



# Development of LKPD assisted by phet simulation on material form of energy and their changes to improve creative thinking ability of students at SMP Negeri 2 Sunggal

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**ABSTRACT**

Student Worksheet (LKPD) is one way to support and activate learning activities so that students and teachers can interact more effectively, which can improve learning activities and student achievement. Because PhET media encourages creativity, it can help students' creative thinking skills. 4D technique, PhET Simulation helps the development of LKPD. In this study, data collection used observational methods, questionnaires, tests, and documentation methods. In this study, descriptive analysis and N-gain test were used for data analysis. Two material experts, learning experts, design experts, seventh grade science teachers, and 32 seventh grade students of SMP N 2 Sunggal became the sample. Based on the approval of LKPD, learning experts, and learning materials experts and design experts, class VII science teachers and 32 students of class VII SMP N 2 Sunggal. Based on expert validation, learning experts and LKPD material design experts, the participant's response was very good and the LKPD materials assisted by PhET Simulation could improve students' creative thinking skills, which can be seen from the N-gain calculation, which is 0.71 high categories.

**Keywords: LKPD, PhET Simulation, Creative Thinking**

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## INTRODUCTION

One area of development that must be improved is education. Education is expected to be able to make Indonesia able to follow the progress of science and technology that advances the country. As a result, in line with Darmodiharjo (in Idris et al., 2014: 18) asserts that teachers must perform at least three tasks: educating, teaching, and training. It is possible for teachers to change the way children are taught to think creatively.

Of course, learning designs must be produced with adequate designs so that they can be used and help students learn. Making learning designs that integrate learning by building models or teaching materials that students can use is one way to answer students' needs in terms of learning is an effort. Learning models must be built and designed in such a way as to support the teaching and learning process effectively (Darmawan and Wahyudin, 2018).

According to J, Goenawan (1998) suggested that to put more emphasis on the process aspect, students should be taught skills such as observing, classifying, measuring, communicating, interpreting data, and experimenting gradually according to the complexity of the material and students' thinking abilities, in line with the curriculum. Therefore, the existence of a laboratory has a significant impact on the achievement of science learning objectives.

While in classroom learning, teachers often do demonstrations due to limited tools so that in the implementation students are not directly involved which causes students to tend to be passive (Al Fajri Muchamad Haikal, et al 2016). Based on observations at SMP Negeri 2 Sunggal, science learning at SMP Negeri 2 Sunggal began to decline and learning during this pandemic was less effective. based on interviews with teachers of SMP Negeri 2 Sunggal, they rarely do practicum, because the teacher only uses textbooks in explaining the material. While the number of students is quite large in one class, besides that, practicum materials are also quite difficult to find. do it repeatedly, and the practical implementation time is quite long. While the learning time during this pandemic period is still limited so as to improve students' thinking skills are still low, Based on the results of interviews with several seventh grade students, the results were (1) students did not participate actively during the science

learning process (2) the learning media were less attractive. Student Worksheets. Exercises on student worksheets can encourage curiosity in them. The creativity and ability of this LKPD enhances the actions of educators and serves as a guide for carrying out tasks based on the steps involved and the requirements contained in educational activities must also be complied with in compiling, designing and developing LKPD.

The use of PhET media can improve student learning because it helps students create solid and durable concepts. An easy-to-use simulation is the PhET simulation. The colorful, interactive, PhET simulations allow students to learn while doing this practicum highlighting the similarities between actual events and computer simulations before presenting them in a physical conceptual framework that students can understand (Muchamad Haikal, et al. 2016).

Supported by the results of research by Marsa, et al., (2016) which states that the use of LKPD in learning can improve students' creative thinking skills by using LKPD as a reference for carrying out learning activities that can form effective interactions between the environment and learning activities. Based on the rationale above, the authors are interested in conducting a research entitled Development of Phet Simulation Assisted LKPD on Material Forms of Energy and Its Changes to Improve Creative Thinking Skills for Students of SMP Negeri 2 Sunggal.

## RESEARCH METHOD

The development model used in this study is a modified version of the 4-D (Four Model) Thiagarajan which has several stages. The definition, design, develop, and distribution stages are the steps of this development model. The first stage of the 4 stages of the 4D model is defining. The definition stage is the first step in finding out and defining educational needs. Needs in the learning process can be identified and defined at this point, and various data on the product can then be collected. 2) design The purpose of the design phase is to create a worksheet format using PhET Simulation to improve problem solving as well as conceptual skills. 3) Making LKPD with the help of PhET Simulation based on Guided Inquiry is the third stage of development. This stage has been modified based on comments, suggestions, and opinions of experts, practitioners, small-scale field tests, and operational field tests. 4) The Dessimite Stage of learning effectiveness is distributed at SMP Negeri 2 Sunggal to 32 students.

