Development of E-LKPD based on Ethnomathematics Material Cube and Beam Spaces for Elementary School Students

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**Abstract- The low understanding of mathematical concepts of cube and block building materials is caused by the lack of utilization of interactive learning media and related culturally based example problems such as traditional cake food. Therefore, this study aims to determine the feasibility of ethnomathematics-based E-LKPD on cube and block building materials for elementary school students. The type of research used is development research (Research and Development) which refers to the ADDIE (Analysis, Design, and Development) development model. The research instruments were in the form of needs analysis, product design and the results of validation sheets filled out by material experts, teaching material experts, and linguists. The novelty of this research is to develop ethnomathematics-based E-LKPDs that focus on the introduction of traditional cakes, namely jadah cakes resembling cube spaces and getuk cakes resembling beam spaces. The validation results showed that the developed E-LKPD obtained an average score of 80% from material experts with "feasible" criteria, 97% from media experts with "very valid" criteria, and 89% from linguists with "very valid" criteria. Thus, this ethnomathematics-based E-LKPD is declared feasible to be used as a mathematics learning media on the material of building cubes and beams in elementary school students.**

**Keywords- E-LKPD, Ethnomathematics, Building Space**

# Introduction

Learner Worksheets (LKPD) are printed teaching materials designed to guide students through certain tasks, containing instructions, steps, and how to complete tasks on certain materials (Iriani et al., 2023) . LKPD is one of the learning resources that can be developed by educators as facilitators in learning activities (jowita, v., 2017) . Learner Worksheets (LKPD) are very important learning media to help students understand concepts and develop skills (Zuriatin et al., 2022) . LKPD as a well-designed teacher evaluation tool and can facilitate teachers in implementing learning and support students in an active learning process and can encourage students to think critically, increase students' ability to participate in the learning process and be able to understand teaching material (Rewatus et al., 2020) . The LKPD contains material, instructions, and steps as well as practice questions that must be done by students (Amali et al., 2019;) . With this LKPD, it can encourage students to be actively involved in the learning process and be able to practice the concepts that have been learned.

Based on the results of direct observations and interviews with fifth grade homeroom teachers at public elementary schools in Malang district, the LKPD provided by the teacher is still print-based, colorless and still focuses on teaching materials from the government and has never designed its own LKPD, this causes the LKPD to be less attractive and still not effective in encouraging active student participation. LKPD provided by the teacher contains tedious exercise questions and has not been fully connected with examples of mathematical problems related to culture in everyday life in mathematics learning, especially in the material of building space, this causes students to find it difficult to understand concepts in real situations, lack of interest in learning and students think that learning mathematics is a difficult and boring lesson. So that this has an impact on the low learning outcomes of students. Based on the explanation above, to attract students' interest and attention in learning, appropriate learning resources are needed that are more interesting and interactive, one of which is the Electronic Learner Worksheet (E-LKPD) (Nusroh et al., 2024) .

Technological developments have opened up new opportunities in the world of education, especially in designing teaching materials, LKPD which used to be only in printed form, can now be converted into digital LKPD. With the use of LKPD technology, it can be designed as interesting as possible so that it can produce LKPDs that are easily accessible to students by utilizing technology so as to produce Electronic Learner Worksheets (E-LKPD) (Siregar et al., 2023) . Digital-based E-LKPD functions as an effective learning media to improve the learning process of mathematics, as well as offering a new approach for students in understanding subject matter (Nabilla et al., 2022) . The use of E-LKPD serves as an effective media, because it can provide a new approach for students in understanding the material taught by the teacher with a complex where this E-LKPD has interactive features. With the help of this E-LKPD, it can provide opportunities for students to hone technological skills such as online information capabilities, use digital devices, and be able to interact with digital technology in the learning process.

Learning mathematics, the application of ethnomathematics is often ignored in the learning process which results in less effective learning (Sarwoedi et al., 2018) . According to (Lubis et al., 2024) due to the absence of the application of ethnomathematics in the mathematics learning process students lose the opportunity to learn their own culture through mathematics learning. According to (Dari & Jatmiko, 2024) , with this problem, it is important to apply ethnomathematics in mathematics learning as a reference for understanding mathematical concepts and is directly related to students' daily environment, besides that through the application of ethnomathematics, students are aware of the importance of preserving local wisdom culture and students also know more about what is included in their culture. According to (Nurniyati et al., 2024) the importance of the ethnomathematics approach by inserting cultural elements in learning can increase student motivation and involvement and strengthen critical thinking skills. According to (Juliyansah & Hakim, 2024) A good understanding of the cubes and blocks is very important, because it is the basis for learning more complex geometry material at the next level of education.

