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MASLEMBING TEACHING MATERIALS CONTAINING ETHNOMATHEMATICS: INNOVATION IN PROBLEM-BASED MATHEMATICS LEARNING IN ELEMENTARY SCHOOLS

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Abstract

This study aims to obtain a product in the form of MASLEMBING teaching materials containing ethnomathematics on the subject of probability for grade VI of elementary school. This research is a development research that uses the ADDIE design model with the stages of *analysis*, *design*, *development*, *implementation*, and *evaluation*. Data collection techniques use questionnaires, learning outcome tests, observation, and documentation. This research instrument is in the form of a questionnaire sheet, a learning outcome test sheet, which is then analyzed using qualitative and quantitative data. Qualitative data used are in the form of sentences, pictures, and charts. Quantitative data is collected by conducting validity tests, practicality tests, and effectiveness tests. The developed product is validated by material experts, media experts, and language experts. The results of the study show that the validation test score obtained an average score of 3.3, with a very good category. Based on the results of the student response questionnaire, a score of 3.30 was obtained, and the results of the teacher response obtained a score of 3.57, with a very good category. Based on the results of the effectiveness test, the results of the N-Gain test on the pretest and posttest scores in the experimental class obtained an average difference of 0.53 with moderate criteria, so the level of effectiveness is effective. The results of the Independent T Test comparison test showed that the significance value was 0.000 less than 0.05, so it can be concluded that there is a significant difference between the posttest results of the experimental class and the control class. With this, the MASLEMBING teaching materials containing ethnomathematics for grade VI elementary school students are effective, practical, and suitable for use in classroom learning.

Keywords: Teaching materials; mathematics; MASLEMBING; opportunities; problem-based learning.

Abstrak

Penelitian ini bertujuan untuk memperoleh suatu produk berupa bahan ajar MASLEMBING bermuatan etnomatematika pada materi peluang kelas VI sekolah dasar. Penelitian ini merupakan penelitian pengembangan yang menggunakan model desain ADDIE dengan tahapan Analyze, Design, Development, Implementation, dan Evaluation. Teknik pengumpulan data menggunakan angket quesionaire, tes hasil belajar, observasi, dan dokumentasi. Instrumen penelitian ini berupa lembar angket, lembar tes hasil belajar yang kemudian dianalisis menggunakan data kualitatif dan kuantitatif. Data kualitatif yang digunakan berupa kalimat, gambar, maupun bagan. Data kuantitatif dilakukan dengan melakukan uji validitas, uji kepraktisan, dan uji efektifitas. Produk yang dikembangkan dilakukan uji validasi oleh ahli materi, ahli media, dan ahli bahasa. Hasil penelitian menunjukkan skor uji validasi memperoleh rata-rata skor 3,3 dengan kategori sangat baik. Berdasarkan hasil angket respon siswa diperoleh skor 3,30 dan hasil respon guru diperoleh skor 3,57 dengan kategori sangat baik. Berdasarkan hasil uji efektifitas diperoleh Hasil uji N-Gain pada nilai pretest dan posttest pada kelas eksperimen didapatkan selisih rata-rata sebesar 0,53 dengan kriteria sedang, maka tingkat efektivitasnya adalah efektif. Hasil Uji banding Independent T Test didapatkan bahwa nilai signifikansi menunjukkan sebesar 0,000 lebih kecil dari 0,05 maka dapat dsimpulkan terdapat perbedaan yang signifikan antara hasil posttest kelas eksperimen dan kelas kontrol. Dengan hal ini bahan ajar MASLEMBING bermuatan etnomatematika untuk siswa kelas VI sekolah dasar efektif, praktis, dan layak digunakan dalam pembelajaran di kelas.

Kata kunci: *Bahan ajar, matematika, MASLEMBING, peluang, problem-based learning*

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INTRODUCTION

As time goes by, along with the advancement of science and technology, teachers are required to cultivate a quality young generation capable of competing. A quality and competent young generation is inseparable from education. Quality education will produce a quality future generation (Apriansyah & Pujiastuti, 2020).

Mathematics is a subject that involves a learning process aimed at finding answers to everyday problems, utilizing information, knowledge of shapes and sizes, calculation, and most importantly, the ability to see problems within the human context (Rismawati et al., 2022). The connection between mathematics and students' daily lives, for example, in the batik-making process, can also utilize mathematical concepts.