The population in this study were all seventh grade students of SMP Negeri 2 Sunggal in the 2021/2022 academic year, totaling 8 classes with a total of students. There are 32 students in class VII-6. The student sampling technique in this study used simple random sampling in a random way. This research method includes observation method, interview method, test method, and documentation method. Qualitative and quantitative data analysis was used in this study.

## RESULT AND DISCUSSION

### Research result

This study describes the process of developing Student Worksheets (LKPD) assisted by PhET Simulation to improve students' creative thinking in the form of energy and its changes in class VII SMP by using the 4-D development model.as follows:

### Definition Stage (Define)

This phase of the research process is important to identify and define the demands in the learning process in relation to the teaching materials made. This is separated into various steps at this point, including:

1. Preliminary analysis

The initial analysis that has been carried out by the researcher is observations at SMP Negeri 2 Sunggal, especially for seventh grade students of SMP. At the time of learning students only listen and observe the teacher who is teaching, therefore students are not accustomed to finding their own concepts and theories in the learning process. The results of the interview are:

Table 1 of Problem Analysis Results Faced by Teachers

| No | Problems encountered                |
|----|-------------------------------------|
| 1. | Limited time in learning            |
| 2. | Less interesting teaching materials |

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| No | Problems encountered                 |
|----|--------------------------------------|
| 3. | Teachers rarely do practicum         |
| 4. | Students are less active in learning |

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## 2. Task Analysis

The purpose of the task analysis in this step is to identify the content of the learning unit which includes learning objectives, indicators, content structure, concepts, and sources of information, as well as choices of Basic Competencies (KD). The topics developed in the LKPD with the help of PhET Simulation are types of energy and its variations.

## 3. Specification of Learning Objectives

The learning objectives of the form of energy and its changes are selected and formulated at the specification stage based on the Core Competencies (KI) and Basic Competencies (KD) mentioned in the curriculum.

## Design Stage (Design)

The design stage aims to design the developed LKPD. In this stage there are The typeface used for the content is 'Times New Roman'. The following is the front cover of the designed LKPD, which can be seen in the picture



Figure 1. LKPD cover designed

preparation of research instruments designed by researchers to collect data that can be used as a guide to decide whether the product is feasible, as well as answers from students and lecturers from material experts, learning experts, and design experts.

## Development Stage (Development)

Assessment by material experts, learning expert assessments, design expert assessments, and student reactions are all carried out at the development stage.

### 1. Material Expert Validation

the results of the assessment by material experts, are declared valid with the percentage of material feasibility from validator 1, namely the percentage of 95.83% and validator 2 the percentage is 87.5%, the presentation feasibility of validator 1 gets a percentage of 87.5% and from validator 2 the percentage is 75%, then is the use of language from validator 1 gets a percentage of 100% and validator 2 the percentage is 75%. Achievement scores are then taken into account when determining very realistic requirements. And it can be said that the LKPD that has been made by researchers can be expressed in science learning for class VII SMP Negeri 2 Sunggal.

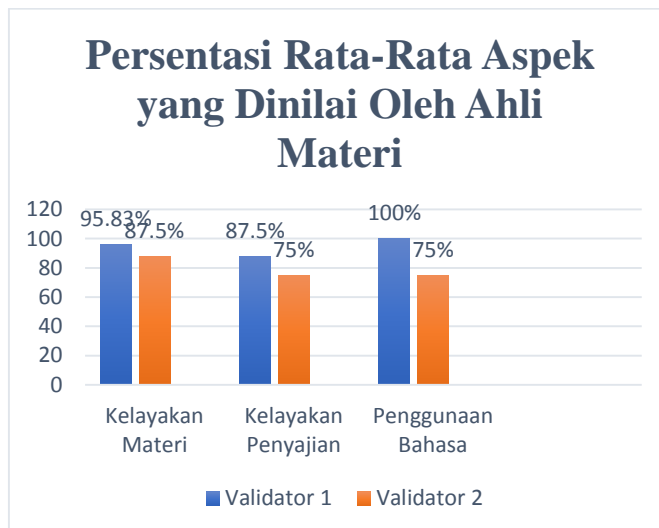


Figure 2 validation results by material experts

## 2. Learning Expert Validation

evaluation by learning experts. Evaluation of learning by expert lecturers aims to improve product quality. It can be seen in Figure 1.2

