DEVELOPMENT OF LKPD USING A PROBLEM BASED LEARNING MODEL BASED ON ETHNOMATHEMATICS ON CIRCLE MATERIAL SMP CLASS VIII

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Abstract
The aim of this development research is to produce LKPD using the Ethnomathematics-based Problem Based Learning Model in SMP Class VIII on Circle Material that is valid, practical, and has potential effects. The ethnomathematics used in this research is the architecture of the Abdul Kadim grand mosque. Development research was carried out using the ADDIE model which consists of 5 stages, namely: Analysis, Design, Development, Implementation, Evaluation. This research was tested on students in class VIII of SMP Negeri 1 Sekayu, the sample in this study was limited to students in class VIII.2 of SMP Negeri 1 Sekayu. The data collection instruments used were observations, validation sheets, questionnaires and tests. The analysis technique used is quantitative analysis. So, the results of this research show that the Student Worksheet (LKPD) developed is in the very valid category based on the validity aspect with an average percentage score of 89.7%, based on the practicality aspect with an average percentage score of 84% categorized as very practical, as well as the potential effect on student learning outcomes of 88.8%.

Keywords: Ethnomathematics, Circles, LKPD, PBL

INTRODUCTION
Mathematics is a science that universal, the basis for the development of modern technology, has important role in all fields of science, develop human thinking abilities and is one of the fields of research, supporting the development of science and technology (Aledya, 2019). Mathematics learning can train students to think logically and be able to solve problems systematically (Noperta & Sari, 2023). Mathematics also classified into several branches, one of which is geometry. Geometry is branch of mathematics which taught at all levels of education from elementary school to college. According to Andriliani et al. (2022) geometry is part of mathematics which very close to students because almost everything
around students is geometric objects. One of the geometric materials contained in mathematics learning is circles.

The application of this circle material is very much related to everyday life. Even though this circle material is widely used in everyday life applications, students still experience difficulties in learning circles. As stated by Jayanti & Hidayat (2020) and Suhaeti et al. (2020), through research they have conducted, stated that there are still many students who have difficulty understanding questions on circles, lack the ability to identify problems, and lack the ability to understand concepts.

The results of observations made by researchers at SMP Negeri 1 Sekayu stated that there were still many students who did not understand mathematical concepts in circle material. The lack of understanding of the concepts in this circle material is influenced by the lack of interest in the teaching materials and learning concepts used by teacher. An alternative that can be used to overcome students' difficulties is by developing innovative and interesting teaching materials, one of which is in the form of LKPD because LKPD used at SMPN 1 Sekayu was still not attractive.

LKPD usually contains instructions, steps to solve a problem (Astuti et al., 2021). Through research conducted by Istiqomah & Somakin, (2022) and Novitasari et al. (2021) stated that LKPD can increase students' interest in learning because the activities in LKPD direct them to think so that they are more interested in using LKPD, and can increase students' understanding of mathematical concepts. Apart from being able to increase students' understanding of concepts and interest in learning, LKPD usually also requires learning strategies that can also improve students' abilities. One of the appropriate strategies to use in facilitating students' mathematical understanding abilities is PBL. PBL is one of the appropriate strategies because with this PBL strategy students find it easier to understand the mathematical problems around them.

According to Andeswari et al. (2022) the PBL learning model begins by providing authentic problems to students so that learning focuses on students' problem solving abilities. As stated by Fitriyanti et al. (2022) that the problem-based PBL learning model can improve learning outcomes and student learning activities. The problems contained in the Problem Based Learning Model are usually related to everyday life. Therefore, from the two opinions above, the researcher updated the PBL-based LKPD by adding ethnomathematics to the problems in LKPD.

According to Brandt & Chernoff Hasanah et al. (2019) ethnomathematics is culture-based mathematics, then integrated into mathematics classes. Culture in mathematics is usually known as Ethnomathematics. Through the application of ethnomathematics in mathematics education, it is hoped that students will be more interested in learning mathematics and understand mathematics better. Ethnomathematics can also be used as
a means of studying mathematical elements in local culture that can be integrated with mathematics. 

Musi Banyuasin Regency is a district located in South Sumatra Province. Musi Banyuasin Regency has various cultures such as dance, traditional fabrics, crafts and in terms of building architecture such as the architecture of the Abdul Kadim Grand Mosque.

