Development of electronic student worksheets using a Liveworksheet on Pythagorean theorem material class VIII junior high school

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Abstract: This research is inspired by the many students who think mathematics as a difficult subject, one of which is the Pythagorean theorem. This study aimed to determine the validity and practicality of using the Electronic Student Worksheets or E-LKPD with a Liveworksheet on Pythagorean Theorem material. This type of research is research and development using the ADDIE development model. The subjects in this study were material experts, media experts, and class VIII A students of SMP Muhammadiyah Imogiri. The findings show that the developed E-LKPD received a "valid" category from material experts with a total of 79.6% aspects, a "very valid" category from media experts with a total of 81% aspects, for the practicality of assessment students obtained 85% for small classes with category "very practical", and for large classes of 75.7% with the category "practical". According to the findings of this study, the E-LKPD is valid and practical use in learning.

Keywords: E-LKPD; Liveworksheet; Pythagorean Theorem

INTRODUCTION

In today's modern era, technology plays an important role for human survival because all forms of activities and activities carried out are closely related to technology. Technology is an approach that logically leads and has efficiency characteristics in every activity carried out by humans (Asry, 2020). According to Great Dictionary of the Indonesian Language, efficiency is the ability to carry out tasks properly and accurately without wasting time, effort, or money. The nature of efficiency is what causes technology to be used and utilized in various spheres of life, for example, education. According to (Lestari, 2018) the use of technology in the education sector is to support successful learning, for example the existence of learning media, administrative tools, and also learning resources. Talking about education certainly cannot be separated from a teacher. Teachers are individuals who are professional, skilled and knowledgeable, and teach their knowledge to others, with the aim that that person experiences an increase in the quality of his human resources (Hazmi, 2019). One of the sciences taught by the teacher is mathematics.

Mathematics is a subject that is still considered difficult and complicated by students. On the other hand, mathematics is a vital subject in human life (Siregar, 2017). Following the results
of the researcher's questionnaire given to 29 students in class VIII A students at SMP Muhammadiyah Imogiri, 60% (17 respondents) agreed that mathematics is a difficult subject to learn. One of the materials considered difficult is the Pythagorean theorem. Several difficulties are often experienced by students, namely difficulties in applying mathematical formulas and also difficulties in calculations. Not only that, but students also often have difficulty recognizing the differences between the sides of a triangle, especially in answering questions related to everyday life. In these conditions the role of the teacher is needed to be in a position to aid and direct pupils in dealing with the difficulties experienced. Teachers are expected to be able to think innovatively and creatively so that students' difficult impressions of mathematics can slowly disappear. One method that can be done is to produce interesting learning media to redevelop students' interest in learning mathematics.

Learning media is a tool that can aid in the process of learning to ensure that the information to be given becomes clearer and that learning objectives can be achieved effectively (Nurrita, 2018). The selection of suitable learning media will undoubtedly significantly influence teaching and learning. One of the learning media that teachers can be create is Student Worksheets (LKPD). LKPD is printed teaching material that facilitates students in understanding the material presented, apart from that, LKPD also encourages students to learn actively and independently (Vitasari, 2018). LKPD presented in electronic form is called electronic student worksheet (E-LKPD) In making it, the LKPD is structured in such a way as to display the steps as well as instructions for use, so that when working on the questions and exercises contained in the LKPD, students can easily do it.

Based on an interview on October 19, 2022 with the mathematics teacher at SMP Muhammadiyah Imogiri, learning mathematics in class VIII uses LKPD learning media in printed form, the teacher also adds that learning requires something new, diverse and also fun for the purposes of instruction and learning. As stated by Hidayati and Zulandri (2021) LKPD in printed format has yet to be effective and practica So that there is a need for renewal, namely by replacing printed worksheets with interactive worksheets so that the material becomes interesting, in-depth and increases the creativity of students (Herawati et al., 2016). One example of interactive learning media is LKPD in electronic form or E-LKPD.

In its creation, the E-LKPD does not only focus on content, but also on the appearance of the E-LKPD, where the E-LKPD will be structured in such a way that it can attract students' attention in completing their assignments because there are audio and visual elements in it (Awe & Ende, 2019). For example, by presenting a colorful E-LKPD, using attractive pictures and also showing supporting animations to explain the material. Currently there are various online platforms available that can be used to compile E-LKPD, one of which is by using a Liveworksheet.

