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DEVELOPMENT OF STUDENT WORKSHEETS USING ETHNOMATHEMATICS APPROACH ON PRISM GEOMETRY FOR MIDDLE SCHOOL

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ABSTRACT

This research aims to produce the topic of space geometry, specifically Prisms, for eighth-grade on middle school students (SMP/MTs) while meeting the criteria of validity, effectiveness, and practicality. The research method used is the Research and Development (R&D) approach with the Plomp model, which includes several stages, namely preliminary investigation, design, development or construction, as well as testing, evaluation, and revision. Based on expert validation, the developed worksheet obtained an average score of 3.81, which falls into the valid category. The results of the final learning test show a success rate of 81.10%, which falls into the very effective category. Meanwhile, the analysis of the teacher response questionnaire shows a practicality level of 93.05% with a very practical category. The results of the student response questionnaire also showed a practicality level of 91.23% with a very practical category. Thus, it is proven to be valid, effective, and practical, to be used in the learning process

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INTRODUCTION

Mathematics is science that has various properties such as having abstract objects of study, oriented towards an agreement, having a deductive mindset, consistent in the system, having meaningful symbols and prioritizing the universe of discussion (Siregar et al., 2024). In education, mathematics is one of the subjects that has an important role. However, most students find it difficult to understand the mathematical concepts taught by their teachers. Most students find it difficult to apply mathematics in everyday life because the mathematics learning developed by their teachers is only limited to memorizing formulas and little understanding of concepts. Facts show that in learning mathematics, especially geometry material, learning is often given examples or models of geometric shapes, both flat and spatial shapes that are less relevant to the lives of students (Ndiung & Jediut, 2021). This is the initial cause of students' difficulties in learning mathematics, namely learning mathematics that feels less meaningful (Dahlan & Permatasari, 2018). Students' difficulties in learning geometry materials are also caused by the existence of bad perceptions about mathematics lessons including geometry materials as difficult, boring lessons and tend to be irrelevant to students' daily lives (Rika Audina, 2021)

Abstract mathematics learning should be strengthened with a learning approach that makes it possible to concretize these concepts. By studying, exploring, and developing mathematics learning using an ethnomathematics approach, it can be one of the learning innovations for mathematics teachers. Based on the opinion expressed by Farhan in (Qurani et al., 2024) from an etymological point of view, ethnomathematics is defined as mathematics practiced in identifiable cultural groups such as groups, communities, and so on. Culture and mathematics are an inseparable component of the transition of science and technology so that mathematics is believed to be one of the sciences that is often applied in people's lives Meanwhile, according to D'Ambrosio in (Wijayanto, 2017) ethnomathematics is analogous to a lens for viewing and understanding mathematics as a cultural result or cultural product. According to (Dahlan & Permatasari, 2018), ethnomathematics is knowledge that connects mathematic with cultural elements. The form of this connection is seen in the application of mathematical concepts in culture as well as in methods of teaching mathematics that are adapted to local culture and the uniqueness of the character of students so that students are expected to blend in with the mathematical concepts taught and feel that mathematics is part of their culture.

From Francois, Ethnomathematics is a program or activity that delivers values in culture and mathematics education (Wijayanto, 2017). Ethnomathematics, which is a combination of mathematics and culture, needs to be connected to a context that is relevant to people's lives so that mathematics is not only seen as a subject, but also as a human activity that is closely related to local culture (Handayani et al., 2024).

In general, mathematics learning is still centered on the material in the book. Based on information from mathematics teachers who are active in MGMP in Sigi district, Central Sulawesi, it is stated that learning motivation is very necessary (Silfitrah & Mailili, 2020), (H.Mailili et al., 2023), this is intended in the learning process to be used as a driving force, driving, and directing learning activities. Furthermore, critical thinking skills and literacy skills are also still low, the data was obtained through interviews and questionnaires to MGMP math teachers in Sigi district. It is still rare to learn mathematics that really reveals the cultural reality around students, especially in Central Sulawesi. The balance between existing concepts in school and traditional culture is necessary in realizing contextual learning in accordance with curriculum expectations. A teacher has an important role in transforming culture-based mathematics learning. So that learning can be accepted more easily, close to students'

daily lives, and not impressed as something new that is far from real life.

