initial introduction to numeration. Integrating abstract knowledge into real-world objects [54], the student learning experience [6] is also integrated with local wisdom, motivating students to learn [21]. However, this does not occur in the classroom learning process [58, 45]. The focus of problem solving in math books is analytical and difficult for students [33]. Therefore, learning that integrates mathematical literacy with an ethnomathematical approach is crucial to be applied.

Based on the results of the 2022 Program for International Student Assessment (PISA) study released by the Organization for Economic Cooperation and Development (OECD), one of the contents of the math ability questions is related to mathematical literacy [50]. The results of the survey showed that the mathematical ability of Indonesian students related to mathematical literacy with an average score of 366 from the average score of OECD of 450 was ranked 60 out of 73 countries. This indicates that Indonesian students still have a low level of mathematical literacy [37, 36]. Therefore, teachers also need to improve their understanding of literacy practices to improve teaching and learning, especially in mathematics [4]. Mathematical literacy is the ability to solve problems in a context [34] and to understand and use fundamental mathematics in daily life [38]. The ability to formulate, solve, and understand mathematics in various contexts is another aspect of mathematical literacy [35]. Therefore, mathematical literacy is the ability of pupils to formulate, solve, and understand mathematics in various contexts, enabling them to address mathematical problems in everyday life.

Calculating is only one aspect of mathematical literacy; another is thinking mathematically while also considering the environment in which mathematics is applied [50]. The teacher assessment literacy instrument [20], instructional materials [14], and the creation of mathematical literacy tools [12] are some strategies to improve mathematical literacy abilities. The creation of Student Worksheets (SW), which incorporate mathematical literacy based on local wisdom using an ethno-mathematical approach, is one way in which innovation is required in the creation of instructional materials. In the context of indigenous Maluku knowledge, this is also true. The purpose of incorporating mathematical literacy into student worksheets according to Mujahidah and Suparman [30] is to:

1. Foster a thorough comprehension of mathematical ideas.
2. Improve students' capacity to use mathematical ideas in practical contexts.
3. Develop their capacity for critical analysis and problem solving.

In addition to cultural elements, local wisdom includes beliefs, practices, and information that can enhance the educational process [5]. However, the integration of local wisdom into mathematics learning often faces practical obstacles. Teachers generally face the pressure of a dense curriculum, limited resources, and a lack of concrete examples or teaching materials that have been

systematically developed. In addition, not all teachers feel confident in adapting cultural content to a mathematical context. It is anticipated that incorporating local knowledge into mathematics instruction will result in a relevant and contextual learning environment. For instance, geometry and trigonometry can be taught using the Maluku maritime heritage, which is rich in navigational expertise. This research is presented as an effort to bridge this gap by providing worksheets that are not only culturally relevant but also easy to use and proven effective in improving student understanding. Student Worksheets (SW) that integrate mathematical literacy and are based on local wisdom can increase the effectiveness of learning. According to Ramdiah et al. [43], utilizing learning models and resources rooted in Kalimantan knowledge has a positive impact on students' learning outcomes, enhancing their cultural literacy and civic engagement [22], and facilitating their understanding of the fundamentals of mathematics [53].

The integration of local cultural elements into mathematics education, commonly referred to as ethnomathematics, has been shown to increase students' interest and deepen their conceptual understanding [55]. By connecting abstract mathematical concepts to familiar cultural contexts, students are more likely to perceive mathematics as relevant and meaningful, rather than as a set of isolated procedures. This enhanced relevance fosters greater engagement and motivation, which in turn supports improved learning outcomes. In this context, the development of student worksheets (SWs) that incorporate mathematical literacy within the cultural wisdom of Maluku represents a pedagogically sound and contextually responsive strategy. In addition, ethnomathematics in Indonesia has been researched by many people, including related to the exploration of mathematical concepts in local cultural practices by [2, 39], ethnomathematics as an old mosque building between myth and science [49], ethnomathematics as a learning resource in mathematics learning by [41, 56], preservation of local culture through ethnomathematical integration by [46, 48], and the development of ethnomathematics-based learning media by [47, 40]. Furthermore, using the mathematics learning approach categorized in product development and evaluation of the quality of learning instruments by [5, 27], the impact of learning interventions on academic achievement by [42, 23], development of mathematical literacy and thinking skills by [14, 28], the use of local culture as a context for mathematics learning by [42, 28], and indirect impact on the formation of values and attitudes by [23, 26].

Based on these ethnomathematical studies, there has not been much research on the implementation of student worksheets that integrate mathematical literacy based on local wisdom through an ethnomathematical approach in mathematics learning. More ethnomathematical research is done separately. Therefore, this study aims to explore the relationship between the implementation of student worksheets, mathematics learning, mathematical literacy, local wisdom in the context of Maluku, and ethnomathematics. It aims to test the effectiveness of student worksheets that integrate mathematical literacy based on local wisdom from Maluku, using an ethnomathematical approach, in improving the quality of learning.