Ethnomathematics is a new knowledge linked to cultural elements. This connection can be seen in the application of mathematical concepts in a region's culture (Bintoro et al., 2021; Kabuye Batiibwe, 2024). Local culture can also be linked to students' daily problems, which can be encountered and taught through mathematical concepts. Ethnomathematics also includes mathematical modeling, which helps students translate mathematical concepts and behaviors derived from cultural components (Sunzuma & Umbara, 2025; Wulandari et al., 2024). Indonesia's culture is very diverse, with examples of this diversity being found in Kudus Regency, known as the city of kretek cigarettes, and Jepara, known as the city of carvings.

The development of mathematics teaching materials is a crucial aspect in improving the quality of learning in elementary schools. In the modern era of education, innovative and interactive learning methods are increasingly needed to engage students and facilitate their understanding of complex mathematical concepts. One particularly effective approach is *Problem-Based Learning* (PBL), which places students at the center of learning and encourages their active participation in the process (Affandy et al., 2024).

Björklund et al. explain that teaching is framed to present mathematical content to young children, so that it is meaningful to them, and takes into account the children's experiences and knowledge (Björklund et al., 2020). Then, through narrative problems provided by teachers, they find insights into the subjects of statistics and probability by engaging children and being responsive to the children's own experiences, rather than only using material presented in textbooks.

Problem-Based Learning is an approach where students can be actively involved in solving real-life problems. Hadiq explains that *Problem-Based Learning* is an active learning approach, also known as problem-solving, that can improve students' critical thinking, analytical skills, and understanding of certain ideas (Al Hadiq, 2023). In the context of mathematics education, PBL provides opportunities for students to apply mathematical concepts in situations relevant to everyday life (Santos-Meneses et al., 2023).

Implementing PBL in mathematics learning can also increase student motivation. When students are faced with interesting and challenging problems, they tend to be more engaged in the learning process. Furthermore, PBL encourages collaboration among students, which can strengthen their understanding of the material through discussion and cooperation (Misrom et al., 2020).

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Within the current curriculum, integrating PBL into sixth-grade mathematics instruction can support the achievement of expected competencies. By linking mathematical material to real-world situations, students can see the relevance of their learning to everyday life (Hendriana et al., 2018). This is expected to increase their interest in and understanding of mathematics. Through systematic research and development, PBL-based mathematics teaching materials are expected to meet established educational standards.

The low learning outcomes of students need to be addressed, not only to improve learning outcomes but also to improve students' critical reasoning skills in solving problems. Therefore, it is necessary to develop mathematics teaching materials to improve student learning outcomes. Finally, the development of MASLEMBING (Problem-*Based Learning*) teaching materials containing ethnomathematics in grade VI of elementary school is expected to create a dynamic and engaging learning environment. With this approach, students not only learn to understand mathematical concepts but also to develop the skills needed in their future lives.

This is in line with research conducted by Islahiyah et al., related to the development of e-modules with problem-based learning models to improve students' mathematical problem-solving abilities, obtaining validation results from media experts of 79%, material experts 78%, language experts 77%, and practicality criteria met 87%. The percentage of the evaluation test results obtained 80% so the e-module was declared valid, practical, and effective for use in mathematics learning for grade XI high school (Islahiyah et al., 2021).

Several previous studies have succeeded in improving student learning outcomes, previous studies have focused only on electronic teaching modules in the form of e-modules and require an internet connection to access them. Therefore, this study will develop teaching materials into an application that can be accessed through digital devices and used anytime and anywhere without an internet connection. This will make it easier for students and make learning more practical.

Based on the problem description that has been expressed in this research, a MASLEMBING-based teaching material containing ethnomathematics on probability material for sixth-grade elementary school students will be developed that is practical, effective, and feasible to be applied in classroom learning. The teaching material developed can be accessed using digital devices.

METHODS

This research uses a development model, often known in English as *Research* and *Development* (R&D). The development research method is a research method used to produce a specific product and test its effectiveness. This development research uses the ADDIE model (Sugiyono, 2019). The ADDIE model consists of five stages, including Analysis, Design, Development, Implementation, and Evaluation. The product produced in this research is the MASLEMBING teaching material, containing ethno-mathematics, material on opportunities for sixth-grade elementary school students in Jekulo District. Figure 1 is the beginning of the ADDIE model flow.