Based on the results of research conducted by (Y.A. Talo et al., 2022) developed LKPD based on ethnomathematics of grave stones and traditional houses of Sumba for grade IV students in elementary schools. The researcher used cultural elements of grave stones and traditional houses of the Sumba community and the material developed from the researcher was square, rectangular, and triangular flat shapes. The research was carried out limited to only knowing the level of quality of ethnomathematics-based LKPD on the material of the perimeter and surface area of flat shapes so that it did not know the results of the effectiveness of the LKPD products developed. According to (Anggreyani et al., 2024) developed ethnomathematics-based mathematics LKPD on Jambi batik motifs for grade III in elementary schools, it is still in printed form. According to (Rahmadhani et al., 2024) developed LKPD based on kawung batik ethnomathematics on the material of the elements of a circle. The researcher used cultural elements from batik kawung with the material of the elements of a circle which was applied to VI grade students in elementary school. In line with the previous researchers above, this researcher also has similarities, namely both focus on developing ethnomathematics-based LKPD. However, in this development research, a novelty will be carried out from previous researchers, namely developing ethnomathematics-based E-LKPD with cube and beam building material. The E-LKPD that the researchers developed can also be accessed using smartphones, computers so that it is expected to increase students' interest in learning mathematics. While in the cultural context, researchers will focus on traditional jadah cake food typical of Rembang, Central Java, where the specific shape of the cake resembles a cube and getuk cake from Magelang, Central Java, where the specific shape of the cake resembles a block.

# Methodh

The research method used is the Research and Development method of the ADDIE model (Analysis, Design, Development, Implementation, and Evaluation) developed by Dicky and Cray. According to (Mulyatiningsih, 201 )6 the development of teaching materials is carried out through 5 stages visually but researchers only take three, namely Analysis, design and development. At the analysis stage, it is carried out to determine the CP and ATP on the material of cube and beam spaces in grade V SD in Malang district, analyze student characteristics to understand variations in learning styles and levels of interaction in learning, and analyze the needs for teaching materials for LKPD based on ethnomathematics of traditional cube-shaped Jadah cakes and block-shaped Getuk cakes that are already available. at the design stage, E-LKPD is designed in three main parts, namely the introduction which includes a cover, instructions, CP, TP, and ATP mapping, and LKPD activities. The core section contains materials, important information, and student activities, while the closing section includes evaluation and assessment. This E-LKPD is equipped with videos and color images to increase student learning motivation. At the development stage, validation was carried out by asking for input from material experts, LKPD experts, linguists, and supervisors before implementation, and revisions were made based on the suggestions given. After the product is declared feasible, this ethnomathematics-based E-LKPD relates Indonesian culture in mathematics learning, especially on the material of building cubes and blocks. This product is designed to provide interactive activities that encourage students to discover and prove concepts independently and in the form of soft files, this E-LKPD can be accessed via a web link, allowing flexibility in learning using digital devices

The data collection instruments in this study include observation questionnaires to develop ethnomathematics-based E-LKPDs on cube and beam building materials. Feasibility is assessed through a validation sheet by material experts, language experts, and language experts, the assessment is carried out using a Likert scale with a score range of very bad (1), not good (2), good (3), good (4). Data analysis used in this study is quantitative to assess the level of feasibility and qualitative. Analysis of the feasibility of E-LKPD can be known from the results of questionnaires that have been filled in by validators, namely material experts, language experts, and LKPD experts.