2 Related Works

Mathematics is defined as the ability to apply mathematical knowledge and skills in real-world situations. It extends beyond routine calculations to encompass problem-solving, reasoning, and critical thinking. Additionally, these student worksheets help bridge the gap between theoretical mathematics and practical applications, promoting a deeper understanding of mathematical concepts. Furthermore, Local wisdom functions as a valuable cultural asset that can enrich the educational process by providing a contextual learning experience.

Research has shown that incorporating local cultural elements into education, such as traditional knowledge, customs, and practices, helps students connect their learning to real-life experiences, thereby improving their understanding and retention of knowledge. Including cultural elements in teaching materials can also foster cultural preservation and appreciation among students. Linking mathematical literacy with ethnomathematics and local wisdom is an effective strategy to improve the quality of learning. This approach not only enhances students' understanding of mathematics but also instills cultural values and critical thinking skills. Thus, implementing this approach in the curriculum can be one of the strategic steps to create relevant, inclusive, and meaningful learning experiences.

Related research that connects mathematical literacy, ethnomathematics, and local wisdom has demonstrated numerous positive impacts on improving the quality of learning. Yohanes et al. [57] emphasized that culture-based mathematical literacy can facilitate more contextual learning when students encounter mathematical situations closely related to their daily lives. The integration of local culture in teaching materials has also been proven effective in building a deeper understanding of students, among them which emphasis on the systemic development of teaching tools (lesson plans, LKS, models) that are empirically tested to improve learning outcomes [13, 43], digital media is used as a forum for multidimensional integration between academic content, technology, culture, and character building, to build 21^{st} century skills [22, 31], innovation of media formats or question forms (story questions) to make mathematics more interesting, relevant, and easy for students to understand [19, 1], and mathematics is used not only as a discipline, but as a medium for cultural preservation and character formation [22, 31].

In addition, research conducted by Mairing [26] shows that ethnomathematics approaches can increase students' interest and involvement in mathematics learning, primarily through activities that reflect the traditions and lives of local communities. Other research conducted by Eriawandi et al. [15] and Latif and Talib [22] indicates that ethnomathematics-based learning helps students more easily understand the mathematical concepts being taught because they relate them to known cultural practices.

In the context of creating student worksheets, research by Nasution and Yerizon [32] and Hidayanti et al. [16] found that mathematical literacy-based student worksheets improve students' problem-solving abilities. This research has implications for the value of practice for students, which serves as both a learning tool and a way to connect mathematical concepts with the local cultural context, as evidenced by the findings of studies by Dewi et al. [10, 11], which found that a local wisdom-based approach can enhance the caliber of student comprehension and learning outcomes.

While qualitative findings suggest increased student engagement, few offer quantitative data on improvements in mathematical literacy. Additionally, many focus on general cultural integration rather than structured development models or measurable learning outcomes. Our study builds on this foundation by combining:

(a) A validated 4-D development model.

(b) Empirical assessment of validity, practicality, and effectiveness.

(c) Integration of Maluku-specific cultural elements.

This combination allows us to contribute not only to pedagogical innovation but also to policy discussions on culturally responsive curricula.

3 Materials and Methods

3.1 Research design

This study uses a descriptive quantitative research method. The student worksheet was developed based on validated results from a 4-D model, which was validated through research. The worksheet was implemented over four sessions (60 minutes each):

(a) Two group-based activities with teacher guidance.

(b) Two individual assessments. Students engaged in tasks such as:

- Measurement of geometric patterns in traditional Maluku textiles.
- Calculating distances based on maritime navigation symbols.

Observation revealed strong student participation and enthusiasm, especially during hands-on cultural tasks.

3.2 Research subjects

The study subjects were fifth-grade students from Ambon's Elementary School. The purpose of selecting these youngsters was to evaluate the efficacy of the student worksheet, which combines Maluku cultural wisdom with mathematical literacy. This study examines the potential effects of student worksheets on mathematical comprehension and learning engagement. Teachers who use student worksheets in the classroom are also included in the study's subject matter because their participation in the use and implementation of these resources is crucial to assessing the usefulness and efficacy of the instructional materials created.

3.3 Research instruments

Student worksheets, learning outcome exams, student activity observation sheets, questionnaires to gauge students' responses to the worksheets, and teacher-completed learning management observation sheets are among the research tools used in this study. Learning outcome assessments, student activity observation sheets, questionnaires to gauge students' responses to student worksheets, and teacher-completed learning management observation sheets are some of the research tools utilized in the creation of this student worksheet. The purpose of the learning outcome test was to assess students' comprehension of mathematical ideas incorporated into Maluku culture. The student activity observation sheet was used to gauge the level of participation of the students in the worksheet. The students received a questionnaire to determine to what extent they responded favorably to the student worksheet; at least 50% of students had to answer favorably to 70% of the assessed factors. With the criterion that instructors' skills must fall into the high category for student worksheets to be deemed effective, the learning management observation sheet is used to evaluate how well teachers utilize student worksheets in the classroom.

