ISSN 2502-5872 (Print)
ISSN 2622-3627 (Elektronik)

Volume 9 Nomor 2, May 2024, 381-402

DEVELOPMENT STUDY: ETHNOMATHEMATICS-BASED DIGITAL WORKSHEETS WITH A REALISTIC APPROACH

Winda Alma Saputri [1*], Sri Wahyuni[2]
[1,2]Departement of Tadris Mathematics, Institut Agama Islam Negeri Metro, Jl. Ki Hajar Dewantara No.15A Iringmulyo, Kota Metro, Lampung, Indonesia
*Correspondence: windaalmasaputri@gmail.com

ABSTRACT
Cultural diversity in Indonesia can be utilized by integrating it into education using a learning model, the RME or PMR. The development of technology in the latest era shapes new mindsets and attitudes in society, requiring discoveries in mathematics learning. This study aims to create an interactive learning medium based on digital technology for junior high school students in grade VIII.B that is valid, practical, effective, and has a potential effect on student learning outcomes. The type of research applied is design research type development study and consists of two stages, namely preliminary and formative evaluation (self-evaluation, expert reviews, one-to-one, small group, and field test). The data analysis method is carried out descriptively using questionnaire results, interview results, and student tests. Based on what will happen, the media research developed must be valid, practical, effective, and have a potential impact. The validity is seen from the validation of material experts as much as 3.4 and media experts as much as 3.28, which is included in the very valid category. Furthermore, the media can be used by students to determine the practicality of the LKPD digital media. The practicality of learning media that has been developed in the small group step of 3.4 is included in the very easy or very practical category. Students are given a test before and after using the LKPD Digital media to determine the effectiveness of LKPD Digital. It was found from the N-Gain Score test results that the LKPD digital media was quite effective.
Keywords: Android, Development, Design Research, Digital LKPD, Ethnomathematics

How to Cite: Saputri, W. A., & Wahyuni, S. (2024). Development Study: Ethnomathematics-Based Digital Worksheets With A Realistic Approach. *Mathline: Jurnal Matematika dan Pendidikan Matematika*, *9*(2), 381-402. http://doi.org/10.31943/mathline.v9i2.612

PRELIMINARY

Mathematics has a significant role in shaping a better quality of life in theory and application. So far, mathematics is often considered a scary and difficult field of study to learn (Maisyarah & Prahmana, 2020). However, math is one of the school subjects that needs to be taught to train students' skills in solving problems and creating creativity. With that, learning mathematics should be interesting and generate student interest (Juhaeni et al., 2023). Quality learning activities allow students to actively develop their potential and skills according to their level of development.

Keeping up with the times requires an innovation that makes learning more fun (Farhan, 2023). Interesting teaching materials are needed to support learning so that

students are more interested and excited about learning math (Apriliyani & Mulyatna, 2021). In line with the results of observations and interviews with mathematics teachers and teachers at SMP N 10 Metro, the results obtained are that the curriculum applied there is the independent curriculum for class VII, and the 2013 curriculum is still being applied in classes VIII and XI for the last time. Furthermore, after interviewing about the curriculum, an interview was continued about the characteristics and understanding of students in mathematics. It was obtained that the characteristics are categorized as good and the ability of mathematical knowledge tends to be lacking, while for students, after being asked by the teaching teacher about learning support or media used in learning at the school using textbooks. Furthermore, after interviewing one of the students about learning mathematics in class VIII B, it was found that students still had difficulty understanding the concepts and drawing conclusions about the material explained. Students said that the teacher still did not use real examples in learning, so they still had difficulty understanding the purpose of the learning.

Efforts to increase student interest in learning are carried out to develop teaching materials in the form of electronic student worksheets (E-LKPD). E-LKPD is essentially the same as digital LKPD in general, except that E-LKPD is not printed on sheets of paper but only in the form of soft files that can be accessed via smartphones, laptops, and computers and can be accessed anywhere, which makes it easier for users to learn. The development of E-LKPD is based on the development of technology at this time, which can be used as a means to develop the abilities of students in the field of education. This can be a positive contribution to the welfare of mankind because technology can be utilized as a tool for developing individual potential, especially in the context of education (Umi & Purna, 2023). In addition, in this modern era, it would be better for us to keep up with technological developments by starting to utilize technology as a learning medium (Suryaningsih & Nurlita, 2021). There are many types of E-LKPDs that can make students learn interactively, one of which is professional flip-pdfs.

Flip PDF Professional is one application that can be used to convert PDF files to digital flipping pages, which allows users to create interactive learning media with various features in the application that can support the development of digital LKPD learning media. Can be accessed for free through the link https://online.flipbuilder.com/kjyvq/pvwl. Previous research that developed teaching materials using the professional PDF Flip website was conducted by (Fitri, 2023; Nabilla & Edy, 2022). According to Fitri (2023), the advantages of LKPD Digital are that it can be accessed anytime and anywhere, is

practical, and has various features that can make LKPD Digital more fun and danceable. Students can feel a learning model that is close to everyday life.