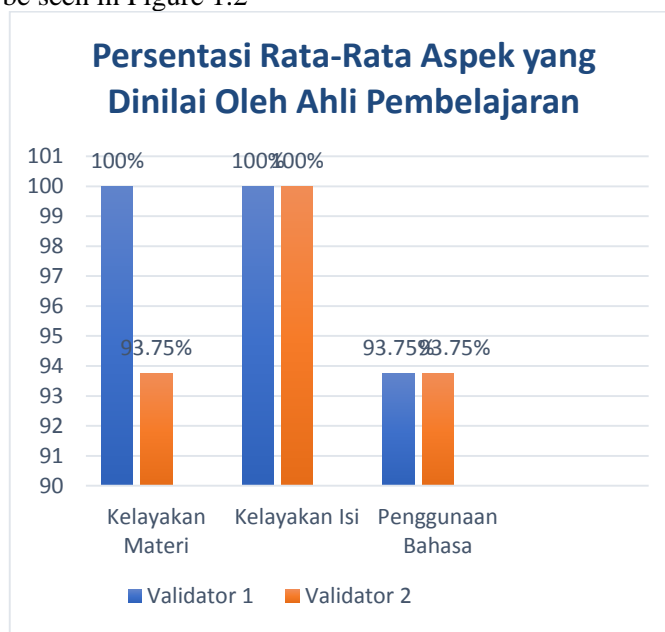


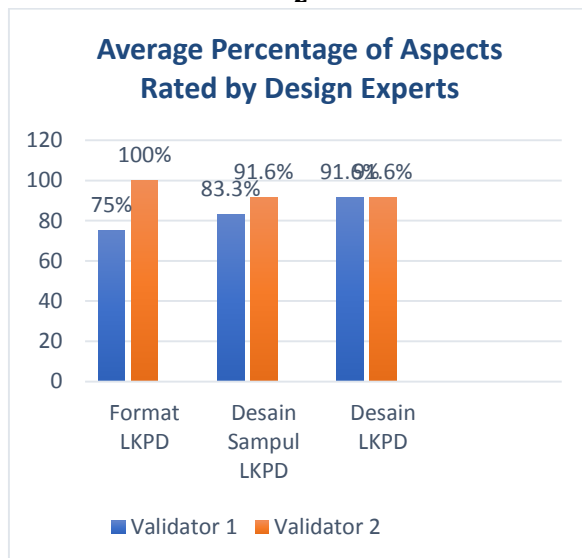
Figure 3 Validation Results of Learning Expert LKPD

The researcher's LKPD is considered valid with a percentage of material feasibility from validator 1, or a percentage of 100 percent, based on the findings of the learning expert evaluation. and validator 2 the percentage is 93.75%, the feasibility of content validator 1 gets a percentage of 100% and from validator 2 the percentage is 100%, next is the use of language from validator 1 gets a percentage of 93.75% and validator 2 the percentage is 93.75%. Then the achievement score is included in the very feasible criteria.

## 3. Design Expert Validation

Validation by design experts on LKPD assisted by PhET simulation aims to be able toThe results of the assessment by design experts are as follows.

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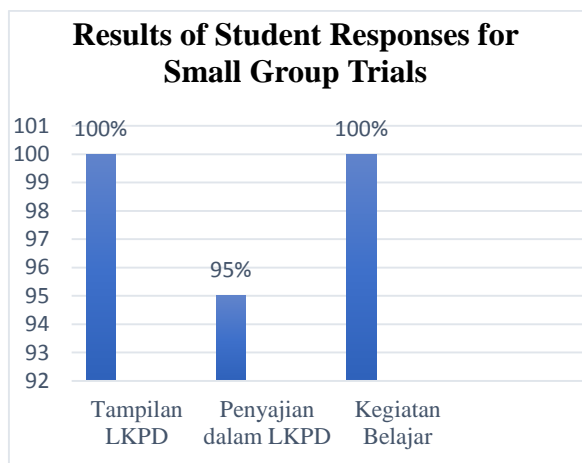
**Figure 4 Design Expert Validation Results**

The research LKPD is considered valid with the % LKPD format from validator 1 based on the evaluation findings by design experts. The percentage is 75% and the validator 2 is 100%, the cover design of the LKPD from validator 1 gets a percentage of 83.3% and from validator 2 the percentage is 91.6% , next is the LKPD design from validator 1 gets a percentage of 91.6% and validator 2 the percentage is 91.6%. The achievement score is then added to the very practical criteria.