Liveworksheet is an example of an online platform that can be used to prepare E-LKPD for free. E-LKPD using Liveworksheet also allows students to be able to access E-LKPD anytime and anywhere, either using a cellphone or laptop connected to the internet, students can also work on questions directly on E-LKPD. As in research conducted by (Sariani & Suarjana 2022), the resulting learning tool in the form of E-LKPD received very good criteria from media experts and student responses, so it was able to increase students' enthusiasm for learning, so that E-LKPD is suitable for use during the learning process. Therefore, this research aims to determine the validity and practice of using E-LKPD with Liveworksheets on Pythagorean Theorem material for class VIII SMP so that it is hoped that it can support learning activities. The expected benefit of developing this E-LKPD is that it makes it easier for students to understand mathematics lessons, especially the Pythagorean theorem material and can be used as teaching material for the Pythagorean theorem material.

**METHOD**

This research uses the research and development method with the ADDIE model, a research technique used to create a product and evaluate its effectiveness (Fransisca & Ramalia, 2019). This research develops E-LKPD using Liveworksheet on Pythagorean theorem material.
Meanwhile, the ADDIE model is a model that is still relevant to use because it can adapt to a variety of circumstances and because each stage of the cycle has revisions and evaluations (Kurnia et al., 2019) (Figure 1).

![ADDIE Model](Source: Anasis & Alyani, (2021))

The initial stage of the ADDIE model is the analysis stage. The analysis stage aims to collect relevant information related to the development of E-LKPD. At the analysis stage, researchers divided it into two, namely needs analysis and curriculum analysis. After carrying out the analysis stage, the next step is the design stage. This stage begins with material design and development media design. Then the next step is the development stage. At this stage the material and media that have been designed are developed, then validation will be carried out by media experts and material experts. Implementation is the stage of applying learning media that has been developed by testing it on students. The final stage is the evaluation stage. The evaluation stage is the stage of looking at the results of trials that have been previously carried out on students, then improvements are made to the parts that are still lacking.

The type of data used is qualitative and quantitative data. These two types of data are needed because data taken from quantitative data can be clarified with qualitative data, because with qualitative data respondents are freer to provide explanations, input or suggestions. Qualitative data was collected through interviews, suggestions and input from material experts and media experts which were used to measure product clarity based on oral explanations, while quantitative data was obtained from material validation and media validation by experts as well as student response questionnaires used, as a target with the aim of measuring product clarity using numbers. In this research, data sources were obtained from interviews and questionnaires. The questionnaires used were material expert, media expert and student response questionnaires. The assessed assessment aspects are scored on a 1-5 Likert scale, and Formula 1 is employed to calculate percentages in the questionnaire.

\[
X(\%) = \left( \frac{\text{sum total score}}{\text{criteria score}} \right) \times 100\% 
\]

In the context of information provided by Bintiningtiyas (2016), the variable X represents the percentage, reflecting the value of validity and practicality. The calculation of the criteria score equals highest score for each item \( \times \sum \text{item} \times \sum \text{validator} \). This method, as outlined in the source, serves as a reference for assessing and quantifying the validity and practicality of the given criteria.

After knowing the results of the calculation of the percentage above, it will then be adjusted according to the Table 1.

<table>
<thead>
<tr>
<th>Range</th>
<th>Criteria</th>
</tr>
</thead>
<tbody>
<tr>
<td>80% &lt; X ≤ 100%</td>
<td>Very Valid</td>
</tr>
<tr>
<td>60% &lt; X ≤ 80%</td>
<td>Valid</td>
</tr>
<tr>
<td>40% &lt; X ≤ 60%</td>
<td>Less Valid</td>
</tr>
<tr>
<td>20% &lt; X ≤ 40%</td>
<td>Invalid</td>
</tr>
<tr>
<td>0% X ≤ 20%</td>
<td>Very Invalid</td>
</tr>
</tbody>
</table>

Source: Modification from Gulo & Harefa, (2022)
Modifications are made by changing the sufficiently valid criteria to be replaced with less valid ones. A learning media can be declared valid if it has a percentage of more than 60%. Based on Table 1, researchers took a threshold of 60% considering that the E-LKPD developed was valid for use. A learning media is declared practical if it has a percentage of more than 60%. Based on Table 2, researchers took a threshold of 60% considering that the E-LKPD which was developed was practical to use.