3.4 Data analysis

The data collected in this study were analyzed quantitatively. Quantitative analysis is conducted using descriptive statistics to assess the level of proficiency and understanding among students. The data analyzed in this study include trial results, data related to learning implementation, teachers' ability to manage learning, student activity data, learning outcome data, and student response data. From the data obtained, two categories of analysis were made:

1. Practicality analysis (data from observation of learning implementation).
2. Effectiveness analysis (data from observations on teachers' capacity to supervise learning, student activities, responses, and learning outcomes).

Furthermore, the criteria used to determine that the learning student worksheet has a good level of implementation are that the minimum value X and Ai are in the category of being carried out mainly. The following Table 1 are the criteria for the implementation of learning:

Table 1: Learning implementation criteria.

Criteria for the Implementation of Learning SW	Implementation Level of SW Learning
$M > 2$	Fully implemented
$1.5 \leq M \leq 2$	Mostly Implemented
$0.5 \leq M \leq 1.5$	Partially Implemented
$0.0 \leq M \leq 0.5$	Not at all

Source: Adopted from Nurdin's dissertation (2007)[3].

$M = A_i$ to seek the feasibility of every aspect.
$M = X$ to seek the feasibility of the entire aspect.

The analysis's findings can serve as a foundation for updating the tested student worksheet. The analysis's findings can serve as a foundation for updating the tested student worksheet:

(1) Teachers' ability to manage learning:
The following Table 2 illustrates the criteria for the teacher's ability to manage learning.

Table 2: Criteria for teacher ability to manage learning.

Criteria for Teachers' Ability to ML	Teacher's Ability Level
$KG \geq 4.5$	Very high
$3.5 \leq KG \leq 4.5$	High
$2.5 \leq KG \leq 3.5$	Moderate
$1.5 \leq KG \leq 2.5$	Low
$KG < 1.5$	Very low

Source: Adopted from Nurdin's dissertation (2007) [3].

(2) Student activities:
The ideal percentage of time that should be used in student activities is depicted in Table 3.

Table 3: Ideal time percentage of student activities.

No.	Student Activity Category	Time (%)	Achieving ideal time (%)	Ideal time tolerance interval
1.	Listen to or pay attention to the teacher's explanations, take notes, and ask questions as necessary.	20	21	16–26
2.	Group students and distribute student worksheets.	10	11	6–16
3.	Working on a student worksheet.	40	42	39–47
4.	Discuss or ask questions among fellow students about the results of the student worksheet work during the presentation by one of the groups.	15	16	11–21
5.	Take quizzes.	10	11	6–16
6.	Summarizing the subject matter.	10	11	6–16
7.	Doing things that are not related to Teaching and Learning Activities.	0	0	0–5

Source: Adopted from Nurdin's dissertation (2007) [3].

$$\text{Response percentage} = \left(\frac{\text{The number of positive responses to each aspect that emerged}}{\text{Total number of students}}\right) \times 100\%.$$

(3) Learning outcome test using learning objective completeness criteria:
The following Table 4 shows the criteria for completeness of learning objectives that must be achieved.

Table 4: Ideal time percentage of student activities.

Interval	Criterion	Intervention
0-40	Have not reached the goal	Remedial in all parts
41-65	Not yet complete	Remedial where needed
66-85	It has reached completeness	No need for remedial
86-100	It has reached completeness	Need more enrichment/challenges

Source: Adopted from Nurdin's dissertation (2007) [3].

4 Results

4.1 Test results

4.1.1 Analysis of the practicality of student worksheets in learning

Information related to the practicality of Student Worksheets in learning was obtained from two observers. As part of the observation analysis conducted during the deployment of the learning Student Worksheet, the instrument's reliability is assessed to evaluate the practicality of learning. Table 5 provides a summary of the findings from the examination of the learning implementation data:

Table 5: Results of learning implementation analysis.

No.	Observation Aspect	Percentage of Agreements	Category	Average observation results	Category
1.	Syntax.	0.75	Reliable	3.71	Fully implemented
2.	Social interaction	0.67	Reliable	3.30	Fully implemented
3.	Reaction principle	0.75	Reliable	3.50	Fully implemented
	Average	0.73	Reliable	3.50	Fully implemented

The investigation into the dependability of total learning implementation yielded a reliability coefficient of R=73%, or 0.73, suggesting that it is dependable. Based on the average observation findings from two observers, M = 3.50, the full implementation of learning falls into the category of fully implemented $(M > 2)$.

4.1.2 Analysis of the effectiveness of student worksheet in learning

The effectiveness criteria that must be met for a learning Student Worksheet to be said to be effective include:

1. Teachers' ability to manage learning is at a level according to the minimum teacher competency score (CS) is relatively high.
2. The student's activity reaches a specific ideal time, provided that the group discussion and presentation activities which are the main components of cooperative learning meet at least six of the seven criteria.
3. The student's favorable reaction to the student worksheet, in which over half of the students provide a favorable response for at least 70% of the questions.