In recent years, many studies have discussed culture, especially ethnomathematics in learning, but generally they are still exploratory and have not produced worksheets based on Central Sulawesi culture. Some studies highlight the importance of local culture (Afifurrahman et al., 2025), (Suciati et al., 2024), (Fitriyah & Dasari, 2023), (Hidayati et al., 2022), but have not been developed into teaching materials. Although there has been development of ethnomathematics-based worksheets (Fajriah & Mangkurat, 2024), (Aurelya & Bahri, 2023), (Shabira & Andhany, 2023) but not yet in the context of the local culture of Central Sulawesi. Therefore, this study fills the research gap by developing ethnomathematics worksheets based on Central Sulawesi culture, then supporting the themes of the National Research Master Plan in the focus areas of Social Humanities, Education, Arts and Culture on the theme of Education with the topic of educational outcomes and national character building (Dirjen PT Ristek, 2024). Thus, this study aims to produce Student Worksheets based on ethnomathematics of Central Sulawesi culture on the material of prism geometry for class VIII SMP / MTs students who are valid, effective and practical.

METHOD

The method used is research and development (Research and Development) with the development model is the Plomp development model which consists of four stages, namely from the preliminary investigation stage, the design stage, the realization/construction stage, and the test, evaluation and revision stage.

The supporting instruments used in this study consisted of validation sheets used to test the validity of Worksheet, teacher response questionnaire sheets and student participant response questionnaire sheets used to test the practicality of Worksheet, and end-of-learning evaluation test questions to measure the effectiveness of teaching Worksheet. The data used in this development research are quantitative and qualitative data. Quantitative data consists of an assessment of the validity test, effectiveness test, and practicality test. Meanwhile, qualitative data is in the form of input or suggestions for improving the developed Worksheet. Quantitative analysis was carried out on the score data given by the validator through the validation sheet. According to (Hobri, 2021), Hasanah in (Munir et al., 2023), determining the total average of validity aspects follows the following steps.

1) The average score of validation results from all validators for each indicator:

$$I_j = \frac{\sum_{j=1}^{n} V_{ji}}{n}$$

V_{ji} = validator-j is score data against indicator-i

n = number of validators

2) Average score for each aspect:

$$A_j = \frac{\sum_{j=1}^{m} I_{ji}}{m}$$

I_{ji} = average score for aspect-i for indicator-j

m = number of indicators in the i-th aspect.

3) Average total score (V_a) for all aspects:

$$V_a = \frac{\sum_{i=1}^{n} A_i}{n}$$

A_i = average value for the ith aspect-i

n = number of aspects

Table 1. Validity Categories

No	Average Expert Rating	Criteria
1	$1 \leq Va < 2$	Invalid
2	$2 \leq Va < 3$	Less Valid
3	$3 \leq Va < 4$	Valid
4	$Va = 4$	Highly Valid

The value Va or the average total value obtained refers to the interval for determining the level of validity as contained in Table 1. The Worksheet is declared valid if the average total score meets the valid or very valid criteria.

In the end-of-learning evaluation question, there are 4 description questions about the surface area and volume of prisms. The evaluation questions are used to determine the effectiveness of the developed Worksheet. The evaluation results are classically expressed in the form of a standard score on a scale of 1-100 with reference to the Criteria for Achievement of Learning Objectives set by the school which is 75 used to measure the effectiveness of the Worksheet. Adapted from (Nababan & Aminah, 2018), classical completeness can be calculated using the following formula:

$$p = \frac{T}{n}\ x\ 100\%$$

Description
p= percentage of classical completeness
T= number of students who are complete
n= number of students

Table 2: Effectiveness Level Categories

Persentage (%)	Category
81 – 100	Highly Effective
61 – 80	Effective
41 – 60	Fairly Effective
21 – 40	Less Effective

In the preparation of teacher and learner response questionnaires, there are indicators to determine the criteria for the level of practicality of the Worksheet that will be assessed by teachers and . Indicators that will be assessed in the teacher response questionnaire are teacher preparation, use of Worksheet, interest in Worksheet, teacher satisfaction in the learning process, and writing and language. Meanwhile, the indicators that will be assessed in the student response questionnaire are students' responses to the learning model applied, students responses to learning tools, students' responses to learning materials, and students' interest in participating in learning. The practicality of the developed product is reviewed from the analysis of the results of the teacher and learner response questionnaires. The questionnaire was filled in after the implementation of mathematics learning by applying the developed Worksheet. The scores obtained from the teacher and learner response questionnaires were converted into percentages using the following formula(Akbar, 2017).

$$p = \frac{TSe}{TSh}\ x\ 100\%$$

Description:
p = percentage value
TSe = Score obtained
TSh = Expected score

Table 3. Criteria for Practicality Level

Skor	Practicality Percentage	Practicality criteria
1	81%– 100%	Highly Practical
2	61%– 80%	Practical
3	41%– 60%	Less Practical
4	21%– 40%	Impractical
5	0%-20%	Highly Impractical

RESULT AND DISCUSSION

The development carried out by the researcher produces a product in the form of ethnomathematics-based Worksheet on the geometry prism spaces for students in grade VIII SMP /MTs.