<table>
<thead>
<tr>
<th>Range</th>
<th>Criteria</th>
</tr>
</thead>
<tbody>
<tr>
<td>80% &lt; X ≤ 100%</td>
<td>Very Practical</td>
</tr>
<tr>
<td>60% &lt; X ≤ 80%</td>
<td>Practical</td>
</tr>
<tr>
<td>40% &lt; X ≤ 60%</td>
<td>Less Practical</td>
</tr>
<tr>
<td>20% &lt; X ≤ 40%</td>
<td>Impractical</td>
</tr>
<tr>
<td>0% X ≤ 20%</td>
<td>Very Impractical</td>
</tr>
</tbody>
</table>

Source: Modification from Gulo & Harefa, (2022)

RESULTS AND DISCUSSION

Results

E-LKPD development using this Liveworksheet uses the ADDIE development model. The stages of developing E-LKPD using ADDIE are as follows:

Analysis

At this stage, a needs analysis was carried out at SMP Muhammadiyah Imogiri through interviews and observations with mathematics teachers and students. Based on the results of observations, students said that mathematics is a difficult subject to understand, one of which is regarding the Pythagorean theorem, this is because students have difficulty remembering formulas, and have difficulty understanding the questions given, based on information from the mathematics teacher said that the difficulty was due to there is a difference in the students' capacity to comprehend the subject material provided, the teacher also said that learning mathematics in class VIII still uses printed teaching materials, besides that teachers and students want learning media that is interesting and can help students understand the material provided. Next, the researcher conducted a curriculum analysis, the aim was to find out the curriculum implemented by the school, so that the researcher could identify competency indicator and basic competence of the material to be used in the E-LKPD. Based on the results of the interviews, it is known that the curriculum applied at SMP Muhammadiyah Imogiri class VIII is the 2013 curriculum. Therefore, the entire contents of this E-LKPD refer to the 2013 curriculum.

Design

At the design stage, researchers carried out three activities, namely compiling material, designing the E-LKPD framework, and preparing validation instruments for material experts, media experts, and student response questionnaires. Before compiling the material, core competencies, basic competencies, indicators of competency achievement and learning objectives are carefully examined, so that the material prepared is in accordance with these four parts. Core competencies, basic competencies, indicators of competency achievement and learning objectives are integrated in the material section, example questions and competency tests. At the material preparation stage, the researcher designed the E-LKPD according to the results of the analysis carried out during the interview. The developed E-LKPD contains material regarding the Pythagorean theorem, and the application of core competencies and basic competencies has been adapted to the 2013 curriculum. Next, at the stage of preparing the E-LKPD framework, it consists of several parts that will be developed, such as the front cover, E-LKPD identity, table of contents, instructions usage, materials, competency test, bibliography and back cover. And the final stage is instrument preparation, where the preparation of instrument items and questionnaires takes into account various aspects in
accordance with the guidelines for preparing teaching materials by the Department of National Education which includes aspects of appropriateness of content, language, presentation and graphics, using a 1-5 Likert scale.

**Development**

At this stage, the E-LKPD is created according to the previously designed design. The design of the E-LKPD was first designed using Microsoft Word, then converted into PDF form, and to make it in electronic form, the E-LKPD was entered into the Liveworksheet website. The resulting E-LKPD can be accessed easily via the Liveworksheet website, namely https://www.liveworksheets.com/, apart from that, teachers can also provide a link to the E-LKPD contained in the Liveworksheet to share with students, so students only need to click on the link. and will go straight to the E-LKPD page. Following are several examples of the E-LKPD.

![Figure 2. E-LKPD front cover](image)

![Figure 3. E-LKPD identity](image)

In Figure 2 there is the front cover of the E-LKPD which contains information about the title of the E-LKPD, learning material, class, and author's name, and in Figure 3 contains the E-LKPD identity sheet which contains a description of the E-LKPD. author, validator and software used at that time to design the E-LKPD.

![Figure 4. Foreword](image)

![Figure 5. List of contents](image)

In Figure 4 there is a foreword and in Figure 5 there is a table of contents which makes it easier for users to find the material or page they want.
In Figure 6 there is a sheet containing Basic Competencies, competency achievement indicators, learning objectives, and in Figure 7 there are instructions for use which contain procedures for using E-LKPD.