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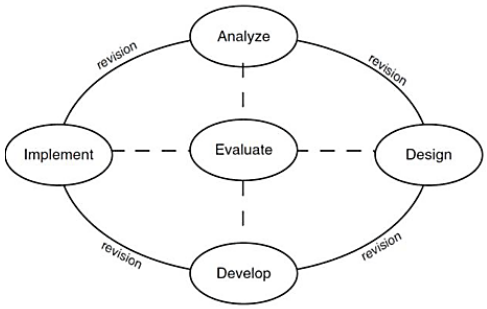

Figure 1. Chart of ADDIE Model Steps

The first step is analysis. Activities at this stage are carried out by reviewing the curriculum, student characteristics, and analyzing materials that are appropriate for the needs of students. This analysis is carried out as the basis for determining the teaching materials to be developed.

The second step is design. At this stage, the product application to be developed is designed. At this stage, the researcher collects information related to the development of other digital teaching materials to be used as a reference for application development. Then, the application framework containing an overview of the teaching materials to be developed is designed.

The next stage is development. This stage involves the process of creating MASLEMBING teaching materials based on the Android application according to the design that has been prepared previously. This stage produces a product in the form of an application containing teaching materials that can be installed on mobile phones. Once completed, the product is validated by subject matter experts, language experts, and media experts to determine and ensure that the designed teaching materials have content that is in line with the subject matter and learning objectives.

The fourth stage is implementation. After the product has been declared feasible and valid by experts, the next stage is to implement the product in grades VI of SD 8 and 9 Tanjungrejo. The learning activities are continued by filling out student and teacher response questionnaires and conducting learning outcome tests by students after using the MASLEMBING teaching material application.

The final stage is evaluation. Evaluation is conducted to obtain feedback on the learning process and to measure the achievement of learning indicators.

This research was conducted in elementary schools in the Ahmad Yani Cluster, Jekulo District, Kudus Regency, specifically in Elementary Schools 2 Tanjungrejo, 7 Tanjungrejo, 8 Tanjungrejo, and 9 Tanjungrejo. The research was conducted in the even semester of the 2024/2025 academic year from March 2025 to July 2025. The research subjects in the limited product trial stage were a teacher and 7 sixth-grade students of Elementary School 8 Tanjungrejo. The subjects for the field trial were carried out in sixth grade, namely Elementary School 8 Tanjungrejo and Elementary School 9 Tanjungrejo as the experimental class, and Elementary School 2 and 7 Tanjungrejo as the control class. The material for this research took the opportunity material in Chapter 4 of the sixth-grade material in the even semester.

The data collection techniques used in this development research included questionnaires, learning outcome tests, observation, and documentation. Two questionnaires were administered: one for the need for teaching materials and one for responses related to the implementation of the MASLEMBING teaching materials.

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A test is a method used to measure and assess an individual's abilities, knowledge, skills, or attitudes (Creswell, 2014). Learning outcome tests are conducted to determine and measure student learning outcomes using the MASLEMBING teaching materials. Tests are conducted before and after the product is tested to determine the level of effectiveness of the MASLEMBING teaching materials containing ethnomathematics that are developed.

Observations are also conducted during learning activities. Observation is a data collection activity using the five senses to observe real-life events or phenomena and obtain factual information based on conditions at the research location (Sukestiyarno, 2020).

Documentation methods are used to obtain data deemed important. Documentation is conducted during learning activities to ensure accuracy, such as recording important data, taking photos of learning activities, and compiling lists of student names and learning evaluation results.

The instruments used in this study were questionnaires, learning outcome tests, observation sheets, and interview guidelines. The questionnaires consisted of questionnaires on teaching material requirements, student responses, and teacher responses after learning activities. The tests consisted of learning outcome tests before and after learning took place. The data obtained were then analyzed using a Likert scale with scoring guidelines. The learning outcome tests were analyzed using a t-test in SPSS.