The following describes the results of the analysis of the effectiveness of the Student Worksheet in learning after being piloted:

(1) Data on teachers' ability to manage learning:

Data on teachers' proficiency in overseeing cooperative-based learning, as assessed through the use of the Student Worksheet created, were gathered using the observation sheet instrument. Table 6 provides an overview of the findings from the examination of teachers' capacity to manage learning.

Table 6: Results of analysis of teachers' ability to manage learning.

No.	Activity Stages	Percentage of Agreements	Average observation	Category
1.	Initial Activities	1.00	3.88	Tall
2.	Core Activities	0.80	3.65	Tall
3.	Final Activities	1.00	4.00	Tall
4.	Classroom Atmosphere	1.00	3.71	Tall
	Average	0.95	3.81	Tall

Table 6 show that, according to observers' findings, all learning activity stages fall into the high category, with an average score of 3.81.

(2) Student activity data:

Data on student activities during the trial activity, which two observers oversaw, was gathered using the student activity observation sheet instrument. Every five minutes, students' activities are observed by submitting check data on specific tasks listed on the observation sheet. Table 7 contain comprehensive information on the findings of observations of students' learning activities.

Table 7: Results of analysis of ideal time percentage of student activities.

Student Activity Category	Tolerance Interval (%)	Percentage of Time (%)	
		Group 1	Group 2
1	16–26	18.46	18.34
2	6–16	9.52	9.52
3	39–47	36.55	36.91
4	11–21	14.29	14.29
5	6–16	9.52	9.52
6	6–16	9.52	9.52
7	0–5	1.90	1.90

Based on the information in Table 7 above, all seven of the students' activities were completed within the recommended time tolerance interval, which indicates the effectiveness of the cooperative learning process. The average proportion of time students spend on learning activities, particularly in Activities 3, 4, and 5, which constitute the basis of cooperative learning and fall within an ideal and beable time frame, shows this information.

(3) Student response data:

Data on student responses to learning and the Student Worksheet were developed and obtained after participating in cooperative-based learning, using a student response questionnaire instrument. An overview of the findings from the analysis of the student response questionnaire is provided in Table 8 below.

Table 8: Results of student response questionnaire analysis.

No.	Students' responses	Learning activities	Student worksheet
1.	Positive	100	99.09
2.	Negative	0	0.91

The following are the results of the analysis carried out on the student's responses in the table above:

i. Students responded to learning activities after the test, 100(%) answered positively, while 0(%) gave negative answers.
ii. Students answered the student worksheet positively or negatively, namely 99.09(%) of students gave positive responses and 0.91(%) of students gave negative responses.

(4) Learning outcome test (LOT) data:

Following the study, information on learning outcomes was collected using a learning outcome test instrument with 10 multiple choice questions. The prepared learning outcome exam must be able to evaluate the student's proficiency in the subject area following the learning process. An overview of the findings from the analysis of the student learning outcome data is as shown in Table 9.

Table 9: Analysis of student learning outcomes.

No.	Category	Frequency	Presented (%)
1.	Complete	22	100
2.	Negative	0	0

All of the student learning outcomes are complete, according to the data above. A minimum score of 66 is required for the learning objectives to be considered complete.

5 Discussion

According to the findings of expert validation, the student worksheet that incorporates mathematical literacy and local Maluku wisdom is appropriate for usage. This is corroborated by studies carried out by [13, 19]. Furthermore, the student worksheets were tested on teachers and students.

The worksheet, which was shown to significantly improve student learning outcomes, particularly in conceptual understanding and mathematical literacy, was carried out in grade V at SD Cendekia Ambon. The evaluation of student learning outcomes, which achieves a 100% success

rate with a minimum value of 66% completion of learning objectives, serves as proof of this. This aligns with the opinion [7, 25] that student worksheets can be effectively adjusted based on the learning patterns and designs applied to each learning material.

Furthermore, more than 50% of students achieved a score above the Learning Objective Completeness Criteria (LOCC), which demonstrates the effectiveness of this student worksheet in helping students understand the mathematical concepts being taught. In addition, student responses to the use of these worksheets have been overwhelmingly positive, with most students feeling more interested and motivated to learn math. And supported by research conducted by [18].

Teachers who employ student worksheets also give them high marks for usefulness. This student worksheet is designed to be user-friendly and beneficial for classroom management of learning. When using these student worksheets, teachers also remark that students are more involved and active in the learning process. This is corroborated by studies by [52, 29]. Integrating the local wisdom of Maluku culture into mathematics learning through student worksheets has proven to be effective in increasing student engagement and learning outcomes. According to [19, 24], students not only learn mathematics in a context closer to their daily lives, but also gain knowledge and appreciation for their own local culture. This is in line with the theory that contextual and relevant learning to students' backgrounds can improve motivation and learning outcomes [51, 17].

Furthermore, the use of student worksheets based on local culture also helps in preserving local wisdom among the younger generation. Through this learning, students not only understand mathematical concepts but also learn the cultural values contained in various elements of Maluku culture, such as traditional symbols, geometric patterns in arts and crafts, and traditional games [9, 59].