Figure 1. Mosque of Abdul Kadim

The Abdul Kadim Grand Mosque is a place of worship for Muslims in Musi Banyuasin Regency, especially in Epil Village. This mosque is one of the grandest mosques in South Sumatra. It is because of its grandeur and unique architecture, the Abdul Kadim Grand Mosque attracts a lot of attention from the people of Musi Banyuasin and its surroundings. Therefore, researchers took the initiative to take the concept of mathematical elements of circles in the architecture of the Grand Abdul Kadim Mosque, such as the base of the dome in the Grand Abdul Kadim Mosque which is in the shape of a circle.

Figure 2. The dome base of the Abdul Kadim Mosque is circular

Based on the description of the problem, a solution is needed to overcome this problem. One of the right ways to overcome existing problems is to design teaching materials in the form of LKPD that are valid, practical and interesting. This solution is used so that students can easily understand mathematical concepts and increase students’ interest and insight into the culture around them.

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problems is to design teaching materials in the form of LKPD that are valid, practical and interesting. This solution is used so that students can easily understand mathematical concepts and increase students' interest and insight into the culture around them.

METHODS

The method used in this research is the research and development method which aims to produce products that are valid, practical and effective. The development model used in this research is the ADDIE model. According to Robert Maribe Branch (2009) in (Sugiyono, 2019), developing learning designs using the ADDIE model, this ADDIE model is the appropriate model to use in this research because this development model has advantages in systematic work stages. The ADDIE model includes five steps, namely: (1) Analysis, (2) Design, (3) Development, (4) Implementation, (5) Evaluation.

The procedures implemented in the ADDIE model in this research are: 1) Analysis, which includes needs analysis, curriculum analysis, and material analysis; 2) Design, namely collecting sources related to material, selecting media, and selecting format; 3) Development, which includes validation tests by experts and one to one trials, 4) Implementation, which includes small group trials and field trials (large groups); 5) Evaluation, evaluation of suggestions and improvements received during product testing is carried out. The data collection instruments used in this research include validation questionnaires used to assess the validity of the LKPD being...
Development of LKPD that are valid, practical and have potential effects. The resulting product has gone through every step of the ADDIE model development, which includes five steps, namely:

**Analysis**

The analysis stage includes needs analysis, curriculum analysis and material analysis. At the needs analysis stage, an indirect interview was conducted with one of the teachers at SMP Negeri 1 Sekayu with the aim of finding out about the learning resources used in the learning process. The results of this analysis are there is still a lack of mathematics learning materials, and LKPD usually use was still less attractive so that students were less interested in carrying out the mathematics learning process.

Furthermore, at the curriculum analysis stage, information was obtained that the curriculum used in class VIII was the 2013 curriculum. The 2013 curriculum was still used in class VIII due to limited learning tools such as books. Next, analysis of material that will be used in LKPD being developed is carried out. Material analysis in this research was carried out by identifying what materials were suitable for the product being developed. The material used by researchers in product development is circle material.

**Design**

The design stage is the initial design stage carried out in making ethnomathematics-based LKPD. This design stage begins with collecting relevant references, then creating LKPD design, the results of which include two components, namely the LKPD cover and the contents of
LKPD which consists of instructions for use, KD, KI, and the problems provided.

The designed LKPD contains problem-based learning steps, namely orienting students to problems, coordinating students to learn, guiding students in the learning process, presenting results, and evaluating the learning process.

After the design stage, LKPD is then made which is called prototype I. This prototype I is an outline of the general appearance of LKPD which includes the design that was created in the previous stage.

**Development**

At the development stage, after LKPD Prototype I was completed, the next step was product validation by experts and one to one trials. The validation stage for this product was carried out by three validators including two lecturers in mathematics education (one lecturer in mathematics education study program at PGRI University in Palembang and one lecturer in mathematics education study program at Muhammadyah University in Palembang) and one teacher at SMP Negeri 1 Sekayu. During the validation process, there were several comments and suggestions received from validators which can be reviewed in Table 2.

Based on the comments and suggestions received from the validator, revisions were made to prototype 1, so that the results of prototype I produced prototype II. Prototype II was handed back to the validator and the researcher provided a validation questionnaire sheet to the validator, so that the validator could assess the product being developed. Next, after getting the results of the validation questionnaire, the researcher grouped each validator's assessment into several aspects that were required so that LKPD being developed was said to be valid, namely the content aspect, construct aspect and language aspect.