The data analysis techniques used were qualitative and quantitative. The qualitative data used were in the form of sentences, images, and charts. In this study, the qualitative data consisted of data related to teaching materials used by teachers in class. The data was then analyzed using a *flow analysis model technique* consisting of data reduction, data presentation, and conclusion drawing (Miles et al., 2020; Sugiyono, 2019). Quantitative data was analyzed by conducting validity tests, practicality tests, and effectiveness tests. These data included both numerical data and qualitative data (Budiyono, 2019).

RESULTS AND DISCUSSION

This research develops an interactive teaching material product based on *problem-based learning* and contains digital-based ethnomathematics, which includes learning videos, images, material summaries, educational games, and practice questions. The teaching material can be accessed via smartphone and can be accessed anytime and anywhere. This research was conducted in grade VI of the Ahmad Yani Cluster, Jekulo District, Kudus Regency, specifically in Elementary Schools 2, 7, 8, and 9 Tanjungrejo. The teaching material developed refers to the material on probability for grade VI of elementary school. The researcher used the ADDIE model, which has 5 stages: analysis, design, development, implementation, and evaluation.

Based on a preliminary study conducted by researchers on March 7, 2025, in grade VI of SD 8 Tanjungrejo, Jekulo District, Kudus Regency. Researchers conducted classroom observations and interviews with grade VI teachers. The results of the preliminary study found that in learning activities, teachers only use textbooks from the government and student worksheets as companions. Grade VI teachers stated that they have not developed accompanying teaching

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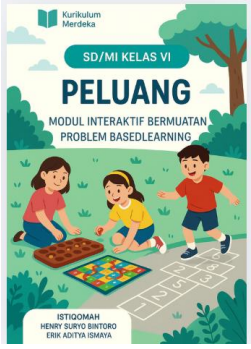
materials optimally. The methods used are also still less varied, especially in mathematics lessons, because teachers still use the lecture method and focus on formulas and problems in the student worksheet. So that students easily feel bored, lack enthusiasm, and lack motivation in the learning process, so in students' mathematics learning outcomes for students.

Researchers also distributed questionnaires regarding the need for mathematics teaching materials to teachers and sixth-grade students at SD 8 Tanjungrejo. The results of the analysis of the need for teaching materials distributed to students revealed that students expected interesting and innovative teaching materials, which were not only in the form of writing but also interspersed with images. The results of the analysis of the need for teaching materials given to sixth-grade teachers revealed that teachers also needed innovation in the use of learning media, especially interesting teaching materials, so that learning was more interactive and students became motivated to learn. Teaching materials need to be packaged creatively and innovatively to be more attractive to students (Kurniawan, 2021). Teaching materials should also be accessible anywhere and anytime, as well as provide information and expect readers to follow world developments and social issues, and be able to increase student attraction (Safithri & Saputri, 2023).

The second stage of the ADDIE model is designing. The design stage consists of several activities, namely 1) creating a prototype framework format for teaching materials, 2) compiling a framework for teaching materials, and 3) compiling an assessment instrument for MASLEMBING teaching materials containing ethnomathematics by validators, student responses, and teacher responses.

Before designing the product to be developed, researchers first determined the material that was appropriate for the development of the independent curriculum. The next step was to create a prototype design for the teaching material, consisting of: 1) the cover of the teaching material, 2) instructions for use, 3) learning outcomes, 4) materials, 5) an ethnomathematics-based evaluation, 6) multiple-choice practice questions, 7) a summary, 8) a list of references. The prototype design for the MASLEMBING teaching material can be seen in Table 1.

Table 1. Prototype design of MASLEMBING teaching materials containing ethnomathematics

No.	Element	Picture
1	Cover	
2	Instructions for use	

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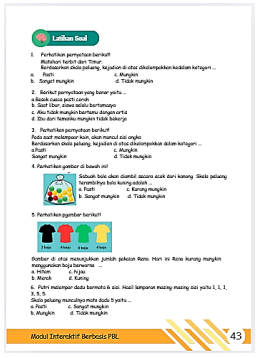
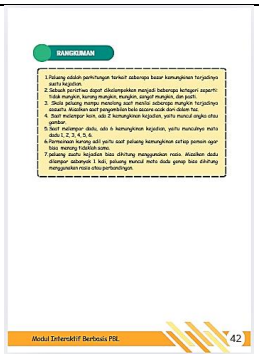
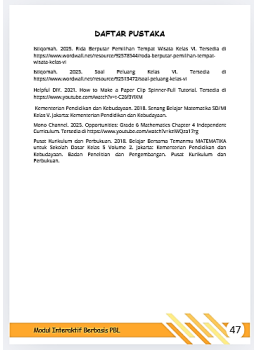
No.	Element	Picture
3	Learning outcomes	
4	Material	
5	Evaluation containing ethnomathematics	
6	Multiple choice practice questions	
7	Summary	
8	Reference list	

