

DEVELOPMENT OF PHYSICS E-LKPD BASED ON PROJECT BASED LEARNING ON THE CREATIVE THINKING ABILITIES OF SMA/MA STUDENTS

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ABSTRACT

This research aims to develop Project Based Learning-Based Physics E-LKPD for High School/MA Students' Creative Thinking Abilities, with valid and practical quality. The development of E-LKPD follows the steps of the Plomp Model, with the stages of preliminary research, prototyping phase, and assessment phase. Research practicality data was obtained through observation sheets and practicality questionnaires for educators and students. The assessment results show that the Physics E-LKPD is valid from the content, construct and language aspects, with the average validity test result being 85%. Product practicality testing by practitioners for the readability and ease of use aspects of E-LKPD is included in the very practical category with an average score of 91.88%. Meanwhile, the implementation of the Physics E-LKPD was assessed by two observers with an average score of 3.78% in the very practical category and Percentages Of Agreements 90.38% in the Very Good Agreement category. Based on the results of this development research, it was concluded that the Physics E-LKPD Based on Project Based Learning on Students' Creative Thinking Abilities has fulfilled the requirements of a good E-LKPD from a valid and practical aspect, so that it can be used as teaching material by students in learning about global warming material. in class X SMA/MA and can be tested at the effectiveness stage.

Keywords: Physics E-LKPD, Project Based Learning, Creative Thinking Ability

A. INTRODUCTION

Creative thinking skills are skills/achievements that students must master. Students need creative thinking skills in their lives, because these skills are very important to support the learning process, especially in physics learning (Armandita, 2018). In learning physics in the independent curriculum, creative thinking skills are one of the learning objectives that must be achieved (Sulaeman .,2023). The government also emphasizes this as stipulated in the Minister of Education and Culture Regulation (Permendikbud) Number 12 of 2024, namely having the skills to think and act creatively, productively, critically, independently, collaboratively and communicatively. (Kemendikbud, 2022). In Islam, creative thinking skills are implied to be attitudes/actions that must be mastered (Srimaryati, 2018), namely stated in the word of Allah SWT Q. S. Al-Baqarah: 219.

The importance of creative thinking skills has not been accompanied by encouraging results. The results of the research show that Indonesian students have a high level of thinking ability, one of which is low creative thinking. Based on the results of the Trends in International Mathematics and Science Study (TIMSS) study, the creative thinking ability of students in Indonesia tends to be lacking, with Indonesia being in the bottom 3 positions. from a total of 32 participating countries (Fhauziyah, 2021).

Many factors cause low creative thinking abilities. Several studies show that the

causes of students' low creative thinking abilities come from teacher and student factors. The teacher factor is related to the teacher's lack of precision in choosing learning models and teaching materials (Hasibuan & Hufri, 2018). The teaching materials used in learning are still in printed form and do not contain learning model steps that enable students to improve their creative thinking abilities (Sabaniah, dkk., 2019). Student factors are related to learning interest, learning motivation, and learning styles which prevent their creative thinking skills from being honed (Harahap, dkk., 2022).

Previous researchers solved the problem of low creative thinking skills by applying Student Worksheets (LKPD) in learning (Kartikasari, 2019). Based on research conducted by several previous researchers, it appears that LKPD teaching materials can improve aspects of creative thinking skills for the better (Subakti et, dkk., 2021). These findings are the same and in line with Mawarni & Sani's research which stated that in the pre-cycle students' creative thinking abilities were far below the KKM, and after implementing the Student Worksheet they were able to develop students' creative thinking abilities. (Mawarni & Sani, 2020).

The development of E-LKPD by previous researchers did not contain summative assessments during learning and was not yet interactive. Based on previous problems, researchers have innovated in developing E-LKPD, the E-LKPD developed is interactive, especially in the E-LKPD navigation system. E-LKPD is equipped with videos and supporting images that are relevant to the material and questions. There is also a novelty in the E-LKPD that the researchers developed, namely the assessment LKPD contained in the E-LKPD, namely that there is a summative assessment in the learning process so that educators can assess students' learning process. It is hoped that this innovation can be a solution for students in training their students' creative thinking abilities.