In Figure 8 there is a concept map, the purpose of including the concept map is to be able to show users, both students and teachers, the Pythagorean theorem material that will be studied in the LKPD.

In Figure 9 there is a display of activities on E-LKPD.
In Figure 9 there is a Learning Activities Section containing material and exercises on the Pythagorean theorem which students can do directly via cell phone or laptop.

![Figure 9](image)

**Figure 9**

In Figure 9 there is a Learning Activities Section containing material and exercises on the Pythagorean theorem which students can do directly via cell phone or laptop.

**Figure 10.** Word Search activity view

**Figure 11.** Competence test

There are also activities such as a word search in Figure 10 and a competency test in Figure 11. In the word search activity, students are asked to search for predetermined words, while the competency test contains ten multiple choice questions that can be done directly.

**Figure 10.** Word Search activity view

**Figure 11.** Competence test

In Figure 12 there is a bibliography which contains several sources that were used as references in making the E-LKPD, and in Figure 13 there is the back cover on the last page of the E-LKPD. After the creation of the E-LKPD is complete, the E-LKPD will be validated by experts before being given to students. Validation was carried out by two material experts and two media experts. From this validation, input and suggestions will be obtained regarding the shortcomings of the product being developed so that it can become a reference for improvements so that E-LKPD can be better implemented for students.

**Figure 12.** Bibliography

**Figure 13.** Back cover of E-LKPD

In Figure 12 there is a bibliography which contains several sources that were used as references in making the E-LKPD, and in Figure 13 there is the back cover on the last page of the E-LKPD. After the creation of the E-LKPD is complete, the E-LKPD will be validated by experts before being given to students. Validation was carried out by two material experts and two media experts. From this validation, input and suggestions will be obtained regarding the shortcomings of the product being developed so that it can become a reference for improvements so that E-LKPD can be better implemented for students.

**Implementation**

After improvements were made to the input provided by experts, the E-LKPD was then tested on 5 students in small classes. The purpose of conducting small class trials is to obtain responses and input from students as users regarding the E-LKPD that has been developed. From the results of small class trials, E-LKPD does not need to be revised, because the response given states that E-LKPD is very good. Next, a large class trial was carried out involving 29 students of class VIII A. E-LKPD was used in learning the Pythagorean theorem material. After learning, students are given a response questionnaire to see the practicality of E-LKPD.
Evaluation

At the evaluation stage, E-LKPD validity data analysis was carried out using live worksheets from material and media experts. The validity of E-LKPD for material experts is measured from the aspects of appropriateness of content, presentation and language, while for media experts it is measured from the aspects of appropriateness of graphics, presentation and language. Analysis of E-LKPD practicality data using a Liveworksheet obtained based on student responses. The practicality of E-LKPD is measured from the aspects of presentation, language, graphics and use. The results are presented in Table 3.

<table>
<thead>
<tr>
<th>No</th>
<th>Aspect</th>
<th>Percentage</th>
<th>Criteria</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Content eligibility</td>
<td>78.1%</td>
<td>Valid</td>
</tr>
<tr>
<td>2</td>
<td>Presentation</td>
<td>82.5%</td>
<td>Very Valid</td>
</tr>
<tr>
<td>3</td>
<td>language</td>
<td>78.5%</td>
<td>Valid</td>
</tr>
</tbody>
</table>

Percentage of Overall Aspects 79.6% Valid

Based on Table 3, a percentage of 78.1% is obtained on the content feasibility aspect, then a percentage of 82.5% on the presentation aspect and a percentage of 78.5% on the linguistic aspect, so that the percentage of all aspects is 79.6% with the "valid" criteria this means that E-LKPD is worth testing. Furthermore, the media expert assessment results are presented in Table 4.

<table>
<thead>
<tr>
<th>No</th>
<th>Aspect</th>
<th>Percentage</th>
<th>Criteria</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Graphic eligibility</td>
<td>80%</td>
<td>Very Valid</td>
</tr>
<tr>
<td>2</td>
<td>Presentation</td>
<td>78%</td>
<td>Valid</td>
</tr>
<tr>
<td>3</td>
<td>language</td>
<td>90%</td>
<td>Very Valid</td>
</tr>
</tbody>
</table>

Percentage of Overall Aspects 79.6% Very Valid

Based on Table 4, a percentage of 80% is obtained in the graphical feasibility aspect, then a percentage of 78% in the presentation and linguistic aspects obtains a percentage of 90%, so that the percentage of all aspects is 81% with the "very valid" criteria this means that E-LKPD is worth testing.