The findings of this study support the notion that instructional materials designed with a local cultural context in mind can enhance learning outcomes. Therefore, the creation of student worksheets that incorporate Maluku cultural wisdom and mathematical literacy can serve as a model for developing instructional materials in other areas with diverse cultural backgrounds.

6 Conclusions

This study demonstrates that student worksheets integrating mathematical literacy and Maluku cultural wisdom through an ethnomathematical approach are effective in improving learning outcomes. The worksheet was validated and effectively implemented, demonstrating measurable improvements in student performance. The results have implications for:

(a) Policy: Encouraging curriculum developers to include culturally relevant materials.

(b) Practice: Supporting teachers in creating inclusive, contextualized instruction.

(c) Future research: Exploring long-term impacts and cross-cultural adaptations.

This work offers a replicable model for integrating local wisdom into STEM education in culturally diverse regions. While the study's results demonstrate the effectiveness of LKS in enhancing students' mathematical understanding and it is essential to consider several limitations. First, this research was conducted in a secondary school in the Maluku region, so the cultural context used was specific to that region. The implementation of this LKS in other areas may require adaptation

to local customs and traditions. Second, the trial was conducted in a limited time, underscoring the need for further research on the long-term impact on students' achievement and attitudes towards mathematics.

The findings of this study are not only relevant to the development of teaching materials in Maluku but also contribute to the global movement in inclusive mathematics education, such as ethnomathematics and culturally responsive teaching. By acknowledging and utilizing cultural knowledge as a learning resource, mathematics education can become more democratic and meaningful. These results also support the Independent Curriculum policy, which encourages the strengthening of Pancasila students' profiles through local, context-based learning. Going forward, cultural integration in STEM subjects requires support from teacher training, resource provision, and policies that enable curricular flexibility, not just in Maluku but in culturally diverse regions worldwide.

Acknowledgement This research was conducted without financial support from any public, commercial, or not-for-profit funding agencies.

Conflicts of Interest The authors declare no conflict of interest.

Ethical Considerations The study was conducted in accordance with ethical standards and approved by the IAIN Ambon Postgraduate Research Examiner Board Number: 01 YEAR 2024. The greatest level of academic integrity and transparency was adhered to in the research process, encompassing all the stages of data collection, analysis, and interpretation. The study's results and conclusions are the sole outcome of unbiased, independent scientific work free from extraneous influences.

References

[1] E. N. S. Agustina, S. Widadah & P. A. Nisa (2021). Developing realistic mathematics problems based on Sidoarjo local wisdom. *Mathematics Teaching Research Journal*, *13*(4), 181–201.

[2] R. Anriana, G. Witri, Z. H. Putra, M. Fendrik, Dahnilsyah & A. Aljarrah (2023). Ethnomathematics study in measurement of Bengkalis Malay community as mathematics resources for elementary school. *Ethnography and Education*, *18*(3), 299–322. https://doi.org/10.1080/17457823.2023.2232500.

[3] N. Arsyad (2007). *Model Pembelajaran Matematika yang Menumbuhkan Kemampuan Metakognitif untuk Menguasai Bahan Ajar*. PhD thesis, Universitas Negeri Surabaya, Surabaya, Indonesia.

[4] M. A. A. Bakar, A. T. A. Ghani & M. L. Abdullah (2024). Discover teacher's knowledge on neuroscience and mathematics learning relevancy via fuzzy conjoint analysis: Study case in Southern Malaysia. *Malaysian Journal of Mathematical Sciences*, *18*(4), 711–725. https://doi.org/10.47836/mjms.18.4.02.

[5] A. Buchori, R. N. Sudargo & M. A. Budiman (2016). Digital media development of math game with ethnomathematics model based on Javanese local wisdom in higher education. *Arts and Social Sciences Journal*, *7*(4), Article ID: 2. https://doi.org/0.4172/2151-6200.1000210.

[6] T. Chandran, N. Kamarudin, S. S. Mustakim, L. Silvarajan & Z. Zaremohzzabieh (2023). Factors influencing teaching higher-order thinking skills among mathematics teachers in

Malaysian primary schools. *Pertanika Journal of Social Sciences & Humanities*, *31*(4), 1509–1524. https://doi.org/10.47836/pjssh.31.4.09.

[7] K. C. Chang (2014). Examining the effect of tour guide performance, tourist trust, tourist satisfaction, and flow experience on tourists' shopping behavior. *Asia Pacific Journal of Tourism Research*, *19*(2), 219–247. https://doi.org/10.1080/10941665.2012.739189.

[8] U. d'Ambrosio (1985). Ethnomathematics and its place in the history and pedagogy of mathematics. *For the Learning of Mathematics*, *5*(1), 44–48.

[9] J. Dasmasela & M. Ratuanik (2023). Implementation of ethnomathematics of Tanimbar coil burning using PMRI approach to circle materials. *Jurnal Eduscience*, *10*(1), 279–286. https://doi.org/10.36987/jes.v10i1.3797.