**Table 2. Validator comments and suggestions**

<table>
<thead>
<tr>
<th>Validator</th>
<th>Comments/Suggestions</th>
</tr>
</thead>
<tbody>
<tr>
<td>V1</td>
<td>Distinguish between verbs and prepositions, and add PBL syntax for each problem</td>
</tr>
<tr>
<td>V2</td>
<td>Add source to each image, and correct the Font in the working instructions</td>
</tr>
<tr>
<td>V3</td>
<td>In material explanation section there are sentences that are interrupted by formula table</td>
</tr>
</tbody>
</table>

**Table 3. Validation results by validators based on assessed aspects**

<table>
<thead>
<tr>
<th>No</th>
<th>Assessed Aspects</th>
<th>Validator</th>
<th>Quantity</th>
<th>Max Score</th>
<th>%</th>
<th>Validation Category</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Content</td>
<td>1 2 3</td>
<td>37  37 35</td>
<td>109</td>
<td>120</td>
<td>90.8 %</td>
</tr>
<tr>
<td>2</td>
<td>Construct</td>
<td>1 2 3</td>
<td>9  8 10</td>
<td>27</td>
<td>30</td>
<td>90 %</td>
</tr>
<tr>
<td>3</td>
<td>Language</td>
<td>1 2 3</td>
<td>22 21 23</td>
<td>66</td>
<td>75</td>
<td>88 %</td>
</tr>
<tr>
<td>4</td>
<td>Overall Average</td>
<td></td>
<td>68 66 68</td>
<td>202</td>
<td>225</td>
<td>89.7 %</td>
</tr>
</tbody>
</table>

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Based on the validation questionnaire sheet that was assessed, LKPD validation results were obtained which can be seen in Table 3. Based on Table 3, the overall average score of LKPD assessment results was 89.7% with a very valid category, so LKPD is suitable for use. According to Riduwan R (2020), if the interval is 81% - 100%, then LKPD is categorized as very valid, as seen in Table 3 the average value is 89.7% in the "Very Valid" category.

After the validation test is carried out, the next step is to carry out a one-to-one trial. One to one trials aim to see the readability of a product being developed so that the product becomes more perfect before being tested in small groups and field trials. One to one trials are carried out by 1-3 students including VNA, HSA, FO. The 3 students provided comments or suggestions on LKPD being developed in order to improve LKPD being developed. The following comments and suggestions from students regarding LKPD can be seen in Table 4.

<table>
<thead>
<tr>
<th>Students</th>
<th>Comments and Suggestions</th>
<th>Revision</th>
</tr>
</thead>
<tbody>
<tr>
<td>VNA</td>
<td>The picture is not clear</td>
<td>The picture is already zoom in</td>
</tr>
<tr>
<td>HSA</td>
<td>LKPD easy to understand</td>
<td></td>
</tr>
<tr>
<td>FO</td>
<td>In the explanation there is a cut off writing</td>
<td>The writing has been corrected</td>
</tr>
</tbody>
</table>

### Implementation

At this stage, LKPD was tested in a small group (Small Group) with five students in class VIII at SMP Negeri 1 Sekayu. In this trial students are asked to solve problem on LKPD. After students solve the problems given in LKPD, students are asked to fill out a student response questionnaire. The results of student response questionnaire for the assessment carried out in class VIII of SMP Negeri 1 Sekayu can be seen in Table 5.

<table>
<thead>
<tr>
<th>No</th>
<th>Name</th>
<th>Selected Total Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>TR</td>
<td>56</td>
</tr>
<tr>
<td>2</td>
<td>EPS</td>
<td>65</td>
</tr>
<tr>
<td>3</td>
<td>DRA</td>
<td>63</td>
</tr>
<tr>
<td>4</td>
<td>KA</td>
<td>59</td>
</tr>
<tr>
<td>5</td>
<td>SA</td>
<td>72</td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>Total Score</strong></td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>315</strong></td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>Total Number</strong></td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>375</strong></td>
</tr>
</tbody>
</table>

To find the overall average of student response questionnaires, a formula is used:

\[
\bar{x} = \frac{\text{total score obtained}}{\text{maximum total score}} \times 100% \\
= \frac{315}{375} \times 100% = 84\% 
\]
Based on the results of student response questionnaire above, the test results were 84% in the very practical category. After small group trials, at this stage a large group trial is carried out with the aim of seeing the potential effects of the product being developed. The field trial was carried out by 27 students of class VIII at SMP Negeri 1 Sekayu. The initial step taken at this field trial stage is that students are asked to work on the problems on LKPD in groups, after working in groups, students are then asked to present the results of their work, after making the presentation and students already understand the material given, then the participants students are given test questions to see students’ learning abilities after being given LKPD.