One of the steps to creating fun math learning is with culture, better known as ethnomathematics (Rura & Fajriah, 2022). Efforts to preserve local culture consist of linking cultural concepts with mathematical learning (Merliza, 2021). Because the issues involved in mathematics learning are closely related, mathematics learning can be linked to cultural and daily issues, allowing students to understand the material more deeply (Loviana & Merliza, 2020). Mathematics is tied to the cultural context because mathematics arises from cultural skills and activities(Oktapia & Nur, 2023). Ethnomathematics aims to deepen the understanding of the relationship between mathematics and culture (Jainuddin & Silalong, 2020). Ethnomathematics integrates mathematical concepts and local cultural values and can increase student creativity (Mustika, 2022). D'Ambrisio has defined "mathematics as being practiced in different cultural groups." This leads to a variety of ideas, ranging from different numerical and mathematical systems to multicultural mathematics education. Providing learning media that is also related to culture is very important to support learning that makes students play an active role and also provides cultural values in it (Silvia, 2019). The digital LKPD should be equipped with a learning model that helps students understand the surface area and volume of material. The learning model used to overcome these problems is the ``Pembelajaran Matematika Realistik" approach (PMR), or alternatively, ``Realistic Mathematics Education" (RME).

RME, or PMR, is a learning theory in mathematics. The RME approach is one of the approaches applied because it has several advantages. Some of the advantages conveyed (Suryati & Krisna, 2021) are that students never forget because they can build their own knowledge, and the learning conditions are interesting; therefore, it needs to be related to real life (reality) so that students are not easily bored. In learning mathematics, students learn to work in groups, think critically, and express their opinions. With the RME approach, it is expected to improve students' understanding of concepts related to flat buildings. The RME learning model was applied by (Octizasari, 2018; Hermina, 2016; Zhafirah, 2020) with the results of the study showing an increase in student learning outcomes (Pangestu & Santi, 2016). Learning with RME can be successful if it begins with careful planning. This planning includes making teaching materials in the form of student worksheets (LKPD), according to (Boru & Ambarwati, 2024).

The development of ethnomathematics-based digital LKPD with a realistic approach was developed by researchers referring to interviews conducted with students and teachers at SMP Negeri 10 Metro. The facilities and teaching materials available at the school exist, but there is no learning media that integrates material with culture in everyday life. The development of ethnomathematics-based digital LKPD is also made by researchers so that students are more familiar with culture. The culture taken by researchers in this digital LKPD is traditional cakes typical of Lampung and traditional houses of Lampung tribes.

The indicators of this ethnomathematics-based digital student worksheet with the RME approach contain real problems in everyday life related to Lampung culture. By applying the sophistication of existing technology, interactive digital teaching materials in the form of interactive digital LKPD were developed, which is the utilization of technology from hardcopy form into softcopy (digital) form that can be driven via cellphones and laptops and can contain videos, images, and others. According to Jenanda (2021), the advantages of using this digital LKPD are: (1) it minimizes time and space; (2) it does not require paper, ink, or others to protect the environment; (3) it exists from time to time because it is presented in digital format; (4) it contains a lot of digital LKPD because of its small format and capacity; and (5) it minimizes expenses.

Based on these problems, the researcher wants to conduct development research entitled "Development of Ethnomathematics-Based Digital LKPD with a realistic mathematics education approach on flat-sided space building material surface area and volume." The purpose of this research is to develop digital LKPDs that are valid, practical, effective, and have potential effects based on student test results after learning using ethnomathematics-based digital LKPDs with a realistic approach.

METHODS

This research applies the method, namely the design research method of the development study type. The model used in this study is a model developed by Tessmer in 1993. This research was conducted at SMP N 10 Metro. The subjects of this study were students of class VIII B SMP N 10 Metro, which amounted to 26 students. According to this development research model (Tessmer, 1993) , the preliminary stage and formative evaluation are part of the research design. Design the problem solution during the design phase of the formative assessment phase, and analyze the problem during the pre-evaluation phase. The processes of prototyping, self evaluation, expert review, one-to-one,

small group, and field testing, as well as the development of LKPD and evaluation instruments, are used to evaluate problem solving. Schematically shown in Figure 1 (Tessmer, 1993; Zulkardi, 2006).

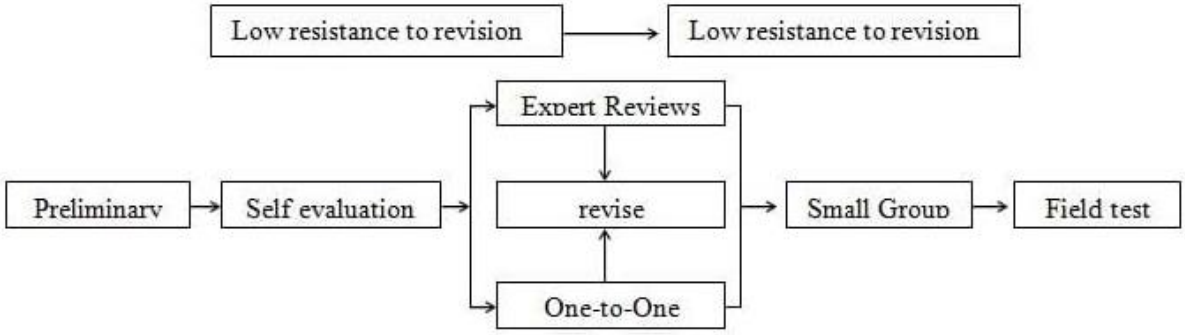


Figure 1: Flow of Development Research Design

Respondents in this study were students of classes VIII.B and VIII.D at SMP N 10 Metro. Students were given a response questionnaire to be analyzed so as to determine the practicality of the developed LKPD media. After learning with digital LKPD using the RME approach, students took the test and analyzed the results of the student tests to determine the potential effect of learning with digital LKPD.