The results of the developed teaching materials are in the form of applications that can be accessed via students' smartphones anytime and anywhere. Teaching materials are materials used to manage the learning process efficiently and improve learning achievement (Siagian et al., 2019; Murni & Ruqoyyah, 2020). Teaching materials must also meet the needs of the subject matter (Cortez et al., 2023; Aydin & Aytekin, 2018). MASLEMBING teaching materials are designed to be as attractive as possible to attract students' attention to learn. The way of visualizing the material presented is very important and influences the student learning process as well as the process of critical thinking and independence in learning, and is able to improve student learning outcomes (Rusli & Negara, 2017).

After completing the creation of MASLEMBING teaching materials containing ethnomathematics, the next step was to determine the validity of the

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teaching materials was a feasibility test conducted by expert lecturers in their fields. The validation or feasibility test was carried out by providing an assessment questionnaire to experts in the form of a checklist of teaching material products that had been compiled based on the scores on each item of the scoring instrument and also providing comments in the form of suggestions for product improvement before being tested in the field (Bintoro & Wijaya, 2024; Mukhlis et al., 2020). The validity test was carried out to measure the precision and accuracy of a research instrument. The validity test was also carried out to obtain information on whether the distributed questionnaire was truly valid or not, so that it could be used to measure the research variables to be carried out (Al Hakim et al., 2021). This study used 3 validators who were experts in their fields, namely material expert validators, media experts, and language experts. The three validators were lecturers at Muria Kudus University who were competent in their fields.

Validation results are said to be valid and feasible if they obtain a minimum score of ≥ 3 with good criteria. MASLEMBING teaching materials containing ethnomathematics were subjected to validation tests in the field by Mr. Dr. Sumaji, S.Pd, M.Pd, media validator by Mr. Dr. Khamdun, S.Pd., M.Pd., while the language expert validator was Mr. Dr. Irfai Fathurohman, S.Pd., M.Pd. The validation results data are presented in Table 2.

Table 2. Validation test results

No.	Validator	Score	Category
1	Media expert validator	3.17	Good
2	Subject matter expert validator	3.33	Very good
3	Language expert validator	3.4	Very good
	Average	**3.3**	**Very good**

The results of Table 2 show that the average validation test results for the MASLEMBING ethnomathematics-based teaching materials by experts obtained a score of 3.3, categorized as very good. Therefore, it can be concluded that the MASLEMBING ethnomathematics-based teaching materials are very suitable and can be used in learning. This statement is supported by several research results stating that interactive learning media is computer-based learning media and contains images, videos, animated audio, text, narration, and graphics (Fitriani et al., 2025; Huda et al., 2025; Amorim et al., 2023).

The implementation stage is carried out after the teaching materials are declared valid and feasible by experts. The implementation stage is the stage where the implementation of the learning trial is carried out using the teaching materials that have been developed. The trial was carried out on a small scale first, namely grade VI students at SD 8 Tanjungrejo, totaling 7 students, to determine the practicality of the teaching materials that have been developed using student response questionnaires and also teacher responses. After receiving input and making improvements, the next field trial was at SD 9 Tanjungrejo with a total of 14 students. The trial was carried out through offline learning at the school.

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Researchers used smart The students' phones were used to access the developed teaching materials. This was because the school did not have computer facilities for several students, so the product trial was conducted using digital devices in the form of mobile phones that could be accessed by the students. The following is documentation of the learning activities for implementing the MASLEMBING teaching materials containing ethnomathematics.