[10] I. Dewi, N. Siregar & A. Andriani (2020). Trial of design means-end analysis learning model based on local cultural wisdom to improve communication ability and mathematical abstraction of middle school students. In *Journal of Physics: Conference Series. The 7th South East Asia Design Research International Conference (SEADRIC 2019)*, volume 1470 pp. Article ID: 012081. IOP Publishing, Yogyakarta, Indonesia. https://doi.org/10.1088/1742-6596/1470/1/012081.

[11] I. N. Dewi, S. Poedjiastoeti & B. K. Prahani (2017). ELSII learning model based local wisdom to improve students' problem solving skills and scientific communication. *International Journal of Education and Research*, *5*(1), 107–118.

[12] N. R. Dewi & N. F. Maulida (2023). The development of STEM-nuanced mathematics teaching materials to enhance students' mathematical literacy ability through information and communication technology-assisted preprospec learning model. *International Journal of Educational Methodology*, *9*(2), 409–421. https://doi.org/10.12973/ijem.9.2.409.

[13] I. Domu & N. O. Mangelep (2019). Developing of mathematical learning devices based on the local wisdom of the Bolaang Mongondow for elementary school. In *Journal of Physics: Conference Series*, volume 1387 pp. Article ID: 012135. IOP Publishing, Bristol, UK. https://doi.org/10.1088/1742-6596/1387/1/012135.

[14] R. Ekawati, S. Susanti & J. C. Chen (2020). Primary students' mathematical literacy: A case study. *Infinity Journal*, *9*(1), 49–58. https://doi.org/10.22460/infinity.v9i1.p49-58.

[15] D. Eriawandi, S. Saptono & Y. K. S. Pranoto (2023). Application of the react model containing ethnomathematics of Javanese scripture to develop the character of love of homeland and student learning outcomes. *International Journal of Research and Review*, *10*(11), 293–306. https://doi.org/10.52403/ijrr.20231134.

[16] N. Hidayanti, M. Yanuar & I. Rohiyatussakinah (2020). Integrating mathematics local wisdom based through worksheet in bilingual program. *Journal of Educational Experts*, *3*(2), 46–52. https://doi.org/10.30740/jee.v3i2p46-52.

[17] W. Y. Hwang, U. Hariyanti, N. S. Chen & S. W. D. Purba (2023). Developing and validating an authentic contextual learning framework: Promoting healthy learning through learning by applying. *Interactive Learning Environments*, *31*(4), 2206–2218. https://doi.org/10.1080/10494820.2021.1876737.

[18] M. S. Kahar, R. Syahputra, R. B. Arsyad, N. Nursetiawan & M. Mujiarto (2021). Design of student worksheets oriented to higher order thinking skills (HOTS) in physics learning. *Eurasian Journal of Educational Research*, *96*, 14–29. https://doi.org/10.14689/ejer.2021.96.2.

[19] I. A. Kartika & N. Lestari (2024). Development of comics based on the local wisdom North Sumatra culture in the mathematics subject geometry material in elementary school. *Journal of Education and Teaching Learning*, *6*(1), 1–12. https://doi.org/10.51178/jetl.v6i1.1733.

[20] M. Khalid, N. Hafizi, A. A. Latif, M. Zakaria, M. A. Zahiri, I. J. Yusof & M. D. M. Jani (2023). Identification of constructs and subconstructs of teacher classroom assessment literacy instrument. *Pertanika Journal of Social Sciences & Humanities*, *31*(2), 683–697. https://doi.org/10.47836/pjssh.31.2.11.

[21] N. Khodeir, N. Wanas, H. Elazhary & N. Hegazy (2017). Addressing student misinterpretations of story problems in MAST. In *2017 International Conference on Advanced Control Circuits Systems (ACCS) Systems & 2017 International Conference on New Paradigms in Electronics & Information Technology (PEIT)*, pp. 204–211. IEEE, Alexandria, Egypt. https://doi.org/10.1109/ACCS-PEIT.2017.8303042.

[22] N. S. Latif & A. Talib (2021). Development of ethnomathematics E-modules based on local wisdom to improve students' cultural and civic literacy. In *International Conference on Educational Studies in Mathematics (ICoESM 2021)*, pp. 112–120. Atlantis Press, Dordrecht, Netherlands. https://doi.org/10.2991/assehr.k.211211.020.

[23] T. Laurens (2018). The effectiveness of local wisdom based-realistic mathematics learning to improve learners' characters at state elementary schools in Ambon city. In *First Indonesian Communication Forum of Teacher Training and Education Faculty Leaders International Conference on Education 2017 (ICE 2017)*, pp. 611–615. Atlantis Press, Dordrecht, Netherlands. https://doi.org/10.2991/ice-17.2018.132.

[24] R. Lestari, R. C. I. Prahmana, M. S. F. Chong & M. Shahrill (2023). Developing realistic mathematics education-based worksheets for improving students' critical thinking skills. *Infinity Journal*, *12*(1), 69–84. https://doi.org/10.22460/infinity.v12i1.p69-84.