Based on the analysis of student learning outcomes using the test questions that have been stated previously, it shows that 24 students have completed it individually, meaning that students have achieved the competency that has been applied, namely understanding the concept of circles. Apart from that, students also meet the classical criteria for completion, because the percentage of students who complete is 88.8%, so it can be said that overall students have achieved the specified competency. Thus, seen from the student learning results, the use of ethnomathematics-based LKPD in building students' conceptual understanding is very effective. Meanwhile, there were 3 students who did not complete the competency in understanding problems related to circles. These 3 students got test scores below the KKM score determined by the school.

Evaluation

Evaluation is carried out in two forms, namely formative evaluation and summative evaluation. However, at this stage only formative evaluation is used which aims to collect data about the effectiveness of LKPD to achieve the stated objectives. This formative evaluation consists of expert review, individual evaluation, small group evaluation, and field test evaluation. After the product is declared feasible by validator, it will proceed to the individual trial, small group trial and field trial stages. If deficiencies are still found in the trial, then another evaluation stage is needed to improve LKPD being developed.

The validity of development product in the form of LKPD was obtained based on validation questionnaire given to the validator. After the validation questionnaire was given and assessed by the validator, the validity percentage of the product developed was 89.7% in the "Very Valid" category, while LKPD developed was declared practical by looking at overall average value of student response questionnaire which obtained score 84% in the "Very Practical" category, as well as the field trials carried out in this development research which obtained completeness which resulted from the student learning test after being given LKPD with score 88.8% in the "Very Good" category.

According to Loka et al. (2022) there are 3 aspects of validity that are conditions for a product that has been developed to be said to be valid, namely (1) content validity, (2) construct validity, (3) language validity. Likewise, according to Haviz
(2013), there are 2 aspects that are requirements for the validity of a product, namely (1) content validation, (2) construct validation. The validity of this construct can be seen from the pictures contained in LKPD in accordance with theory, content validity is determined by the suitability of material description with KD, while language validity includes the accuracy of writing rules and can be easily understood by students, so in this research the three conditions are stated by the experts above has been fulfilled by producing the "Very Valid" category.

Practicality is carried out in order to know that LKPD being developed is practical for use in the learning process. According to Astuti & Wutsqa (2016), practical LKPD can make it easier for students to understand the material provided. LKPD being developed is said to be practical if it gets a minimum positive response from students (Rosliana, 2019), whereas according to Fortuna et al. (2021) the product being developed is said to be practical if it obtains a minimum percentage value of average assessment score, namely > 60% in the practical category. So based on the results of LKPD trial, it shows that the ethnomathematics-based LKPD is very practical. It is because LKPD being developed can be used in the learning process and can make it easier for students to understand mathematical concepts in circle material. Practical LKPD can be seen from the student response questionnaire data which obtained score >80% and is in the very practical category.

Potential effects are based on student test results after learning using LKPD. Meisin (2022), said that LKPD being developed has a potential effect on student test results after using LKPD of at least > 60% in the good category. So, from this development research, the percentage of completeness in the student test is >80% with the "Very Good" category, so the resulting LKPD has a potential effect in the very good category.

So, this ethnomathematics-based LKPD has met the requirements of being valid, practical and effective, in using this LKPD it gets positive marks from students. During the learning process, students are more active and more interested in learning mathematics, especially in circle material. This is in line with research conducted by Luthfi & Rakhmawati (2022), which states that ethnomathematics-based LKPD can increase students' interest and response to learning. In addition, research by Kosasih et al. (2023) shows that LKPD being developed using an ethnomathematics-based PBL model can improve students' understanding of mathematical concepts better. Therefore, ethnomathematics-based LKPD can attract students' interest in learning and can improve students' understanding of mathematical concepts even better.

CONCLUSION

Based on the results of development and discussion in this research, it can be concluded that a product obtained in the form of LKPD that was valid, practical, and had potential effects, so that the resulting LKPD was declared suitable for use in the learning process, and could be used as material for teacher variations in the learning process. This LKPD can
make it easier for students to understand the material presented by the teacher in the learning process, and students can be more interested in carrying out the mathematics learning process.

REFERENCES