1. Initial Investigation Stage

The initial investigation stage consists of the following steps.

(a) Curriculum Analysis

The results of the curriculum analysis obtained by the researcher after an interview with the homeroom teacher of class VIII who is also a teacher who teaches mathematics at SMP Negeri 13 Sigi, it is known that at SMP Negeri 13 Sigi using an independent curriculum, this study uses one of the class VIII classes as the research subject, namely class VIIIA so that the curriculum applied to the development of this learning tool is an independent curriculum. In addition, curriculum analysis is carried out by determining the phases, elements and learning outcomes of the independent curriculum, as in Table 4.

Table 4. Phases, elements, and learning outcomes (CPs)

Phase	Elements	Learning outcomes (CP)
D	Measurement	Learners can explain how to determine the area of a circle and solve related problems. They can explain how to determine the surface area and volume of spaces (prisms, tubes, spheres), pyramids and cones) and solve problems.

The results of the curriculum analysis show that one of the materials that must be achieved by students is the material of the surface area and volume of Prism Spaces. Furthermore, the learning outcomes of the surface area and volume of prism is developed into learning objectives.

(b) Learner Analysis

Learner analysis is conducted to determine the characteristics of students in terms of mathematical knowledge. Based on the results of the diagnostic assessment that researchers conducted on class VIIIA students and interviews with class VIIIA homeroom teachers, it is known that the academic abilities of students vary, ranging from low, medium, to high abilities. In addition, based on the results of interviews and observations of researchers, when students are given problems contained in the package book, they have difficulty solving the problems contained in the book.

This is because the problems presented have not been linked to everyday life, especially those related to local culture. Grade VIII students who are on average 13-14 years old, their cognitive development stage is at the formal operational stage. At this stage, children develop the ability to think abstractly, logically, and systematically. They are no longer limited to concrete experiences or what they can see and do directly, but are able to understand concepts that are hypothetical, theoretical, or symbolic. They can also use deductive reasoning to solve problems, namely starting with general principles and applying them to specific situations. Therefore, researchers developed Worksheet is that are associated with the context of one of the traditional houses of Central Sulawesi, namely the Tambi house in the hope that it can make it easier for students to learn the material and solve problems related to everyday life while introducing regional culture to students.

(c) Concept Analysis

Concept analysis was conducted to determine the learning objectives of the material to be used for research. Concept analysis was carried out by means of direct interviews with teachers teaching mathematics subjects in class VIII. The material used is the surface area and volume of prisms because the concepts in the material are directly related to everyday life, so they can be related to the environment and culture of students. Based on the Merdeka Curriculum Mathematics book for grade VIII SMP / MTs students

published by the Ministry of Education and Culture (2022), and the material that is in accordance with the learning outcomes in phase D is the material studied in the Prism Spaces chapter, namely the surface area and volume of triangular prisms.

2. Design Stage

At this stage, the initial design of the ethnomathematics-based Learner Worksheet was developed. The following is the process carried out during the design stage.

(a) Instrument preparation

In this study, the instruments were in the form of validation sheets, teacher and learner response questionnaires, and end-of-learning evaluation questions. The validation sheet is used to obtain data regarding the assessment of the validator which consists of 4 aspects of assessment, namely,

(1) format aspects,
(2) content feasibility,
(3) language feasibility aspects according to BSNP, and
(4) cultural aspects. This assessment intends to determine the level of validity of the Worksheet

On the surface area and volume of prisms. This validation sheet is also used as assessment data from validators in the form of suggestions or input regarding the developed Worksheet. The four aspects of th assessment above are used as validity criteria with an assessment range of 1-4 where the value of 4 is the highest value. The information obtained from the results of the analysis is a basic reference for whether or not there is a need to revise the developed Worksheet. In the preparation of teacher and learner response questionnaires, there are indicators that will be assessed by teachers and . Indicators to be assessed in the teacher response questionnaire are teacher preparation, use of Worksheet, interest in Worksheet, teacher satisfaction in the learning process, and writing and language. Meanwhile, the indicators that will be assessed in the student response questionnaire are students' responses to the learning model applied, students' responses to learning tools, students' responses to learning materials, and ' interest in participating in learning. The end-of-learning evaluation question has 4 description questions about the material of the surface area and volume of the Prism space used to assess how effective the Worksheet that has been developed. The end-of-learning evaluation questions are included in the appendix of the Worksheet.