B. RESEARCH METHODS

The type of research used in this research is the research and development method. The development model in this research is the Plomp model which includes three development stages, namely: Preliminary Research, Development or Prototype Phase. and Assessment Phase. Development or Prototype Phase (Development of Prototypephase) This stage aims to produce a valid PjBL-based Physics E-LKPD prototype. The activity stage is to carry out a formative evaluation carried out by experts to see whether a product is valid or not. In this phase, what is assessed is content/material validity, construct validity and language validity using a validation instrument in the form of a questionnaire given to 3 lecturers who are experts in this field. The final stage is the Assessment Phase. At this stage there are two things that are assessed, namely the readability and ease of use of the Physics E-LKPD and the implementation of the E-LKPD. To see the readability of the E-LKPD, the researcher used a practicality questionnaire (educators and students) while to see the readability, the researcher used an observation sheet given to two observers to assess how the Project Based Learning-based E-LKPD was implemented during the PBM process in the

classroom.

Table 1. Criteria for assessing questionnaire processing results

No	Value	Criteria
1.	81% - 100%	Very valid, practical
2.	61% - 80%	Valid, practical
3.	41% - 60%	Quite valid, practical
4.	21% - 40%	Not valid, practical
5.	0% - 20%	Invalid, practically

(modified from Riduwan, 2009)

Table 2. E-LKPD Implementation Criteria based Project Based Learning

Criteria	Implementation Level	Category
Everything was done	≥3,20	Very practical
Most of it happened	2,41 - 3,20	Practical
Half done	1,61-2,40	Quite Practical
Only a small part has been implemented	0,81 – 1,60	Not practical
Nothing happened	≤ 0,80	Not practical

Table 3. Determination Criteria Percentages of Agreements

Value	Percentage	Criteria
< 0.2	< 20	Poor Agreement
0.21 – 0.40	21 – 40	Fair Agreement
0.41 – 0.60	41 – 60	Fair Agreement
0.61 – 0.80	61 – 80	Good Agreement
0.81 – 1.00	81-100	Very Good Agreement

C. RESULT AND DISCUSSION

Based on the product development stages, which refer to the Plomp development model, the results for each stage can be stated as follows :

1. Preliminary Research



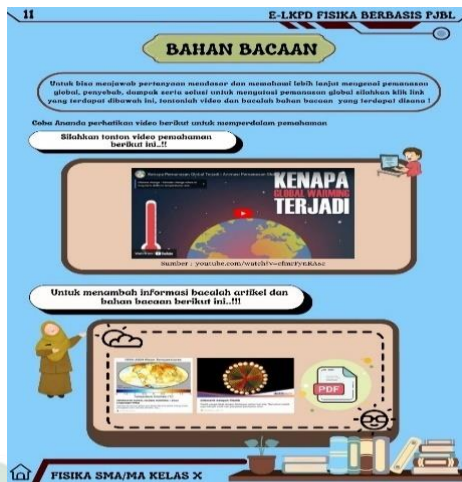
Analysis of the needs of educators and students is carried out through literature analysis/library study, curriculum analysis and analysis of the teaching materials used (Nur Umi Rahmawati & Rahmawati, 2021). The needs analysis was obtained from the results of researchers' interviews with educators and students. From the results of the interviews, information was obtained that the teaching materials used in learning were still in printed form and did not contain steps in learning models that enable students to improve their creative thinking abilities. From the analysis carried out, educators and students really need teaching materials that accommodate their desires in learning and are in line with the characteristics of students who like things related to technology, namely teaching materials in the form of E-LKPD combined with the Project Based Learning model which will later be Students not only solve questions related to learning material but are also required to produce science skills in everyday life.