**4. Deployment Stage**

**Small Group Student Responses**

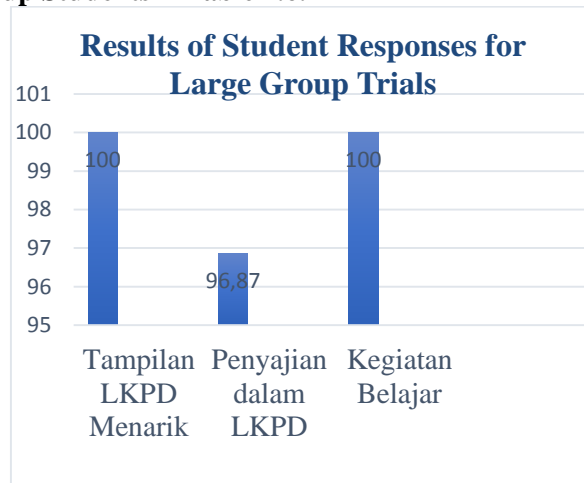
The trial on the small group LKPD was carried out at SMP Negeri 2 Sunggal as many as 10 people. The students' responses to the small group trial can be seen in the picture.



**Figure 5 Responses of Small Group Students**

Based on Figure 1.5Based on the results of the percentage above, namely the response of small group students to the LKPD, the data obtained that the LKPD display is 100%, the presentation in the LKPD is 95%, and learning activities are 100%.

**Responses of Large Group Students in Table 1.6.**



In Figure 4.7 it can be seen that the responses from students from several aspects, namely the aspect of the attractive LKPD display obtained 100%, the presentation in the LKPD obtained 96.87%, and learning activities obtained 100%. very worthy.

**3. Result of Pre-test and Post-test of Students**

The results of data analysis using LKPD assisted by PhET simulation on the material in the form of energy and its changes that have been designed to improve creative thinking skills in large group trials, the average pretest score is 38.75 and the posttest average score is 82.81 and the N-Gain score is 0.71 with a high interpretation. The ability of students is measured by pretest and posttest question sheets. The pretest sheet is used with the aim of knowing the students' abilities and initial understanding before using the LKPD assisted by PhET Simulation, and on the posttest sheet it aims to determine the students' understanding and ability after using the LKPD.

**Table 2 Pretest and Posttest Data of Students to Improve Creative Thinking Ability**

| Types of observed data                              | Pretest results obtained | Posttest results obtained |
|---|--------------------------|---------------------------|
| The highest score                                   | 70                       | 95                        |
| Lowest value  | 20                       | 60                        |
| Number of students who completed ( $\geq 70$ )      | 2                        | 29                        |
| Number of students who have not completed ( $<70$ ) | 31                       | 3                         |
| Average score                                       | 38.75                    | 82.81                     |

**N-Gain . Score Category Table**

| No     | N-Gain Index        | Interpretation | Frequency | Percentage (%) | Average N-Gain |
|--------|---------------------|----------------|-----------|----------------|----------------|
| 1      | $g > 0.70$          | Tall           | 21        | 65.6           | 0.71           |
| 2      | $0.3 < g \leq 0.70$ | Currently      | 9         | 34.4           |                |
| 3      | $g \leq 0,30$       | Low            | 0         | 0              |                |
| Amount |                     |                | 32        | 100            |                |

Based on the analysis of the data in table 4.8 above, it has been obtained 21 students who get a percentage of 65.6% and get an N-Gain score with a high interpretation, and 11 students who get a percentage of 34.4% with a moderate interpretation. The creative thinking gain of students with the material in the form of energy and its changes is 0.71 which is included in the high category.

## **Discussion**

The analysis at the beginning and end was carried out by the researcher in the form of observation, where the researcher conducted interviews directly with the science teacher so that the researchers got information about the problems experienced by teachers and students.

In the problems faced by teachers and students, the way to solve these problems is to create an interesting LKPD where in the LKPD there are not only materials and questions but students can also do practicum and can solve problems in the LKPD.