The data collection methods used in this study are:

1. Questionnaires are used as an activity to collect data and information from expert responses (validators) and student response questionnaires. To find out the valid and practical digital LKPD developed.
2. Test (pre-test and post-test)

   A pretest and posttest are given to students to determine their abilities. The instruments used are validity, reliability, distinguishing power, and test difficulty. Based on the results of calculations carried out by researchers, it can be concluded that the test questions have good quality in terms of validity, reliability, difficulty level, and distinguishing power and are suitable for use to measure student abilities. The flied test stage will carry out tests before learning LKPD Digital and after learning LKPD Digital. The purpose of this test is to verify that the media used is effective.

The data analysis techniques used in this study are analysis of expert validation questionnaires, analysis of student response questionnaires, analysis of the practicality of digital LKPDs, and student test results after studying ethnomathematics-based digital LKPDs with a realistic approach. The results of the expert validation questionnaire were

analyzed descriptively and used as direction for improving each stage of prototype development.

Table 1. Scoring of Expert Validation Questionnaire Analysis

Number	Description	Score
1.	Very good	4
2.	Good	3
3.	Good enough	2
4.	Less good	1

Table 2. Validation Instrument Categories

Number	Average answer score	Category
1.	$3.25 \leq score < 4$	Very Valid
2.	$2.5 \leq score < 3.25$	Valid
3.	$1.75 \leq score < 2.5$	Moderately Valid
4.	$1 \leq score < 1.75$	Less Valid

The analysis of the practicality or usefulness of the LKPD Digital is obtained from the student response survey, which aims to obtain a practical LKPD Digital. Student response surveys use a Likert scale. The following are the steps to analyze the usefulness of digital-based LKPD:

a. Calculating the final score of the student response survey results.

b. Calculate the average score with the following formula: Average Score $(\bar{x}) = \frac{\sum validator\ answers}{\sum instrumen\ answers}$

c. Then determine the class interval distance in the following way: Interval Distance(i) $= \frac{\text{highest score} - \text{lowest score}}{\sum \text{class interval}}$

Based on the interval distance above, the category table in Table 3 below is made:

Table 3. Practicality Instrument Categories

Number	Average answer score	Category
1.	$3.25 \leq score < 4$	Very Practical
2.	$2.5 \leq score < 3.25$	Practical
3.	$1.75 \leq score < 2.5$	Moderately Practical
4.	$1 \leq score < 1.75$	Less Practical

d. For the practicality of e-LKPD, or LKPD Digital, researchers have a minimum target of getting a percentage of 3.25, based on practical criteria. If it does not meet

the minimum criteria, e-LKPD or LKPD Digital must be revised until practical criteria are obtained.

An analysis of the effectiveness of LKPD Digital can be seen from the mathematical results of students. Which includes pretest and posttest results. In this study, we determined the effectiveness of using LKPD Digital on students' mathematical abilities using the N-Gain calculation formula. According to Agustin (2020), the analysis was carried out using the following formula:

$$G = \frac{S_{post} - S_{pre}}{S_{maxs} - X_{pre}} \times 100\%$$

Deskription :

N-Gain : N-Gain Score

S_{pre} : pretest value

S_{post} : posttest value

S_{maxs} : Maximum score

The effectiveness criteria based on the N-Gain effectiveness interpretation category can be seen in Table 4 (Hake,1999).

Table 4. N-Gain Effectiveness Interpretation Category

Percentage(%)	Category
< 40	Inefective
40 -55	Less efective
56 – 75	Moderately efective
>76	Efective

Furthermore, the category of the acquisition of the N-gain score to measure the effectiveness of the applied digital LKPD can be seen in the following table in table 5 (Meltzer, 2002).

Table 5. N-Gain Score Category

N-Gain score	Category
$g > 0.7$	High
$0.3 \leq g \leq 0.7$	Medium
$g < 0.3$	Low

RESULT AND DISCUSSION

Preliminary Stage

The preliminary assessment stage aims to define and establish the necessary learning requirements. At the preliminary stage, observations were made at the school, which included interviews with teachers and students, concept analysis, task analysis, and analysis of the formulation of learning objectives. At this stage, interviews with teachers were conducted with the intention of gathering information related to the problems currently faced in learning mathematics, and then an alternative picture of basic problem solving was obtained, which made it easier to determine the teaching materials developed. After the interview, it was found that (1) the digital LKPD used by the teacher discusses core competencies and basic competencies with performance indicators that are aligned with the Indonesian government's education curriculum (K–13 curriculum). and (2) digital LKPD used in the teaching and learning process has not yet linked science with culture in real life.

At the concept analysis stage, the main concept of the material taught is then designed as an appropriate and systematic submaterial based on the learning objectives that will be included in the digital LKPD based on Lampung ethnomathematics with a realistic approach that has not been applied by teachers at SMP N 10 Metro. Furthermore, in task analysis, students in the teaching and learning process still use printed books. This analysis will produce a description of the tasks that need to be given to students for them to use as learning materials tailored to learning objectives, so that students are able to master the tasks that have been given. The learning objectives stage is carried out to summarize all the results of the analysis that has been done previously. The results of this analysis will provide learning objectives that students will master or achieve when using the Lampung ethnomathematics-based digital LKPD, with a realistic approach to be developed.

The results of the initial observation showed that students in class VIII.D. were selected as the subjects of the individual and small group phases. Class VIII.B students, totaling 26 students, were also field tested with different ability levels. The next step was to create a problem solution. This solution should include the main concept of the material, learning objectives, and product quality assessment tools built based on the 2013 Curriculum and PMR approach.