2. Development of Prototypephase

There is a Plompt model development phase. This stage will consist of three stages, namely designing a prototype, formative evaluation and revising the prototype.

a. Designing Prototypes

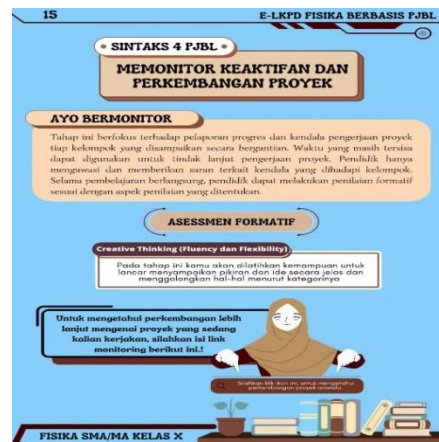
Table 4. Development of PjBL Based Physics E-LKPD

Development of Physics E-LKPD	Results
<p>Cover appearance: consists of the author's name, E-LKPD identity, UIN logo, Kemendikbud logo, and independent curriculum logo, as well as supporting images</p>	
<p>Shortcut Menu: Shortcuts are made simply, which are intended to make it easier for students to use E-LKPD</p>	
<p>Reading sources: In the form of videos, PDFs and articles that can help students understand the material</p>	

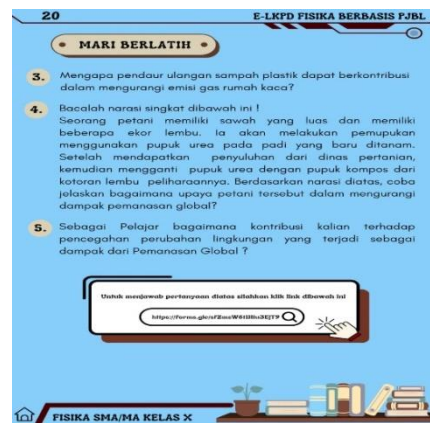
Development of Physics E-LKPD

Results

Display of Summative Assessment in the learning process



Let's Practice: Created using a Google form, connected by using the hyperlink on the Heyzine website Berlatih : Dibuat dengan google formulir, di sambungkan dengan cara memanfaatkan hyperlink yang ada pada website heyzine



b. Formative Evaluation

After the LKPD draft is created, a formative evaluation is carried out to obtain a valid Physics E-LKPD. E-LKPD was given to validators consisting of 3 validators, namely Mrs. Pipi Deswita, M.Pd (content/material validator), Mrs. Adelia Alfama Zamista, M.Pd (construct validator), and Mr. Abdul Basit, M.Pd (validator Language). The results of the validity of the material, construction and language can be seen in table 5.

Table 5. Validity Test Results

Indicator	Percentage	Category
Suitability of material/content	83%	Very Valid
Media/construction feasibility	80%	Valid
Language Eligibility	92%	Very Valid
Average Percentage	85%	Very Valid

Products can be recognized as valid if they comply with established conditions. In accordance with Hamzah's opinion in (Roza & Nasution, 2020) that validity test data is obtained based on analysis of three aspects, namely language, material and media. Based on the validation results from 3 validators,

it can be seen that the E-LKPD based on project based learning is very valid to be developed because it meets the aspects of teaching materials that can be said to be valid, where teaching materials are considered valid if they can show conditions that are in accordance with their content and construction. . This is in line with research (Salsabila, dkk., 2023) which states that the PjBL-based E-LKPD that has been developed is included in the valid category, so that based on the criteria that have been explained, the E-LKPD that has been developed is suitable for testing.

As for the perfection of the product being developed, there are several constructive suggestions and input from the validators regarding product improvement, including: the videos included in the E-LKPD are videos that can hone students' creative thinking skills, it must be explained in what part their creative thinking skills are trained, and clarify the PjBL syntax again. Based on the research results and validity standards, the physics E-LKPD based on project based learning in class X.E.11 physics learning that the researchers developed is categorized as very valid and worthy of being tested at the practicality stage.

c. Prototype Revision

Based on comments and suggestions by validators, there are several product revisions obtained from validators to improve the product. Revisions to the product can be seen in table 6 below :

Table 6. Product Improvement

Before repairs	After repair

3. Assessment Phase

The aim of this stage is to see the practicality (readability and enforceability) of Project Based Learning-based Physics E-LKPD. The level of practicality was seen from the answers to the practicality questionnaire by 1 physics educator and the practicality questionnaire of 36 participants. The implementation of the Project Based Learning-based Physics E-LKPD can be seen from the observation sheet assessed by two observers.