At the design stage, it is intended that the preparation of LKPD is feasible to be used to improve students' creative thinking skills as well as create and develop instruments with good indicators to support the feasibility of LKPD. LKPD was chosen as teaching material because LKPD can be designed or designed and developed based on the conditions and situations of the learning activities carried out (Wulandari and Ismono, 2019). The learning material presented using PhET simulation is based on problem solving, the phenomenon of the form of energy that occurs, at each stage of guided inquiry will make it active. At the stage of collecting data by conducting practical work will be able to overcome misconceptions.

According to Zukhaira and Hasyim (2014) stated that there are several preparation procedures in the development of LKPD, namely 1) knowing the content standards and KD, syllabus, semester programs, and lesson plans, 2) understanding the material to be included in the LKPD, 3) Carrying out material mapping, 4) determine the form of presentation, 5) design the framework structure, 6) draft the LKPD, 7) revise the LKPD, 8) test the LKPD, 9) revise and final write (vinalization). provide suggestions as well as input and assessment of the LKPD where there is validation of material experts, learning experts and design experts, so that from the validation results obtained by researchers it is called feasible which has been revised and perfected the developed LKPD.

Aspects of the assessment of the material expert on the LKPD assisted by PhET simulation by validator 1 and validator 2 with aspects assessed are the feasibility of the material, the feasibility of presenting and using language. the average percentage of language use is 100% with very feasible criteria. To maximize understanding and development of basic skills in accordance with competency indicators, all basic activities needed by students are collected in LKPD (Aldiyah, 2021).

Aspects of assessment by learning experts on LKPD assisted by PhET simulation which consists of two validators, namely validator 1 and validator 2, where the assessment indicators are the feasibility of the material getting an average percentage of 100%, the average content feasibility of 100% and the use of language the average percentage is 93.75% with very feasible criteria. In the preparation of material in the LKPD, it refers to KI and KD so that the learning indicators are appropriate.

Aspects of design assessment validator 1 and validator 2 Aspects of assessment by design experts on LKPD assisted by PhET simulation which consists of two validators namely validator 1 and validator 2 where the assessment indicator is the LKPD format getting an average percentage of 100%, cover design is average the percentage is 91.6% and the average LKPD design percentage is 91.6% with very feasible criteria.

From the results of student responses, it can be seen from several aspects, namely the LKPD display is obtained 100%, the presentation in the LKPD is obtained 95%, and learning activities are obtained 100%. With this, the responses from students are included in the very feasible criteria.

The results of student responses indicate various things, including the fact that the LKPD display is 100% accurate. presentation in LKPD obtained 96.87%, and learning activities obtained 100%, so that the response of students to get the criteria is very feasible.

The results of the students' creative thinking skills and N-Gain scores, the number of students tested consisted of 32 students. 38.75 and the posttest score of 82.81 and also the N-Gain score of 0.71 with a high interpretation.

This affirmation leads to the conclusion that the LKPD test is suitable for use in the educational process. The Ministry of National Education supports this (2008) which states that learning assessment in the learning system is initially a process that determines and ensures that students have completed or not.

## CONCLUSION

The conclusions obtained from the results of the study are: The feasibility level of LKPD assisted by PhET simulation to improve students' creative thinking skills which has been developed and assessed by two material expert validators, two learning expert validators, and two design expert validators. Material expert validator with an average percentage of 91.66%, presentation feasibility with an average percentage of 81.25%, the use of language an average percentage of 87.5% with appropriate criteria. In the learning expert validator, the average percentage of material feasibility is 96.87%, the content feasibility gets an average percentage of 100%, for the use of language the average percentage is 93.75% the criteria are feasible. 5%, the average percentage of LKPD cover designs is 87.45%, and the average percentage of LKPD designs is 91.6% with very decent criteria. Student responses to the LKPD are supported by PhET simulations which are made to help students become more creative thinkers about the material form of energy and its transformations, especially in small groups, with a 100% success rate for small group responses to LKPD. the presentation in LKPD is 95%, and learning activities are 100%. In large groups the percentage of responses from students from the LKPD display is 100%, the presentation in LKPD is 96.87% and learning activities are 100%. LKPD assisted by PhET simulation is made to see how effective and improve students' creative thinking skills in the form of energy and its changes, with this the results of the pretest average of 38.75 and the posttest average score of 82.81 with an N-Gain score of 0.71 with high interpretation.

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