Self Evaluation

This stage aims to plan or design a teaching material in the form of digital LKPD based on Lampung etomathematics with a realistic approach. Activities at this stage are the

selection of teaching materials, format selection, and initial design. In the selection of teaching materials, it is carried out to identify digital LKPDs that are appropriate and in accordance with the characteristics of the learning material, as well as teaching materials that are fun for students. In the Digital LKPD, the format to be developed uses Lampung ethnomathematics with a realistic approach. The initial design stage of the Digital LKPD with a realistic approach based on Lampung ethnomathematics will contain flat-sided space-building material that is related to the real lives of Lampung people, namely traditional Lampung cakes and Lampung traditional houses. After making the LKPD digital, an evaluation was carried out by the researcher with the help of a supervisor. In the one-to-one stage, students and expert reviewers will validate prototype 1 that has been made by researchers.

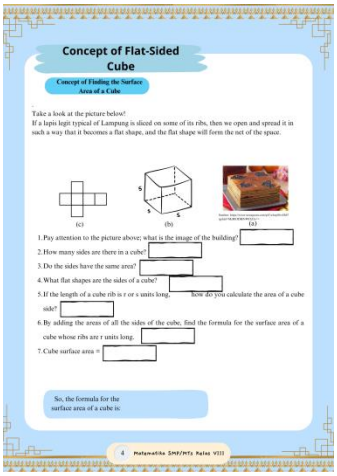


Figure 2. The Subject Matter In Ethnomathematics-Based Digital LKPD

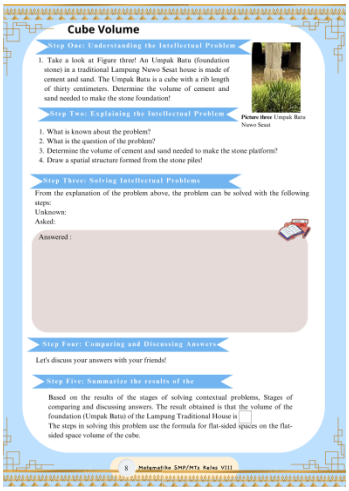


Figure 3. Realistic Approach In Digital LKPD

In the picture above, the LKPD section with the steps of the RME approach is:

1. Understanding problems in accordance with real-life situations, Student learning activities at this stage are to understand the problems presented by the teacher. Students use their own knowledge to understand the contextual problems they face.
2. Explaining contextual problems, The teacher explains a contextual problem that must be solved by students by not forgetting to provide direction and instructions on how to solve it.
3. Solving contextual problems, Problem-solving activities are carried out by students themselves based on the results of their understanding and knowledge.
4. Comparing and then discussing answers. Students conduct group discussions and present the results of the problem-solving process that has been carried out to correct the results of problem-solving together.
5. Concluding, Students are directed by the teacher to be able to conclude the concepts and ways of solving problems that have been discussed together.

Expert Review

Feasibility test of LKPD Prototype I. Two experts, who are material experts and media experts, evaluate prototype I. The experts include:

Material expert validation

1) Dwi Laila Sulistyowati, M.Pd,
2) Selvi Loviana, M.Pd.

Media expert validation

1) Fertilia Ikashaum, M.Pd,
2) Restilawati Wsoe Titi Cahyani, M.Pd.

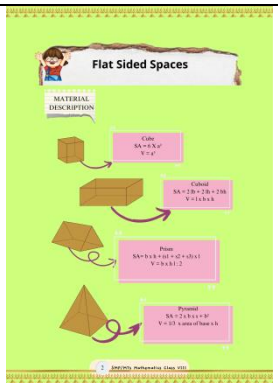
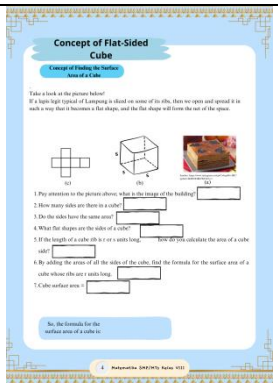
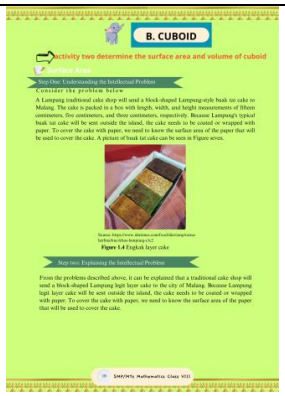
Validation is carried out by assessing the feasibility of digital LKPD by material and media experts, and researchers will be given suggestions and criticisms as instructions for making revisions to the products developed.

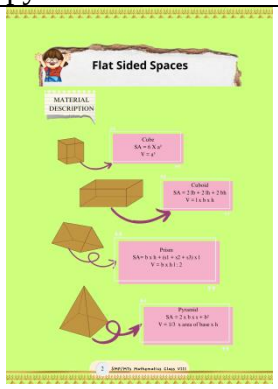
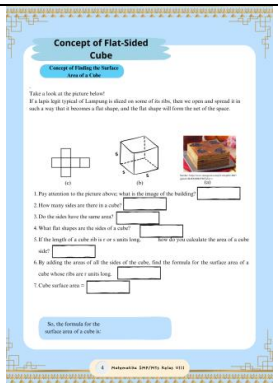
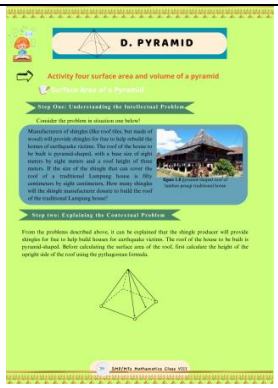
Material Validation for Ethnomathematics-Based Digital LKPD

At this stage, the validation test was carried out by experts, namely two material experts as validators who are lecturers of Tadris Mathematics IAIN Metro. This validation is carried out not only to measure the feasibility of e-LKPD but also to obtain suggestions and input as a basis for improvement for the e-LKPD being developed. On the results of the validation assessment of the validator's material, the overall average value of the material validator is 3.44 in the "Valid" criteria. Based on this assessment, the results obtained for the feasibility assessment of ethnomathematics-based e-LKPD with a realistic approach to the material of flat-sided space building are said to be "Valid". This validation

is done not only to measure the feasibility of e-LKPD but also to obtain suggestions and input as a basis for improvement for the e-LKPD being developed. The following will be shown in table 6 lkpd results after revision and before revision.