(b) Format selection

The material used in this Worksheet is the surface area and volume of prism spaces based on ethnomathematics in the form of a traditional Central Sulawesi house, namely the Tambi house. The format that used in the development of this Worksheet is adjusted to the format and components of Worksheet in the Merdeka Curriculum which contains several components, namely the cover, general information section, Learning Outcomes section, Content section, and Evaluation.

(c) Initial design

At this initial design stage, the researcher designs the cover (cover page) of the Worksheet. Making Worksheet using the canva application. The Worksheet cover uses A4 paper size and Bobby Jones font, has green and Maron color variations, and is equipped with a picture of the Central Sulawesi traditional house, namely the Tambi house taken by the researcher. Some of the contents of the Worksheet. design can be seen in Figure 1.

Figure 1. Design of Worksheet

3. Realization/Construction Stage

At this stage, the Worksheet draft 1 is made, which is the main design based on the initial design. Worksheet is made based on the selected and developed ATP. Worksheet is prepared in accordance with the Merdeka Curriculum which applies to the junior high school / MTs equivalent education level. After producing draft 1, consultations and discussions were held to obtain suggestions/comments on the developed Worksheet. Some of the revisions made to draft I are as follows.

(a) Adding information and sources to the images contained in the Worksheet.

(b) Adding information and placing the original image in the center for all images in the sample questions contained in the teaching materials and evaluation questions.

After draft 1 was revised, draft 2 was produced. Furthermore, draft 2 was submitted to the validators for validation.

4. Test, Evaluation, and Revision Stage

At this stage, the teaching module validation test was carried out to validators and product trials to analyze the effectiveness and practicality of the Worksheet.

(a) Expert validation

At this stage, the validity of the Worksheet draft 1 which has been revised to produce draft 2 is submitted to the validators in order to obtain data on the results of the ethnomathematics-based Worksheet product on the material of Prism geometry for class VIII SMP / MTs students. This validation is carried out to find out what is still lacking and needs to be added to the Worksheet before being tested further to students. After receiving comments and suggestions for improvement from the validators, the draft 2 was revised so that the resulting draft 3 was then used for the trial stage of the learning device.

(b) Product trial

At this stage, the effectiveness test and practicality test were carried out. For the effectiveness test and practicality test using Worksheet draft 3. Effectiveness test data is obtained from evaluation questions that have been done by students based on the material that has been taught. This effectiveness test was carried out on a large group, namely class VIIIA students as an effort to assess the effectiveness of the developed Worksheet. The practicality test was carried out after conducting the effectiveness test, namely by giving a response questionnaire to teachers and students. The results of the response questionnaire will be analyzed to obtain criteria for the level of practicality of the Worksheet that has been developed.

The validity test results were obtained from the assessment of the LKPD validation sheet. The assessment of the Worksheet validation sheet was carried out by 3 expert validators consisting of Lecturer of Mathematics Education Study Program FKIP UNISA, Lecturer of Tadris Mathematics UIN Datrokarama Palu, and 8th grade mathematics teacher from SMP Negeri 13 Sigi. The assessment was carried out by giving a check mark (✓) in the rating scale column on the validation sheet. Each aspect of the assessment is appropriate and comes with some comments and suggestions for

improvement. The assessment results from the three validators can be seen in Table 5 .

Table 5. Results of LKPD Validation

Assessment Aspect	Average of each aspect (Ai)	Total average of all aspects (Va)
Format Aspects	3,83	
Content/Material	3,80	3,81
Appropriateness	3,75	
Aspects of Language Appropriateness according to BSNP Aspects of Culture/ethnomathematics	3,87	

Table 5 shows the results of the average value of the validation of Worksheet is 3.81 which indicates that the Wrksheet on the material of the Prism space for students of grade VIII SMP /MTs developed is in the "valid" category. Although it has very valid validity criteria, Worksheet improvement. After making improvements, the Worksheet draft III was produced. The effectiveness test results were obtained from an evaluation test containing 4 description questions. The recapitulation of the Worksheet effectiveness assessment from the evaluation test results is shown in Table 6 .