[25] J. Luo, S. Ba & H. Zhang (2012). The effectiveness of online shopping characteristics and well-designed websites on satisfaction. *Mis Quarterly*, *36*(4), 1131–1144. https://doi.org/10.2307/41703501.

[26] J. P. Mairing (2023). Ethnomathematics learning model based on motifs of "Dayak Ngaju" Central Kalimantan. *Mathematics Teaching Research Journal*, *15*(5), 30–48. https://doi.org/10.32890/mjli2024.21.1.4.

[27] E. Marlina & F. Azis (2023). The ethnomathematical concept of Sundanese local wisdom through building space for the Earth Alit Kabuyutan West Java site as the development of mathematics learning media. *International Journal of Quantitative Research and Modeling*, *4*(2), 76–81. https://doi.org/10.46336/ijqrm.v4i2.449.

[28] A. Mei, L. A. Purwastuti, R. Hidayat & A. F. M. Ayub (2025). Problem-solving learning model based on ethnomathematics to improve student's creative thinking in elementary school. *Malaysian Journal of Mathematical Sciences*, *19*(1), 289–309. https://doi.org/10.47836/mjms.19.1.15.

[29] R. Miftah, L. Kurniawati & K. F. Musa (2024). Development of prospective teacher student worksheets through interactive case-based learning model assisted by cublend app to improve mathematical literacy skills. *Mathematics Teaching Research Journal*, *16*(4), 76–93.

[30] F. W. Mujahidah & Suparman (2019). Student's worksheets design for eighth grade to improve problem-solving ability with RME. *International Journal of Scientific & Technology Research*, *8*(11), 2093–2098.

[31] T. J. Nareswari, H. W. Wijaya & N. C. E. Setiawan (2024). Development of STEAM-2C: Integrated acid-base digital book based on Malang local wisdom. In *E3S Web of Conferences. International Conference on Sustainable Chemistry (ICSChem 2023)*, volume 481 pp. Article ID: 04003. EDP Sciences, Malang, Indonesia. https://doi.org/10.1051/e3sconf/202448104003.

[32] D. H. Nasution & Yerizon (2019). Development of student worksheets based on discovery learning to improve student mathematical problem solving ability in class X senior high school. *International Journal of Scientific & Technology Research*, *8*(8), 228–231.

[33] D. W. Nurharyanto & H. Retnawati (2020). The difficulties of the elementary school students in solving the mathematical narrative-type test items. *Jurnal Prima Edukasia*, *8*(1), 29–39. https://doi.org/10.21831/jpe.v8i1.29969.

[34] OECD. PISA 2012 Assessment and Analytical Framework: Mathematics, Reading, Science, Problem Solving and Financial Literacy. Technical report OECD Publishing Paris, France 2013. https://doi.org/10.1787/9789264190511-en.

[35] OECD. Pisa 2015 Assessment and Analytical Framework: Science, Reading, Mathematics, Financial Literacy and Collaborative Problem Solving (Revised Edition). Technical report OECD Publishing Paris, France 2017. https://doi.org/10.1787/9789264281820-en.

[36] OECD. PISA 2022 Assessment and Analytical Framework. Technical report OECD Publishing Paris, France 2023. https://doi.org/10.1787/dfe0bf9c-en.

[37] OECD. PISA 2022 Results (Volume I): The State of Learning and Equity in Education. Technical report OECD Publishing Paris, France 2023. https://doi.org/10.1787/53f23881-en.

[38] B. Ojose (2011). Mathematics literacy: Are we able to put the mathematics we learn into everyday use? *Journal of Mathematics Education*, *4*(1), 89–100.

[39] S. H. Pratiwi et al. (2023). Ethnomathematics in Aceh coastal children's football game. *Jurnal Ilmiah Sekolah Dasar*, *7*(1), 150–158. https://doi.org/10.23887/jisd.v7i1.49924.

[40] M. G. Primaniarta & J. R. L. de Mattos (2022). Javanese ethnomathematics: Exploration of the "Tedhak Siten" tradition for class learning practices. *Journal on Mathematics Education*, *13*(4), 661–680.

[41] T. Purniati, T. Turmudi, D. Juandi & D. Suhaedi (2021). Ethnomathematics exploration of the Masjid Raya Bandung ornaments in transformation geometry materials. *Journal of Medives: Journal of Mathematics Education IKIP Veteran Semarang*, *5*(2), 235–243. https://doi.org/10.31331/medivesveteran.v5i2.1639.

[42] N. D. Rahmawati, A. Buchori & M. H. A. Ghoffar (2022). The effectiveness of using virtual reality-based mathematics learning media with an ethnomathematical approach. *KnE Social Sciences*, *7*(14), 1005–1011. https://doi.org/10.18502/kss.v7i14.12050.

[43] S. Ramdiah, A. Abidinsyah, M. Royani, H. Husamah & A. Fauzi (2020). South Kalimantan local wisdom-based biology learning model. *European Journal of Educational Research*, *9*(2), 639–653. https://doi.org/10.12973/eu-jer.9.2.639.