Figure 2. Implementation of MASLEMBING teaching materials

After the learning process was completed, the researcher proceeded to the next stage, namely, testing the practicality of the MASLEMBING teaching materials. The practicality of a product can be determined by testing the product through several trials, namely trials through the administration of student and teacher response questionnaires (Henry Suryo Bintoro et al., 2023; Harefa & Gumay, 2021). This is in line with the statement by Devirita et al., who stated that the practicality of a product can be determined through the stage of observing students during the learning process, interviews, or distributing teacher and student questionnaires (Devirita et al., 2021).

The response questionnaire contains questions that students must answer based on the activities they experience and carry out in class. The teacher response questionnaire contains a number of questions related to the learning that has taken place. The student and teacher response questionnaires are administered to determine the practicality of the developed teaching materials. In warm response, there are four alternative answer choices for students and teachers, namely score 1, score 2, score 3, and score 4. The following are the results of the questionnaire for grade VI students.

Table 3. Results of responses from grade VI students

No	Student Name	Total score	Category
1	Student 1	3.3	Very good
2	Student 2	3.4	Very good
3	Student 3	3.5	Very good
4	Student 4	3.3	Very good
5	Student 5	3.5	Very good
6	Student 6	3.2	Good
7	Student 7	3.1	Good
8	Student 8	3.6	Very good
9	Student 9	3.3	Very good
10	Student 10	2.9	Good
11	Student 11	3.5	Very good
12	Student 12	3.4	Very good
13	Student 13	3.4	Very good
14	Student 14	3.5	Very good
15	Student 15	2.8	Good
16	Student 16	3.3	Very good
17	Student 17	3.5	Very good
18	Student 18	3.1	Good
19	Student 19	3.2	Good
20	Student 20	3.6	Very good
21	Student 21	3	Good
Average		**3.30**	**Very good**

Based on Table 3, the results of the sixth-grade student response questionnaire obtained an average score of 3.30, with a very good category. Students seemed very enthusiastic and eager in learning using MASLEMBING teaching materials containing ethno-mathematics. In addition to distributing

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student response questionnaires, researchers also gave response questionnaires to sixth-grade teachers. The table shows the results of teacher response data.

Table 4. Teacher response results

No.	Teacher's Name	Score	Category
1	Teacher 1	3.6	Very good
2	Teacher 2	3.53	Very good
Average		**3.57**	**Very good**

Based on the results of Table 4, teachers' responses to mathematics learning using MASLEMBING teaching materials containing ethnomathematics obtained an average score of 3.57, categorized as very good. Therefore, it can be concluded that MASLEMBING teaching materials are very practical for use in classroom learning.

The MASLEMBING teaching materials developed are very practical to use, because they are packaged using links that can be accessed anytime and anywhere using digital technology such as computers or mobile phones. This is in line with the statement of Khasanah et al., who stated that the use of more interactive digital technology can increase the attractiveness and effectiveness of learning (Khasanah et al., 2025). This media provides a learning experience that integrates multimedia elements such as videos, QR Codes, and links. YouTube to clarify difficult concepts. In this way, MASLEMBING teaching materials become more practical and effective for peer learning activities, classicism, or independence at home.

The final stage in the ADDIE model is the evaluation stage. At this stage, the researcher will assess the effectiveness of learning using MASLEMBING teaching materials containing ethnomathematics. Then, the effectiveness test will be carried out using the normality test, homogeneity test, N-Gain test, and T-Test. The effectiveness of the MASLEMBING teaching materials containing ethnomathematics developed is measured using a comparison of the increase in student learning outcomes given during the initial learning meeting and at the end of the meeting. The data from the normality test results calculated using SPSS are presented in Table 5.

Table 5. SPSS output results of the normality test

Tests of Normality				
		Shapiro-Wilk		
	Class	Statistics	Df	Sig.
Posttest	Control	.923	21	.098
	Experiment	.924	21	.106
a. Lilliefors Significance Correction				

Based on Table 5, it is known that the control group's posttest significance value of 0.098 > 0.05 proves that the data is normally distributed. The experimental group's posttest significance value of 0.106 > 0.05 proves that the data is normally distributed. The homogeneity test results calculated using the SPSS test are presented in Table 6.