<table>
<thead>
<tr>
<th>No</th>
<th>Evaluation</th>
<th>Percentage</th>
<th>Criteria</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Small Class</td>
<td>85%</td>
<td>Very Practical</td>
</tr>
<tr>
<td>2</td>
<td>Big Class</td>
<td>75.7%</td>
<td>Practical</td>
</tr>
</tbody>
</table>

Based on the percentage results Table 5, obtained a percentage of 85% with the criteria of "very practical" in small classes, then for large classes obtained a percentage of 75.7% with "practical" criteria, this means that E-LKPD is suitable for use. The above results are in line with research conducted by Prastika & Masniladevi (2021), which discusses the development of interactive E-LKPD for regular and irregular polygons based on LKS directly on the learning outcomes of fourth grade elementary school students who received a very valid category from material, media and language experts. as well as getting a very practical category from teacher and student assessments. In the research conducted by Prastika & Masniladevi (2021) used interactive material of regular and irregular polygons, while the research conducted by researchers used Pythagorean theorem material, so the researchers concluded that developing E-LKPD using live worksheets can be applied to various materials.

Discussion

Based on the research results described above, this research is development research using the ADDIE development model. In this research, the product developed is E-LKPD using a live
worksheet on the Pythagorean theorem material. According to Khikmiyah (2021) Liveworksheet is a form of electronic media which contains text, images, animations, and videos which are more effective so that students do not get bored quickly.

The E-LKPD that is developed will later be tested for validity by two material experts and two media experts. According to Mustami, et al. (2017) a learning tool is said to be valid if expert assessment shows that the development of the tool has internal consistency between every aspect assessed in the learning tool. From the validation results by material experts, the percentage of all aspects was obtained, namely 79.6%. Based on the validity criteria table, the E-LKPD product being developed meets the valid criteria for testing. Then, from the validation results by media experts, the percentage of all aspects was obtained, namely 81%. Based on the validity criteria table, the E-LKPD product developed meets the very valid criteria so it is valid for testing. After carrying out a validity test, a practicality test is then carried out by giving student response questionnaires to class VIII A students. According to Nieveen in Rochmad (2021), measuring the level of practicality can be seen from whether the teacher (and other experts) considers that the material is easy and can be used by teachers and students. From the results of the assessment of small class trials, a percentage of 85% was obtained with very practical criteria and large class trials obtained a percentage of 75.7% with very practical criteria. Based on these results, the E-LKPD product developed is practical to use. Thus, it can be concluded that the E-LKPD developed by researchers has proven to be valid and practically applied in the mathematics learning process in class on the Pythagorean theorem material.

**CONCLUSION**

The results of the research show that the Electronic Student Worksheet (E-LKPD) which was developed using LKS directly on the Pythagorean theorem material is valid and practical for use in learning activities, meaning that the resulting E-LKPD product can be applied in mathematics learning for class VIII SMP. This can be seen from 1). In terms of validity, the developed E-LKPD obtained a percentage of 79.6% with the "valid" category from material experts, and a percentage of 81% with the "very valid" criteria from media experts, 2). Regarding the practicality of the E-LKPD being developed, the percentage obtained was 85% with the "very practical" criteria from the small class, and a percentage of 75.7% with the "practical" criteria from the large class.

The limitations of this research are that the test subjects for small classes and large classes can be increased, and the time for implementing learning using E-LKPD can be increased to more than just 2 face-to-face sessions. Suggestions for further research are that the development of E-LKPD only displays material on the Pythagorean theorem, therefore it is hoped that it can be developed continuously in other materials. Suggestions for teachers are that they can use this E-LKPD for learning material on the Pythagorean theorem, and for students this E-LKPD can be used for studying in class or outside class.

**Declarations**

Author Contribution: AKD: Writing - Original Draft, Formal analysis; SS: Conceptualization, Data Curation; NRNP: Methodology, Writing - Review & Editing; SGAE: Validation, Visualization.

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Conflict of Interest: The authors declare no conflict of interest.

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