a. Test the practicality of E-LKPD Physics based on project based learning (PjBL)

1) Practicality test by Physics educators

The practicality test of the Physics E-LKPD based on project based learning (PjBL) on 1 Physics educator was carried out before it was tested

on students by distributing a practicality assessment questionnaire containing 12 statements. The results of the questionnaire from educators can be seen in table 7 and graph 1 below:

Table 7. Results of Educator Practicality

Statement No	Percentage Value	Category
1	100%	Very Practical
2	100%	Very Practical
3	100%	Very Practical
4	80%	Practical
5	80%	Practical
6	100%	Very Practical
7	80%	Practical
8	80%	Practical
9	100%	Very Practical
10	100%	Very Practical
11	100%	Sangat Praktis
12	100%	Very Practical
Average percentage	93%	Very Practical

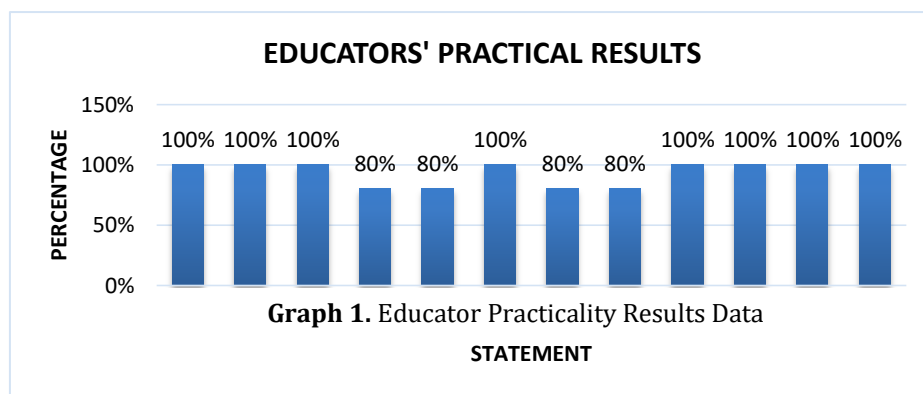


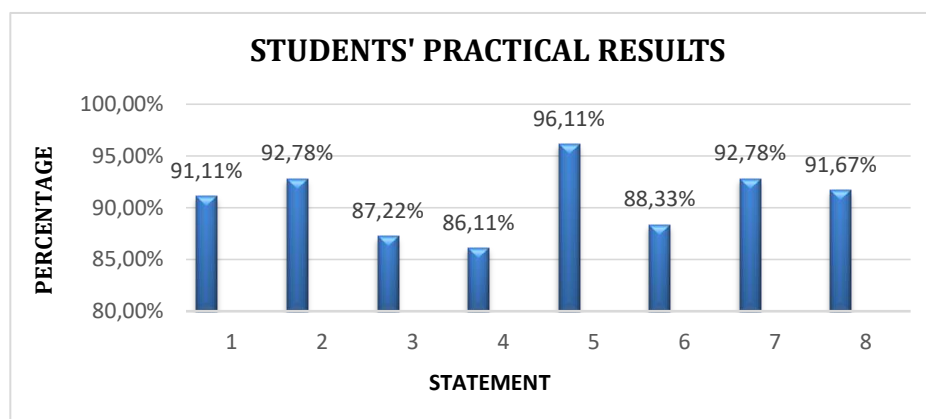
Table 7 and graph 1 show the results of the practicality questionnaire completed by physics educators. The average result obtained was 93% in the very practical category.

2) Practicality Test of Students

The practicality test questionnaire by students contained 8 statements, which were filled in by 36 students in class X.E.11. The results of the questionnaire from students can be seen in table 8 and graph 2 below :

Table 8. Student Practicality Results

Statement No	Percentage Value	Category
1	91,11%	Very Practical
2	92,78%	Very Practical
3	87,22%	Very Practical
4	86,11%	Very Practical
5	96,11%	Very Practical
6	88,33%	Very Practical
7	92,78%	Very Practical
8	91,67%	Very Practical
Average percentage	90,76%	Very Practical



Graph 2. Results of Student Practicality Results

Table 5 and graph 2 show the results of the practicality questionnaire completed by students. The average result obtained was 90.76% in the very practical category.