Table 6. Revision of material on digital LKPD based on input from validators

Number	Before revision	After revision
1		
	The formulas of surface area and volume of flat-sided spaces presented do not have information	The volume formula is replaced with the discovery of the volume formula of a space
2		
	The ethnomathematics presented is still lacking	Ethnomathematics presentation is improved
3		
	Improve the picture of the cake with a clear shape like a	The picture on the LKPD has been corrected

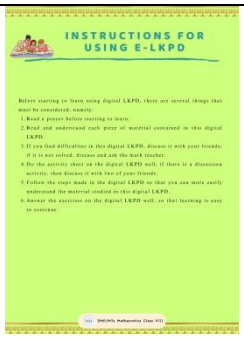
Number	Before revision	After revision
	pyramid	
4		
	Improve writing, add steps to find surface area and volume formulas	The writing style has been improved, the steps for finding the surface area and volume formulas have been completed
5		
	add an explanation at the beginning of the activity	an explanation has been added at the beginning of the activity

Media Validation for Ethnomathematics-Based LKPD

In the results of the media validation assessment of the two validators, the overall average value of the media validator is 3.2 in the "valid" criteria. Based on this assessment, the results obtained for the feasibility assessment of ethnomathematics-based e-LKPD with a realistic approach to flat-sided space building material are said to be "valid" so that it can be tested on students. Suggestions and improvements given by media validators are as follows:

Table 7. Media Revisions To Digital LKPD Based On Input From Validators

Number	Before revision	After revision
1	 Change the design of the LKPD	 LKPD design has been changed
2	 Improve the cover of IAIN and Tadris Mathematics logo placed above	 The location of the IAIN and Tadris Mathematics logos has been corrected
3	 Complete the picture that has no source	 The picture has been completed with the source
4	Add glossary	 Glossary on LKPD has been added

Number	Before revision	After revision
5	 In the instructions for use of LKPD there is too much writing	 It has been improved by changing the design in the instructions for using the LKPD made the same as the basic competencies so that there is not too much writing

The overall improvement of prototype 1 is called prototype 2. The results of the improvements, feedback, and suggestions at the expert review stage, as well as the 'good' criteria questionnaire, all indicate that Prototype 2 is qualitatively valid. In addition. Prototype 2 was tested in the one-to-one phase.

One-To-One

Following the expert validation phase, the one-to-one phase was continued. Prototype 2 was tested on three students of SMP N 10 Metro class VIII.D. with different cognitive abilities. Students are given a digital LKPD to read and understand the questions in the LKPD. The purpose at this stage is so that researchers can find out the obstacles and reactions of students in understanding the questions in the digital LKPD. The three students were named NF, NFA, and RF. The results of student responses at the one-to-one stage obtained an average score of 3.2 with the criteria "feasible." At this stage, overall, students asked for the introduction to be prioritized before entering the activity stage in the LKPD Digital. LKPD Digital was improved to meet valid criteria in terms of content, construct, and language based on suggestions from the expert review and one-to-one stages of prototype 1.

Small Group

After obtaining a valid prototype 2 assessed by experts, at this stage, prototype 2 is tested by six students in class VIII. D SMP N 10 Metro students of low, medium, and high

mathematical ability will be used for the prototype 2 trial, which includes modifications from the expert review and one-to-one stages. These six students have not studied flat-sided space-building material before. Students are given a link to access the digital LKPD. After the digital LKPD is given to students, they read and understand the questions contained in the LKPD. The purpose of this stage is to test the practicality of the developed digital LKPD and see if students understand the essence of the problems contained in the LKPD, both in information, writing, images, and numerical. After working on the LKPD digital questions, students are given a response questionnaire. The results of the questionnaire were analyzed in order to determine the level of practicality of the LKPD Digital. The questionnaire answers will be given as a revision of the teaching materials. After being revised, the teaching material then becomes prototype 3 (for example, the prototype of teaching aids made after being revised is called prototype).

Field Test

The field test is the last stage that aims to see the potential effects on students. Prototype 3 testing was conducted on 26 students in class VIII.B. SMP N 10 Metro. The results of the field test in the form of student answers were used by researchers to analyze the digital LKPD developed in the Lampung context, which had gone through the expert validation process. In the small group experiment, researchers divided this phase into two phases. Phase 1 involves the utilization of digital LKPD in learning, while phase 2 is focused on conducting experiments. The purpose of the experiment and test questions in this digital LKPD is to measure the potential impact on student learning outcomes.

The test results obtained by the Digital Media LKPD with Flip PDF Prefesional with N Gain Score showed that the results were very effective in improving pre- and post-test results. The impact of digital LKPD on learning is clearly visible. Table 8 displays the results of the N-gain score test.