# Results and DISCUSSION

**RESULTS**

The product produced from this research is an E-LKPD based on ethnomathematics of typical jadah cakes from Rembang, Central Java and typical getuk cakes from Magelang, Central Java on the material of cube and beam spaces. The process of developing this E-LKPD by applying the ADDIE development model which has five stages but researchers only take three stages, namely Analysis, Design, Development:

1. The analysis stage is carried out to carry out curriculum analysis based on the results of interviews with the V grade homeroom teacher that the curriculum used is with the guidance of the independent curriculum, besides that, the results of analyzing student characteristics found that students have a variety of different learning styles, so that interactive learning media are needed that can increase participation and understanding of mathematical concepts more effectively. At the needs analysis stage, the results of observations show that the available teaching materials are still printed and less interactive, so it is necessary to develop ethnomathematics-based E-LKPDs that can be accessed digitally to help students understand the concepts of area and volume of cube and beam spaces more contextually.
2. Design stage, Product design results.
3. ethnomathematics-based e-lkpd product design

| NO | Development Results | Ethnomathematics |
| --- | --- | --- |
| 1. | In this section, we will pay attention to what the LKPD activities are. | **A cellphone screen shot of a cellphone screen  Description automatically generated** |
| 2 | Let's Ask. In this activity, students are invited to observe the pictures that have been provided. Let's ask questions students will be invited to make questions | A screenshot of a cellphone  Description automatically generated |
| 3 | Important information. Students will get important information about kue jadah and kue getuk. | A screenshot of a cellphone  Description automatically generated |
| 4 | On this page, students pay attention to the images that are already available from the two cakes, there is a description of each cake resembling the cubes and blocks. |  |
| 5 | Let's Observe In this section, students will find out and work out what are the characteristics of cube and block shapes. |  |
| 6 | In the section students will learn how to find the formula for the surface area and volume of cubes and provided video examples of problems and the process of making typical Palembang srikayaka cakes, as well as working on surface area and volume problems of cubes and blocks that are already available. |  |
| 7 | In this section, students will learn how to find the formula for the surface area and volume of a cube. |  |
| 7 | In this section, students will learn how to find the formula for the surface area and volume of a cube. |  |
| 8 | In this section, a video example of a problem and a video of the process of making a typical Bugis peca sponge cake and providing questions to work on the next slide is provided. |  |
| 9 | In this section, students will work on the volume problem of the beam building. |  |
| 10 | In this section students will work on the evaluation stage |  |

1. Sample of a Table footnote. *(Table footnote)*
2. At the Development stage, the results of suggestions from supervisors regarding ethnomathematics-based E-LKPD products, the application used must be able to include videos, images and student answers must be recorded in the application. Enter from the material expert, the presentation of the material must be systematic and the LKPD instructions must be complete. Input from LKPD teaching material experts provides a unique logo, adjusts the color of the writing with the backgraound, while input from language experts, namely using good and correct EYD language. Based on the results of the supervisor and three expert validators, the ethnomathematics-based E-LKPD on cube and beam building material is feasible to use according to the criticisms and suggestions that have been given. The results of the validation on the validation sheet instrument, so that data is obtained in the form of a percentage of determining the level of validity of the material, E-LKPD, and language on the E-LKPD.

The validation results can be seen in the following table:

|  |  |  |
| --- | --- | --- |
| Assessment Aspect | Average Score | Category |
| Material Expert | 80% | Worth |
| Expert on LKPD | 97% | Very Feasible |
| Linguist | 89% | Very Feasible |

Based on the table above, the results obtained from the material expert are 80% which indicates that the criteria are feasible to use, the LKPD expert gets a score of 97% with a very feasible category to use, and from the language expert the results are 89% with very feasible criteria to use.