[44] M. Rosa & D. C. Orey (2021). Ubiratan D'Ambrosio: Celebrating his life and legacy. *Journal of Humanistic Mathematics*, *11*(2), 430–450. https://doi.org/10.5642/jhummath.202102.26.

[45] S. Setiyani, D. P. Putri, D. Prakarsa et al. (2019). Designing camtasia software assisted learning media toward students' mathematical comprehension in numeral material. *Infinity Journal*, *8*(2), 143–156. https://doi.org/10.22460/infinity.v8i2.p143-156.

[46] J. Soebagyo & F. I. Luthfiyyah (2023). Ethnomathematics exploration of Al-Barkah Great Mosque, Bekasi City, through geometry and transformational geometry learning. *Indonesian Journal of Science and Mathematics Education*, *6*(2), 152–164. https://doi.org/10.24042/ijsme.v6i2.17179.

[47] H. Sofyan, E. Anggereini & J. Saadiah (2019). Development of E-modules based on local wisdom in central learning model at kindergartens in Jambi city. *European Journal of Educational Research*, *8*, 1137–1143. https://doi.org/10.12973/eu-jer.8.4.1139.

[48] P. Sopamena & F. Juhaevah (2019). Karakteristik etnomatematika suku Nuaulu di Maluku pada simbol adat Cakalele. *BAREKENG: Jurnal Ilmu Matematika Dan Terapan*, *13*(2), 075–084. https://doi.org/10.30598/barekengvol13iss2pp075-084ar772.

[49] P. Sopamena, N. S. Sangkala, S. Kaliky, F. Juhaevah & M. S. Rumakabis (2023). Ethnomathematical analysis of Wapauwe Kaitetu old mosque building: Between myth and science. *Jurnal Pendidikan MIPA*, *24*(2), 467–480. https://doi.org/10.23960/jpmipa/v24i2.pp467-480.

[50] K. Stacey & R. Turner (2014). The evolution and key concepts of the PISA mathematics frameworks. In *Assessing mathematical literacy: The PISA experience*, pp. 5–33. Springer, Cham, Switzerland. https://doi.org/10.1007/978-3-319-10121-7_1.

[51] E. Surya, F. A. Putri et al. (2017). Improving mathematical problem-solving ability and self-confidence of high school students through contextual learning model. *Journal on Mathematics Education*, *8*(1), 85–94. https://doi.org/10.22342/jme.8.1.3324.85-94.

[52] T. Suwartono, A. Saripudin & N. Juwita (2022). Applying web-based technology in developing student worksheets on writing local culture content drama script. *Theory and Practice in Language Studies*, *12*(2), 263–273. https://doi.org/10.17507/tpls.1202.07.

[53] P. M. Thana, K. D. Nur'aini & D. R. Suryani (2023). Development of interactive E-module based on Papuan local wisdom on basic mathematics course. *Technium Social Sciences Journal*, *49*(1), 457–462. https://doi.org/10.47577/tssj.v49i1.9841.

[54] P. Tzanakaki, C. F. Grindle, M. Saville, R. P. Hastings, J. C. Hughes & K. Huxley (2014). An individualised curriculum to teach numeracy skills to children with autism: Programme description and pilot data. *Support for Learning*, *29*(4), 319–338. https://doi.org/10.1111/1467-9604.12069.

[55] I. S. Utami, M. Vitasari, I. Langitasari, I. Sugihartono & Y. Rahmawati (2020). The local wisdom-based STEM worksheet to enhance the conceptual understanding of pre-service physics teacher. *Jurnal Penelitian & Pengembangan Pendidikan Fisika*, *6*(1), 97–104. https://doi.org/10.21009/1.06111.

[56] N. W. Utami, S. A. Sayuti & J. Jailani (2022). An ethnomathematics study on the Javanese astrology. *Indonesian Journal of Ethnomathematics*, *1*(1), 43–54. https://doi.org/10.48135/ije.v1i1.43-54.

[57] K. Yohanes, M. Zaenuri & W. Budi (2019). Kontribusi etnomatematika sebagai masalah kontekstual dalam mengembangkan literasi matematika. In *PRISMA: Prosiding Seminar Nasional Matematika*, volume 2 pp. 190–196. Jurusan Matematika FMIPA UNNES, Central Java, Indonesia.

[58] T. N. H. Yunianta, A. Putri & D. Kusuma (2019). Development and comparison of mathematic mobile learning by using Exelearning 2.0 program and MIT inventor 2. *Infinity Journal*, *8*(1), 43–56. https://doi.org/10.22460/infinity.v8i1.p43-56.

[59] R. F. Zahrah & W. D. Febriani (2020). A contextual problem based of local wisdom improve the ability to solving a word problem mathematics students of elementary school. *PrimaryEdu: Journal of Primary Education*, *4*(1), 55–64. https://doi.org/10.22460/pej.v4i1.1492.