Table 8. Effectiveness of Digital LKPD Products

N-Gain Test Results	Criteria
0.68	Moderately Efective

N-Gain test analysis of student tests shows that digital LKPD media development research can affect pre- and post-test results. In accordance with the findings (Heriyadi & Prahmana, 2020; Melisa et al., 2019; Wandari et al., 2018), digital LKPD can increase student learning motivation by using ethnomathematics principles and applying a realistic approach. Research conducted (Hermina, 2016; Rewatus et al., 2020) shows that the

application of LKPD with ethnomathematics elements can determine the suitability of local wisdom in mathematics education. However, this is in line with the findings (Rahmawati, 2021). Children's inability to connect mathematics with their cultural background and experience results in them forgetting and not being able to apply it. Through the integration of culture and mathematics, students learn mathematics with confidence, as it can increase their understanding and aptitude in mathematics or inspire learning motivation. According to research by Chahyanti, et al., (2022), PMR a learning theory that emphasizes students' concrete experiences, was found to promote process skills in mathematics, including discussion, collaboration, and debate with peers. Mathematical concepts can be discovered by students without teacher explanation, allowing them to solve problems independently or in groups. With this ethnomathematics-based mathematics learning, it can increase the love of students for understanding their own culture. In line with research (Mardati, 2001), learning using a realistic approach with everyday problems means that the concepts given can be understood by students because they are related to students' real lives.

This research provides a detailed overview of the findings from a design research study focusing on the development stage. Researchers conducted a thorough assessment of the curriculum, learning materials, and student characteristics in the first stage to identify learning needs. Students used the 2013 Curriculum, along with the documents used in the learning process, to establish links between the content taught and real-life situations through interviews and document review. The importance of learning tools that can benefit students and the relevance of their learning outcomes were demonstrated. This discovery became the starting point of the research in the following semester, which included the creation of a prototype learning tool called Prototype.

In the formative evaluation stage, prototype 1 was collected and evaluated, followed by the self-evaluation stage. The findings at this stage include the utilization of the PMR LKPD approach on cube and block materials, product quality assessment sheets from material experts and media experts, questionnaires to collect student input, and the potential impact on LKPD learning outcomes. Checking questions to measure effectiveness. Cube and beam in LKPD. After that, prototype 1 was conducted through peer review, individual interviews, and small group reviews. Expert evaluation, review, and one-to-one evaluation have been conducted, and it can be concluded that the NPDS, in accordance with the materials and media used, meet the criteria of 'good'. The current method is referred to as Prototype 2.

Small group-level observations were used to evaluate the practicality of Prototype 2 after it was validated in the LKPD. In addition, the assessment of the practicality aspect is based on the material, media (ethnomathematics presentation), and a questionnaire filled out by students. The assessment was carried out by students in class VIII.B who came from high, medium, and low IQ levels. The LKPD guidelines are well defined and must be followed by students in all activities. This is designed so that students understand the context of the LKPD and that it is easy to understand. Furthermore, students have the opportunity to utilize their resources and equipment to complete all stages of the activities listed in the LKPD. The revised prototype 2 was updated to include suggestions and opinions from the small group observations. Prototype 3 was created as a result of the improvements made. The valid and useful prototype 3 fell into the "good" category.

The field test phase is the stage of testing the validated prototype 3. The field test phase consists of two different phases. In the first phase, teachers' utilization of the LKPD during learning was directly observed, and in the second phase, test questions were given to evaluate the effectiveness of the digital KTPD. The first phase of the field trial revealed that teachers faced challenges in implementing digital IDEs. This shows that students usually do not use professional flip-pdf media for learning. Therefore, teachers should first guide students on how to use the application so that it can be used properly and correctly. In the Digital LKPD, each activity of the learning process is adjusted to the characteristics of the RME approach, among others: (1) understand the problem in the context; (2) explain the contextual problem; (3) solve the contextual problem; (4) compare and discuss answers; and (5) conclude the contextual problem. The LKPD Digital material was developed using the 2013 Curriculum, which emphasizes the construction of space, surface area, and volume of the field. In general, the RME approach can have an impact on the test scores of students with low, medium, and high cognitive abilities. Many researchers found that learning is influenced by the five characteristics of RME (Efuansyah & Wahyuni, 2019; Fitrianingsih et al., 2023).

Digital LKPD based on ethnomathematics with a realistic approach is implemented in learning flat-sided space-building material, showing that ethnomathematics-based Digital LKPD with a realistic approach is able to help students understand ethnomathematics-based flat-sided space building material with a realistic approach and improve student numeracy skills, although there are some students who still have difficulty understanding the material. Based on the description of the problem identification above and considering the broad scope of the existing problems, this research is given a problem

limitation, namely: Researchers developed ethnomathematics-based digital LKPD with a realistic approach only on flat-sided space-building material. And the product trial stage in the development of ethnomathematics-based digital LKPD with a realistic approach was only carried out on class VIII students of SMP Negeri 10 Metro.

CONCLUSION

This study successfully developed an electronic learner worksheet (e-LKPD) or ethnomathematics-based digital LKPD with a realistic approach to flat-sided space-building material for grade VIII junior high school students. This development integrates cultural elements, such as traditional Lampung cakes and traditional Lampung houses, to make math learning more fun and relevant to students' daily lives. The results of the validation assessment by material and media experts, student responses, and student test results show that this digital LKPD meets the criteria of being valid, practical, and effective. Students can learn the process of modeling in real life by using Digital Mathematics LKPD as a learning tool. The digital LKPD is proven to have a potential impact on mathematical modeling skills. Assessment of learning outcomes showed that 21 students reached the lowest level of completion, and their performance on the mathematical modeling cycle was excellent with average final results.