**DISCUSSION**

Where students work by understanding the prompts or rare activities in the LKPD in the first part students are asked to pay attention to the images of the two types of traditional cakes in the form of cube and block spaces, then students are asked to make short questions related to the answers that have been provided. After that, in the third part, students are asked to watch a video of a recipe for making a traditional Palembang crescent cake, in the video about what the ingredients are in making crescent cakes and then make a problem to find the surface area and volume of the cube. According to (Fajriyah, 2018) Ethnomathematics owned by each region has a relationship with mathematical concepts that can be integrated in primary school level learning. Related to this concept, the author highlights ethnomathematics that focuses on various types of traditional cakes. In this context, traditional cakes are not only seen as cultural heritage, but also as objects of mathematical study that reflect various concepts. Through this approach, math learning can be linked to real life, so that students more easily understand abstract concepts by linking them to objects or activities that are close to their culture. Thus, the use of traditional cakes as media in ethnomathematics can be an innovative strategy to increase students' understanding and appreciation of mathematics as well as local culture. Ethnomathematics is applied in the E-LKPD on learning mathematics of cubes and beams to introduce mathematical concepts through local culture relevant to learning involving patterns from traditional cake food Jadah typical of Rembang and Getuk typical of Magelang. According to (Dewi & Agustika, 2022) Ethnomathematics-based E-LKPD is very helpful for students and motivated and can improve students' learning style in understanding the material provided because it is continuous with real concepts in everyday life. In line with the opinion according to (Lely Marlina et al., 2023) learning mathematics through the ethnomathematics approach combines culture with mathematics so that learning becomes more interesting and is able to increase students' cultural values and can improve student learning outcomes. This helps students to better understand math in a more contextual and meaningful way. Ethnomathematics in learning cube and block spaces provides an opportunity for students to see that math is not only taught abstractly, but also in the context of their real lives. According to (Silvia, 2019) Ethnomathematics-based LKPD can take advantage of the culture that is around us, so that the existence of cultural links in mathematics learning can increase the effectiveness of student learning and learning becomes fun because it takes place with real concepts. By incorporating local cultural elements such as traditional cake food into E-LKPDs, students can feel a direct connection between mathematics and their world, which in turn can increase their interest and understanding of mathematics.

The use of E-LKPD in ethnomathematics learning also serves to improve students' technological skills, because they will get used to using digital devices to solve problems and access learning materials. This is in accordance with the development of an increasingly digital age. According to (Firtsanianta & Khofifah,2022) E-LKPD is very important to be applied at school according to the rapid development of the era the school learning process must be able to collaborate by utilizing current technology so that students are not left behind in their skills using technology and can link mathematics learning with ethnomathematics by utilizing local culture. this is also expressed according to (Helmina et al., 2022) Current learning is not only about technology, but also about ethnomathematics, 2022) Current learning must be able to collaborate with technology in developing teaching materials as a provision for the nation's children so that they can face an increasingly advanced world, with the E-LKPD it can help students understand the use of technology and can link mathematics learning by linking ethnomathematics with local culture in the student's environment. In the ethnomathematics-based E-LKPD, the problem of building cubes and blocks refers to the patterns of various traditional cake foods. E-LKPDs that integrate ethnomathematics can increase students' creativity and critical thinking skills. Students not only work on math problems technically, but also learn to appreciate their cultural wealth and understand it through the lens of mathematics. This is in line with the opinion of (Liesandra & Nurafni, 2022) development of E-LKPD in learning mathematics flat geometry material based on ethnomathematics, the results of this study E-LKPD media in the form of ethnomathematics-based geometry material is able to provide students with freedom of thought because students learn mathematics through experiences from the surrounding environment (culture) so that students are able to apply mathematical theory more easily, with this, of course, understanding of student geometry material is not only limited to concepts and over time the independence of learning mathematics students will increase. Another study (Susanto & Yenni, 2022) shows that this LKPD can improve students' understanding of mathematical concepts through the context of local culture, especially pyramid houses. In addition, research conducted by (Wiwi et al., 2023) shows that this LKPD can improve students' critical thinking skills through the integration of local culture in mathematics learning.

Based on the results of the study, it shows that the ethnomathematics-based E-LKPD on cube and beam building materials for elementary school students meets the eligibility criteria. In the feasibility test which has gone through the validation stage by material experts, LKPD teaching materials, language. The results obtained from material experts reached 80% with decent criteria, LKPD teaching material experts reached 97% with very valid criteria, language validation reached 89% with very valid criteria. This indicates that the ethnomathematics-based E-LKPD has met the eligibility standards to be applied in learning mathematics in elementary schools.

CONCLUSION AND ACKNOWLEDGMENT

Ethnomathematics-based E-LKPD has a very good assessment. Through the results of validation by material experts, LKPD experts, and language experts in the category of feasible and very feasible for use in learning mathematics. With the existence of ethnomathematics-based E-LKPDs, it can help students to improve learning outcomes and can increase student motivation to want to learn mathematics about cube and beam building materials. This ethnomathematics-based E-LKPD uses the Topworksheet platform which can make E-LKPD more interactive through the features available in the Topworksheet application.

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