Table 9. Average Practicality Value of PjBL Based Physics E-LKPD

Practitioner	Average Percentage	Category
Educator	93%	Very Practical
Learners	90,76%	Very Practical
Average percentage	91,88%	Very Practical

Practicality is the convenience of a product both in preparing, using and storing it. The product standard is said to be practical, namely that the product can be used in normal times and conditions and is easy to use during learning (Sari, 2018). This is in line with Akbar's opinion in research (Amaliah, dkk., 2018) that teaching materials can be said to be practical if students use the teaching materials without problems.

Based on the analysis of practicality standards, it can be seen that the physics E-LKPD based on project based learning on students' creative thinking abilities is very practical for use by educators and students in the learning process, because the teaching materials developed meet the aspects of teaching materials that can be said to be practical. However, there are several suggestions and input from practitioners that can be used to improve future products, namely: increase the number of material sources so that the material is more complete for students to study,

- b. Test the implementation of E-LKPD Physics based on Project Based Learning

Implementation of Project Based Learning-based Physics E-LKPD in learning was observed by 2 observers. These two observers have been explained about the syntax of E-LKPD Physics based on Project Based Learning, so they already understand how to learn with E-LKPD Physics

based on Project Based Learning.

Table 10. Summary of PjBL-based E-LKPD Practicality Test Results

No	Aspect	Phase	Trials		Average	Category
			Teacher	Student		
1.	Observation of the Implementation of PjBL-based E-LKPD	Introduction	3,92	3,75	3,83	Very Practical
		Percentages Of Agreement	85,7	100	92,8	Very Good Agreement
		Phase 1 (fundamental questions)	3,9	3,8	3,85	Very Practical
		Percentages Of Agreement	80	100	90	Very Good Agreement
		Phase 2 (Design project planning)	3,49	3,83	3,66	Very Practical
		Percentages Of Agreement	66,6	66,6	66,6	Good Agreement
		Phase 3 (Developing a project schedule)	4	4	4	Very Practical
		Percentages Of Agreement	100	100	100	Very Good Agreement
		Phase 4 (Monitoring project activity and progress)	4	3,49	3,74	Very Practical
		Percentages Of Agreement	100	66,6	83,3	Very Good Agreement
		Phase 5 (Presentation of report and project results)	3,66	3,5	3,58	Very Practical
		Percentages Of Agreement	100	100	100	Very Good Agreement
		Phase 6 (Evaluation)	4	3,66	3,83	Very Practical
Percentages Of Agreement	100	100	100	Very Good Agreement		
2.	Practicality PjBL based E-LKPD		93%	90,76%	91,88 %	Very Practical

The implementation of project based learning physics E-LKPD consists of 4 phases starting from the introduction, phase 1 namely the problem, phase 2 project planning, phase 3 preparing the project work plan, phase 4

closing.

Based on Nieven's practicality criteria (Sari, 2018) So the PjBL-based physics E-LKPD is categorized as very practical because :

The results of practical research state that E-LKPD based on project based learning can be applied to physics learning about global warming material in the very practical category. The results of the student assessment stated that the physics E-LKPD based on project based learning was easy to apply to physics learning in a very practical way. This is proven by the many positive responses from students regarding the physics E-LKPD based on project based learning..

D. CONCLUSION

Based on the results of the validity and practicality of the Physics E-LKPD based on Project Based Learning on students' creative thinking abilities, a valid and practical Project Based Learning E-LKPD Physics was produced. The Physics E-LKPD based on Project Based Learning is valid both in terms of appropriateness of content/material, construction and language with an average score of 85% in the very valid category. The results of the product practicality assessment with 1 educator and 36 students received an average score of 91.88% in the Very Practical category. Meanwhile, the percentage of agreements is 90.38%, meaning that the agreement between the two assessors falls under the Very Good Agreement criteria. So, Project Based Learning-based Physics E-LKPD for students' creative thinking abilities can be used in the classroom learning process.

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