ACKNOWLEDGMENT

The authors would like to thank SMP Negeri 10 Metro and all stakeholders who have contributed to the writing of this article.

REFERENCES

Apriliyani, S. W., & Mulyatna, F. (2021). Flipbook E-LKPD dengan Pendekatan Etnomatematika pada Materi Teorema Phytagoras. *Seminar Nasional Sains*, *2*(1), 491–500. https://proceeding.unindra.ac.id/index.php/sinasis/article/view/5389

Boru, M. S., & Ambarwati, L. (2024). Preliminary Research : Development Of Digital Student Worksheets Based On Indonesian Realistic Mathematics Education To Improve Deaf Students ' Mathline. *Jurnal Mathline*, *9*(2622–3627), 285–304. https://doi.org/10.30598/jupitekvol1iss1pp1-7

Efuansyah, E., & Wahyuni, R. (2019). Pengembangan Bahan Ajar Matematika Berbasis PMRI Pada Materi Kubus Dan Balok Kelas VIII. *Jurnal Derivat: Jurnal Matematika Dan Pendidikan Matematika*, *5*(2), 28–41. https://doi.org/10.31316/j.derivat.v5i2.139

Farhan, M. N. (2023). Faktor Kesulitan Siswa Sekolah Dasar Dalam Belajar Matematika. *Jurnal Educatio*, *9*(2), 874–879. https://doi.org/10.31949/educatio.v9i2.4934

Fitri, Y. (2023). *Pengembangan E-LKPD Berbasis Pendekatan Saintifik Dengan*

Etnomatematika Menggunakan Flip Pdf Profesional Pada Materi Spldv. Yelda Fitri. https://doi.org/http://repository.uin-suska.ac.id/71388/

Fitrianingsih, N., Nabhar, N., & Auliya, F. (2023). Pengembangan LKPD dengan Pendekatan Realistik pada Materi Bangun Ruang Sisi Datar Kelas VIII. *CONSISTAN: Jurnal Tadris Matematika*, *1*(01), 39–48. https://ejournal.alqolam.ac.id/index.php/CONSISTAN

Octizasari, S. H. G. (2018). Penerapan Model Pembelajaran Rme Berbasis Ethnomatematika Untuk Meningkatkan Kemampuan Pemecahan Masalah Mahasiswa Calon Guru Pendidikan Matematika Fkip Universitas Bengkulu Implementation of Rme Learning Model Based of Ethnomatematic To Improve the Abili. *Jurnal Pendidikan Matematika (JUPITEK)*, *1*(1), 1–8. https://doi.org/10.30598/jupitekvol1iss1pp1-7

Heriyadi, H., & Prahmana, R. C. I. (2020). Pengembangan Lembar Kegiatan Siswa Menggunakan Pendekatan Pendidikan Matematika Realistik. *AKSIOMA: Jurnal Program Studi Pendidikan Matematika*, *9*(2), 395–412. https://doi.org/10.24127/ajpm.v9i2.2782

Hermina, S. (2016). Realistic Mathematic Education (RME) Dalam Meningkatkan Hasil Belajar Matematika. In *Ibriez : Jurnal Kependidikan Dasar Islam Berbasis Sains* (Vol. 1, Issue 1). https://doi.org/10.21154/ibriez.v1i1.5

Jainuddin, J., & Silalong, E. S. (2020). Eksplorasi Etnomatematika pada Ukiran Toraja. *Delta-Pi: Jurnal Matematika Dan Pendidikan Matematika*, *9*(2), 31–47. https://doi.org/10.33387/dpi.v9i2.2273

Juhaeni, J., Pratiwi, N. O. D., Luthfiyah, R., & Safaruddin, S. (2023). Pengembangan Media Pembelajaran E-Learning Melalui Aplikasi Quizizz Pada Mata Pelajaran Matematika Kelas 5 SD/MI. *Journal of Instructional and Development Researches*, *3*(1), 1–14. https://doi.org/10.53621/jider.v3i1.107

Loviana, S., & Merliza, P. (2020). Etnomatematika pada Kain Tapis dan Rumah Adat Lampung. *Tapis : Jurnal Penelitian Ilmiah*, *4*(1), 94–110. https://doi.org/10.32332/tapis.v4i1.1956

Maisyarah, S., & Prahmana, R. C. I. (2020). Pembelajaran Luas Permukaan Bangun Ruang Sisi Datar Menggunakan Pendekatan Pendidikan Matematika Realistik Indonesia. *Jurnal Elemen*, *6*(1), 68–88. https://doi.org/10.29408/jel.v6i1.1713

Mardati, A. (2001). Using realistict mathematics education (rme) approaches for understanding of the concept of geometry. *Conference Proceeding Icets*, 10–11. https://doi.org/10.32332/tapis.v4i1.1956

Rura, P. N. M, & Fajriah, N. (2022). Pengembangan Lkpd Pada Materi Lingkaran Berbasis Etnomatematika Nyiru Kelas VIII Smp/Mts. *Jurmadikta*, *2*(3), 43–52. https://doi.org/10.20527/jurmadikta.v2i3.1389

Melisa, M., Widada, W., & Zamzaili. (2019). Pembelajaran matematika realistik berbasis etnomatematika Bengkulu untuk meningkatkan kognisi matematis. *Jurnal Pendidikan Matematika Raflesia*, *4*(2), 103–110. https://ejournal.unib.ac.id/index.php/jpmr