Table 6. SPSS output results of the homogeneity test

Test of Homogeneity of Variance					
		Levene Statistics	df1	df2	Sig.
Post -test	Based on Mean	.995	1	40	.325
	Based on Median	.482	1	40	.492
	Based on Median and with adjusted df	.482	1	34,964	.492
	Based on the trimmed mean	.975	1	40	.329

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Based on Table 6, it is known that the significance value based on the mean of both groups is 0.325, which is greater than 0.05. Therefore, it can be said that the variance of two or more groups of data population is the same (homogeneous).

Improvements in student learning outcomes can be seen from the difference between pretest and posttest results. These improvements were measured using the normalized gain test. Details of individual improvement results in the experimental and control classes can be seen in Tables 7 and 8.

Table 7. N-Gain score of the control class

No.	Pre test	Post test	Post-Pre	100-Pre	N-Gain	Criteria
1	75	80	5	25	0.20	Low
2	80	90	10	20	0.50	Currently
3	75	85	10	25	0.40	Currently
4	60	70	10	40	0.25	Low
5	80	90	10	20	0.50	Currently
6	60	80	20	40	0.50	Currently
7	80	85	5	20	0.25	Low
8	80	80	0	20	0.00	Low
9	85	80	-5	15	-0.33	Low
10	85	85	0	15	0.00	Low
11	65	70	5	35	0.14	Low
12	65	75	10	35	0.29	Low
13	70	80	10	30	0.33	Currently
14	85	95	10	15	0.67	Currently
15	80	95	15	20	0.75	Tall
16	60	85	25	40	0.63	Currently
17	90	90	0	10	0.00	Low
18	70	80	10	30	0.33	Currently
19	80	80	0	20	0.00	Low
20	65	70	5	35	0.14	Low
21	80	80	0	20	0.00	Low
Minimum					**-0.33**	**Low**
Maximum					**0.75**	**Tall**
Average					**0.26**	**Low**

The results of the N-Gain score calculation show an average value of 0.26, which is in the low category, namely 0.26 < 0.30, so the level of effectiveness is less effective.

Table 8. N-Gain score of the experimental class

No	Pre	Post	Post-Pre	100-Pre	N-Gain	Criteria
1	85	95	10	15	0.67	Currently
2	75	80	5	25	0.20	Low
3	70	95	25	30	0.83	Tall
4	65	90	25	35	0.71	Tall
5	75	95	20	25	0.80	Tall
6	65	85	20	35	0.57	Currently
7	80	85	5	20	0.25	Low
8	90	95	5	10	0.50	Currently
9	90	100	10	10	1.00	Tall
10	85	90	5	15	0.33	Currently
11	75	90	15	25	0.60	Currently
12	70	90	20	30	0.67	Currently
13	80	90	10	20	0.50	Currently
14	95	95	0	5	0.00	Low
15	70	85	15	30	0.50	Currently
16	65	85	20	35	0.57	Currently
17	70	80	10	30	0.33	Currently
18	75	90	15	25	0.60	Currently
19	95	100	5	5	1.00	Tall
20	70	85	15	30	0.50	Currently
21	95	95	0	5	0.00	Low
Minimum					**0.00**	**Low**
Maximum					**1.00**	**Tall**
Average					**0.53**	**Currently**

The n-gain score calculation results show an average value of 0.53, which is in the moderate category, namely 0.30 < 0.53 < 0.70. It can be concluded that the level of effectiveness is effective. A product will be tested for effectiveness if it has been declared valid and practical. A teaching material can be said to be effective if the teaching material has a positive influence or effect on achieving learning objectives (Devirita et al., 2021). This is in line with Murtafiah et al., who stated that questions in mathematics learning should be linked to the context of students' daily lives and everyday problems faced by students (Noor et al., 2024).

An independent sample t-test is used to determine whether there is a difference in the average of two unpaired samples. The main requirements for an independent test,

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the sample t-test, are for normally distributed and homogeneous (not absolute) data. The post-test difference test results are presented in Table 9.

Table 9 shows that the significance value is 0.000, which is less than 0.05, indicating a significant difference between the post-test results in the control and experimental classes. Therefore, It can be concluded that the development of MASLEMBING teaching materials is proven to be effective in improving the learning outcomes of sixth-grade elementary school students. MASLEMBING teaching materials are a form of digital learning resource that can be used independently. Digital modules have the advantage of presenting material using interactive learning media (Bintoro, H S et al., 2021; Serevina et al ., 2018).