Table 6. Recapitulation of Evaluation Test Results

Criteria for KKTP	End of Learning Evaluation Test	
	Frequency	*Percentage (%)*
≥ 75	23	81.10
< 75	3	18.90
Total	26	100

Based on Table 6, the average percentage of completeness is 81.10% and meets the criteria of very effective. Therefore, it can be said that the developed Worksheet is declared effective. Thus, the effectiveness criteria for ethnomathematics-based Worksheet is on Prism geometry for class VIII SMP / MTs students can be said to be achieved and can be used in the learning process.

In the practicality test results, to determine the level of practicality, Worksheet draft3 was tested in class VIIIA SMP Negeri 13 Sigi. The practicality test carried out is divided into two, namely through a teacher response questionnaire and a student response questionnaire. After carrying out learning using ethnomathematics-based Worksheet on Prism geometry, the teacher fills out a response questionnaire for the teacher. Meanwhile, students fill out a response questionnaire after completing the end-of-learning evaluation test. The practicality test was carried out through a student response questionnaire in the form of an assessment from 26 students of class VIIIA SMP Negeri 13 Sigi. The recapitulation of the practicality assessment of the Worksheet from the results of filling out the learner response questionnaire can be seen in Table 7 .

Table 7. Recapitulation of the Results of the Learner Response Questionnaire

Indicator	TSe	TSh	P (%)	Criteria
Learning model applied Learning tools	648	728	89,01	Highly Practical Highly
Learning tool	293	312	93,91	Practical
Learning material	184	208	88,46	Highly Practical Highly
Learners' interest in learning	583	624	93,42	Practical
Total	1708	1872	91,23	Highly Practical

Description:
P =percentage value
TSe =total score obtained
TSh =total expected score

Based on Table 7, the average percentage of students' responses was 91.23% and met the practical criteria. Practicality test through teacher response questionnaire in the form of assessment from one mathematics teacher of SMP Negeri 13 Sigi. The recapitulation of the Worksheet practicality assessment from the results of filling out the teacher response questionnaire can be seen in Table 8.

Table 8. Recapitulation of Teacher Response Questionnaire Results

Indicator	*TS*e	*TSh*	P (%)	Criteria
Teacher preparation	8	8	100,00	Highly Practical
Use Of Worksheet	11	12	91,67	Highly Practical
Interest On Worksheet	10	12	83,33	Highly Practical
Teacher satisfaction in the learning process	14	16	87,50	Highly Practical
Suitability Of Worksheet Content	16	16	100,00	Highly Practical
Writing and Language	8	8	100,00	Highly Practical
Total	67	72	93,05	Highly Practical

Description:
P =percentage value
TSe =total score obtained
TSh =total expected score

Based on Table 8, the average percentage of teacher response is 93.05% and meets the criteria for being very practical. Based on this analysis, it can be concluded that the ethnomathematics-based Worksheet meets the practical criteria because the results of the teacher response questionnaire and the student response questionnaire reach the minimum criteria, namely practical.

This development research was conducted with the aim of producing a product in the form of ethnomathematics-based Worksheeet on Prism geometry for grade VIII SMP / MTs students that is valid, effective, and practical. Based on the results of the validity test analysis in Table 5, a value of 3.81 was obtained, so the worksheet developed by the researcher was included in the valid category. In terms of the four aspects of assessment on the Worksheet validation sheet, the highest score of assessment by the validator is in the Culture / ethnomathematics aspect, which is 3.87 with the valid category. Based on this, it can be said that the context of historical buildings in Central Sulawesi, namely the Tambi traditional house presented in the Worksheet on the material of the surface area and volume of prism spaces is good and appropriate. Thus, this research is in line with research conducted by (Fairuz et al., 2020). The result of the study was the development of Worksheet on number pattern material based on sasirangan ethnomathematics in class VIII junior high school with an average validity of all aspects of the assessment was 3.56. This research is also in line with research conducted by (Hisni et al., 2022) which produced a valid banjar cultural ethnomathematics-based Worksheet on flat-sided geometry with an average validity of all aspects of 3.14 which is included in the valid category on a 4 scale.