Meltzer, D. E. (2002). The relationship between mathematics preparation and conceptual learning gains in physics: A possible “hidden variable” in diagnostic pretest scores. *American Journal of Physics*, *70*(12), 1259–1268. https://doi.org/10.1119/1.1514215

Merliza, P. (2021). Studi Etnomatematika: Eksplorasi Konsep Matematika pada Permainan Tradisional Provinsi Lampung. *Suska Journal of Mathematics Education*, *7*(1), 21–30. https://doi.org/10.24014/sjme.v7i1.12537

Mukhtar, N. (2021). Penerapan Model Pembelajar Penerapan model pembelajaran realistic

mathematics education (rme) untuk meningkatkan hasil belajar matematika siswa kelas v sd negeri 173 pekanbaru. *Tunjuk Ajar: Jurnal Penelitian Ilmu Pendidikan*, *4*(2622), 282–296. https://doi.org/http://dx.doi.org/10.31258/jta.v4i2.282-296

Mustika, J. (2022). Oemah Matematika: Pendampingan Pembelajaran Matematika Berbasis Etnomatematika Untuk Anak-Anak Di Kelurahan Yosorejo. *Journal of Social Sciences and Technology for Community Service (JSSTCS)*, *3*(1), 101–107. https://doi.org/10.33365/jsstcs.v3i1.1899

Nabilla, N., & Edy, S. (2022). Pengembangan E-Lkpd Matematika Interaktif Berbasis Literasi Digital. *Jurnal Pembelajaran Matematika Inovatif*, *5*(6), 1581–1594. https://doi.org/10.22460/jpmi.v5i6.1581-1594

Oktapia, L., & Nur, L. (2023). Development Of Lkpd Based On Contextual Teaching And Learning On Square And Rectangular Materials To Improve Learning Outcomes Of Grade Iv Elementary School Students. *Jurnal Mathline*, *8*(3), 937–954. https://doi.org/https://doi.org/10.31943/mathline.v8i3.479

Pangestu, P., & Santi, A. U. P. (2016). Pengaruh Pendidikan Matematika Realistik Terhadap Suasana Pembelajaran Yang Menyenangkan Pada Pelajaran Matematika. *FIBONACCI: Jurnal Pendidikan Matematika Dan Matematika*, *2*(2), 58–71. https://doi.org/10.24853/fbc.2.2.58-71

Rahmawati, F. (2021). Pengembangan LKPD berbasis etnomatematika dengan motif Lampung pada materi bangun ruang sisi datar kelas VII SMP. *Jurnal Diktatis Indonesia*, *1*(2), 141–155. https://doi.org/http://journal.didaktis.id/index.php/jurnaldidaktisindonesia/article/download/17/20

Rewatus, A., Leton, S. I., Fernandez, A. J., & Suciati, M. (2020). Pengembangan Lembar Kerja Peserta Didik Berbasis Etnomatematika Pada Materi Segitiga dan Segiempat. *Jurnal Cendekia : Jurnal Pendidikan Matematika*, *4*(2), 645–656. https://doi.org/10.31004/cendekia.v4i2.276

Silvia, T. (2019). Pengembangan lembar kerja peserta didik (LKPD) berbasis etnomatematika pada materi garis dan sudut. *Hipotenusa : Journal of Mathematical Society*, *1*(2), 38–45. https://doi.org/10.18326/hipotenusa.v1i2.38-45

Suryaningsih, S., & Nurlita, R. (2021). Pentingnya Lembar Kerja Peserta Didik Elektronik (E-LKPD) Inovatif dalam Proses Pembelajaran Abad 21. *Jurnal Pendidikan Indonesia*, *2*(7), 1256–1268. https://doi.org/10.36418/japendi.v2i7.233

Suryati, K., & Krisna, E. D. (2021). Pendekatan Pembelajaran Matematika Realistik (PMR) Berbantuan Telegram Untuk Meningkatkan Hasil Belajar Matematika. *PENDIPA Journal of Science Education*, *5*(3), 479–485. https://doi.org/10.33369/pendipa.5.3.479-485

Tessmer. (1993). Buku *Ragam Analisis Data Penelitian* (S. R. Wahyuningrum (ed.)). Cetakan 1. Kementrian Pendidikan dan Kebudayaan. https://doi.org/https://g.co/kgs/h9eovw7

Umi, N., & Purna, R. (2023). Pengembangan Video Pembelajaran Berbasis Pemecahan Masalah Berbantuan Adobe Captivate Materi Matriks Pengembangan Video Pembelajaran Pemecahan Masalah Berbantuan Adobe Captivate Materi Matriks. *International Journal of Progressive Mathematics Education*, *1*(2785), 1–15. https://doi.org/https://journal.uhamka.ac.id/index.php/ijopme/article/download/7689/2787

Chahyanti, V. E., Kamid, K., & Anggereini, E. (2022). Pengembangan LKPD berbasis pendekatan RME pada materi segiempat untuk meningkatkan kemampuan berpikir kreatif siswa. *AKSIOMA: Jurnal Program Studi Pendidikan Matematika*, *10*(4), 2815–2825. https://doi.org/http://dx.doi.org/10.24127/ajpm.v10i4.4337

Wandari, A., Kamid, K., & Maison, M. (2018). Pengembangan Lembar Kerja Peserta Didik (LKPD) pada Materi Geometri berbasis Budaya Jambi untuk Meningkatkan Kreativitas Siswa. *Edumatika : Jurnal Riset Pendidikan Matematika*, *1*(2), 47–55. https://doi.org/10.32939/ejrpm.v1i2.232