Table 9. SPSS output results of the T-Test

		Independent Samples Test								
		Levene's Test for Equality of Variances		t-test for Equality of Means						
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Standard Error Difference	95% Confidence Interval of the Difference	
									Lower	Upper
Learning outcomes	Equal variances assumed	2,040	.157	5,674	82	.000	8,095	1,427	5,257	10,933
	Equal variances not assumed			5,674	77,847	.000	8,095	1,427	5.255	10,936

MASLEMBING teaching materials containing ethnomathematics have been proven to be effective and capable of improving student learning outcomes. This is because MASLEMBING teaching materials based on problem-based learning have several advantages, namely helping students develop new knowledge, helping students transfer their knowledge in solving problems, and developing children's critical thinking skills. The results of validation tests by experts explain that the teaching materials are suitable for use, while the results of the t-test in SPSS prove that the teaching materials are effective and suitable for use. This is in line with research conducted by Islahiyah et al (2023) that problem-based e-module teaching materials are very valid, practical, and effective for use in learning. The advantage of this study is that the problem-based ethnomathematics teaching materials in the form of an Android-assisted application are cer-tainly feasible, practical, and effective for use in learning based on the results of data analysis conducted by the researcher.

Several factors contributed to the significant results obtained in this study. The integration of Problem-Based Learning (PBL) encouraged students to actively engage in solving contextual problems, leading to deeper conceptual comprehension. The ethnomathematics component, which incorporates local cultural contexts such as traditions from Kudus and Jepara, made the learning experience more meaningful and relatable to students' everyday lives. Additionally, the use of a digital application

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as the delivery medium allowed the material to be presented interactively through videos, images, educational games, and practice questions, increasing student engage-ment and participation (Affandy et al., 2024). The initial needs analysis conducted with teachers and students also showed a strong desire for more innovative and appealing teaching materials, which the digital MASLEMBING product successfully addressed.

In terms of strengths, this study offers several notable advantages. It effectively combines PBL and ethnomathematics within a digital application that can be accessed anytime and anywhere, supporting flexible and independent learning. The multimedia elements embedded in the teaching materials make learning more attractive and enjoyable for students. However, the study is not without limitations. The field trials were conducted only in several schools within a single district, which limits the generalization of the findings. Additionally, the use of a digital application requires adequate access to smartphones, which may not be available to all students (Palinussa et al., 2025).

When compared with previous studies included in the state of the art, the findings of this study are consistent with research by Islahiyah et al. (2021), which reported that PBL-based teaching materials are valid, practical, and effective in improving mathematical problem-solving skills. This study is also in line with other research showing the positive impact of PBL on students' critical thinking and learning achievement (Nahdi et al., 2020; Bintoro et al., 2024). Regarding ethnomathematics, the present findings reinforce earlier studies that demonstrate the benefits of integrating cultural contexts into mathe-matics instruction to enhance students' conceptual understanding and engagement. A key difference from prior research is that most earlier studies produced online e-modules requiring internet access, whereas this study developed an offline Android-based application, providing greater accessibility and practicality.

This study has important implications for elementary mathematics education. The MASLEMBING teaching materials enhance the quality of learning by providing a contextual, interactive, and meaningful learning experience. Teachers gain a valuable alternative digital teaching resource that simplifies the implementation of PBL in the classroom, while students benefit from a more enjoyable, motivating, and comprehensible learning process. Theoretically, this study contributes to the growing body of research on digital teaching materials that integrate PBL and ethnomathematics. Practically, the product developed through this research provides an innovative and accessible learning tool that can be used independently or in classroom settings and has the potential to be expanded to other areas of mathematics.

CONCLUSION AND SUGGESTIONS

The results of expert validation, student and teacher response questionnaires, N-Gain tests, and T-test comparisons using SPSS show good criteria, proving that MASLEMBING teaching materials based on ethnomathematics assisted by Android media are valid, practical, and effective for use in mathematics learning.

Similar research is expected to pay more attention to the limitations of technical development and planning.

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Future researchers are expected to develop other teaching materials that utilize a wide range of educational applications to optimally achieve learning objectives.

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