Based on the results of product trials conducted on 26 students of class VIIIA SMP Negeri 13 Sigi to assess the effectiveness and practicality of the Worksheet that has been developed. From the analysis of the effectiveness test based on the results of the evaluation test, the percentage of classical learning completeness was 81.10%, where 23

students scored more than KKTP so that it met the criteria or being Highly effective. This shows that the ethnomathematics-based Worksheet presents problems related to culture, then continues with activities that guide students in understanding the material, both finding concepts and understanding problem solving procedures so that students are easier to understand the material being taught. Ethnomathematics applied in learning can help students to more easily understand mathematical concepts because they are related to everyday life (Hutauruk, 2020). The results of this effectiveness test are in accordance with the results of research conducted by (Fajriah & Mangkurat, 2024) which produced Worksheet relations and functions in smp students in the context of Sigi cultural ethnomathematics in the study which was declared valid, practical and effective for improving student learning outcomes.

Based on the results of the analysis of the practicality test through the learner response questionnaire, a percentage of 91.23% was obtained and from the analysis of the practicality test through the teacher response questionnaire sheet, a percentage of 93.05% was obtained. In such a way, the acquisition of the two percentages of the response questionnaire is included in the very practical category. In terms of assessment indicators on the learner response questionnaire sheet, the highest score of assessment from students is on the indicator of learner responses to learning devices with sub-indicators The material is in accordance with the needs and interests of 93.91%. This shows that the LKPD that has been made can make students interested in learning materials. In addition, when viewed from the assessment indicators on the teacher response questionnaire sheet, the highest score of teacher assessment is on the indicator of teacher preparation, interest in Worksheet, suitability of

Worksheet content, and writing and language. This shows that the Worksheet that has been developed is practically used in the learning process. This is in line with research conducted by (Aurelya & Bahri, 2023) which produces market hawker ethnomathematics-based Worksheet is to improve students' mathematical problem solving skills which are practical with the results of the practicality test based on a student response questionnaire which reached a percentage of 89.87% and a teacher response questionnaire of 91%. This shows that the Worksheet that has been developed is Hghly practical to use in learning.

Based on the discussion above, the results of this development research have met the research objectives, namely to produce ethnomathematics-based Worksheet is on Prism geometry for class VIII SMP / MTs students who meet the valid, effective, and practical criteria. The results of this study are in line with research conducted by (Febriyanti & Ain, 2021) and (Azizah et al., 2024) which have produced ethnomathematics-based mathematics modules that are valid, practical and effective. Thus, Worksheet in the form of draft 3 is the final product of this research and development.

The developed Worksheet has advantages and disadvantages. The advantages of the Worksheet developed by researchers are that the Worksheet developed has been validated by experts with valid criteria and based on the results of the trial, the Worksheet developed meets the effective and practical criteria. The Worksheet is designed with the theme of the context of historical buildings in Central Sulawesi and uses attractive images. Worksheet was developed with the context of historical buildings in Central Sulawesi, such as the Tambi traditional house, so that it can be easier to understand the problems contained in the Worksheet. Also, ethnomathematics-based Worksheet can increase students' knowledge about the cultural context raised.

Meanwhile, the shortcomings of the Worksheet that the researchers developed are that the material on the Worksheet developed in this study is only limited to the material on the surface area and volume of prism spaces for class VIII students at the junior / secondary school level in the independent curriculum. In addition, because the Worksheet developed only

focuses on the culture of Central Sulawesi, the problems presented are only relevant for students who live in the area. This Worksheet development research was only carried out up to the test, evaluation, and revision stages. The implementation stage has not been carried out due to limited time, costs owned by researchers.

CONCLUSION

This research produces ethnomathematics-based worksheet is on the material of surface area and volume of prism spaces with valid, effective, and practical criteria through a development process. Results Validation analysis is obtained from several validity instruments. The average validity of all aspects assessed was 3.81 with a valid category. Thus, the worksheet developed reached the valid criteria. Furthermore, the results of data analysis showed that the level of effectiveness obtained from the classical learning completeness value of students reached 81.10%. In other words, it can be concluded that the worksheet developed reached the effective criteria. Then, the results of data analysis from the learner response questionnaire and teacher response questionnaire were 91.23% and 93.05% which werincluded in the highly practical category. Thus, the worksheet developed reached very practical criteria. Therefore, it can be concluded that the developed worksheet achieves valid, effective, and practical criteria.

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AUTHOR CONTRIBUTIONS

Author one: Responsible for the conceptualization of the study, drafting of the initial manuscript, editing process, and data visualization.
Author two: Contributed to manuscript review and editing, formal analysis, and the development of the research methodology.
Author three: Provided validation of the results and overall supervision of the research implementation.
Author Four: Formal analysis.
Author Five: Formal analysis.

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