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The Feasibility of E-LKPD Based on a Constructivist Approach in Physics Learning for Phase F Students on Dynamic Electricity Material

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Abstract : *This study aims to determine the feasibility of E-LKPD based on a constructivist approach to the dynamic electricity material for Phase F students. This study is a type of R&D (Research and Development) research with a 4D Development Model (Define, Design, Develop, and Disseminate). This study has research limitations where researchers only carry out 3 stages without the disseminate stage due to limited time and energy. This study uses trial subjects, namely validators (validating the product) and students (product response test). The validators are carried out by two lecturers and 1 teacher who act as media experts and material experts. The product response test to assess the readability of the product was carried out by 20 students of grade XI of SMA Negeri Mojoagung Jombang. The research instruments used are: a) media expert validation sheet, b) material expert validation sheet, and c) student response questionnaire. The validation results from media experts show that the feasibility level is very feasible with an average percentage of 84%. Validation by material experts gives a feasibility value of 71%, which means it is suitable for use. Student responses to the E-LKPD were very positive, with an average percentage of 88%, indicating that this medium is interesting, easy to understand, and helpful in the learning process. The E-LKPD based on a constructivist approach is suitable for use as a supporting medium for physics learning on dynamic electricity material to improve student learning outcomes and skills.*

Keywords : *E-LKPD; Constructivistic Approach; Dynamis Electricity Material*

INTRODUCTION

21st-century learning emphasizes the use of ICT in the classroom. The rapid advancement of Information and Communication Technology (ICT) has influenced aspects of life, including the teaching and learning process. The development of ICT has impacted various activities in life, for example in the field of education (Putra et al., 2023). Various possibilities offered by ICT to improve physics learning include: 1) improving and developing the professional abilities of educators, (2) as a learning resource in learning, (3) as an aid and interaction tool in learning activities (Ariyansah et al., 2021). Students are asked to be able to learn from various sources, applications, and real experiences inside and outside of school (Rahayu et al., 2022). Teachers are not only required to teach but also

to be facilitators for students. The facilities provided by teachers aim to enable students to be actively involved in learning (Ginting, D. et al., 2021). Therefore, teachers must be able to adapt to ICT developments and be able to develop teaching materials that are appropriate to the times and according to student needs.

21st-century learning must be implemented in every school. However, not all educational institutions have been able to adapt to 21st-century learning using the Independent Learning Curriculum. Several issues encountered in the field indicate that students lack collaborative skills, are less able to express ideas or opinions, and are less motivated to learn. Furthermore, classroom learning tends to be monotonous or lacks variety. This results in poor conceptual understanding or a lack of visible skills.

Student Worksheets (LKPD) are a collection of sheets containing student activities that enable students to carry out real-life activities with the objects and problems being studied (Anisa, 2017; Khikmiyah, 2021). Furthermore, LKPD is a printed teaching material containing guidance that students can use to develop their abilities (Ardiansah & Zulfiani, 2023; Prastika & Masniladevi, 2021; Rahmi, 2023). LKPD is also defined as teaching materials that can direct the learning process, containing several practice questions and learning materials that can guide students in practical learning (Berlian et al., 2023; S. Wahyuni et al., 2025). LKPD functions as a learning guide for students and also facilitates students and teachers in carrying out teaching and learning activities. Furthermore, other research has found that developed Student Worksheets (LKPD) can be used as an alternative learning medium by teachers to support learning activities (Anisa, 2017; Ardiansah & Zulfiani, 2023). According to (Trianto, 2013), the student worksheet contains a series of activities that must be carried out by students to maximize understanding in an effort to develop basic skills according to the learning outcome ability indicators that must be achieved. Therefore, LKPD functions as a learning guide for students and also makes it easier for students and teachers to carry out teaching and learning activities (Suwastini et al., 2022) and LKPD is excellent for training students' thinking and analytical skills.

LKPD can be developed in accordance with developments in science and technology, resulting in the form of E-LKPD or Electronic LKPD. E-LKPD is a teaching material that can increase student interest in learning and facilitate teachers (Kasmini et al., 2023). Based on research by (Fitriyati et al., 2013), the use of E-LKPD, which can be completed online, can be an alternative learning resource for students in phase f. E-LKPD has many advantages, one of which saves paper as the material used to print LKPD and E-LKPD also visualizes concepts to be easy to understand and can be used independently anywhere and anytime (Kasmini et al., 2023; Syafar et al., 2024). Using E-LKPD can increase students' enthusiasm for learning when their enthusiasm is low and can also make learning more efficient (Suryaningsih & Nurlita, 2021; Untung et al., 2023). E-LKPD (Electronic Student Worksheets) have been widely developed by researchers. One such study by (Suryaningsih & Nurlita, 2021) found that the development of innovative E-LKPD in the 21st-century learning process is based on the need for teaching materials, practical work, boredom, technological developments, and the impact of the pandemic. Furthermore, as stated by (Syafar et al., 2024), E-LKPD with Liveworksheet offers the advantage of flexible accessibility via digital devices such as laptops, smartphones and computers, allowing students to study anytime and anywhere. In addition, this research

emphasizes the use of interactive multimedia in E-LKPD, such as images, audio and video, which can increase students' conceptual understanding and learning motivation.

Based on the background above, the purpose of this study is to determine the feasibility of E-LKPD based on a constructivist approach to the material of dynamic electricity for Phase F students. The researcher hopes that E-LKPD based on a Constructivist Approach: a) can provide a more enjoyable and effective learning experience, and make a positive contribution to improving the quality of physics education in schools, b) can be an effective tool for teachers in delivering material consistently and efficiently, c) can help students understand the material being taught and not get bored quickly during the learning process, and d) can increase student involvement actively in the learning process and have higher motivation to achieve better learning outcomes.

METHOD

This research is a type of R&D (Research and Development) research and development (R&D). The R&D model used is the 4D (Define, Design, Develop, and Disseminate) model (Figure 1). This study has research limitations in that the researcher only conducted three stages, with no dissemination stage due to time and resource constraints.

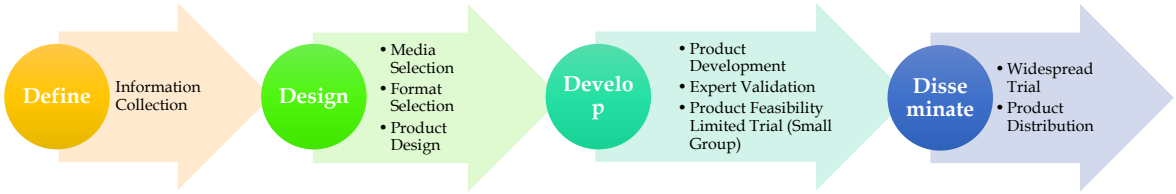


Figure 1. Research model with using 4D (Define, Design, Develop, and Disseminate) model

This research was conducted over a one-month period, namely in May 2025. This study used trial subjects: validators (product validation) and students (product response test). The validators were two lecturers and one teacher who acted as media experts and material experts. The product response test to assess the product's readability was conducted by 20 grade XI students of SMA Negeri Mojoagung Jombang. The research instruments used were: a) media expert validation sheet, b) material expert validation sheet, and c) student response questionnaire.

The research data obtained from the Constructivist Approach-based E-LKPD validation activity and the Constructivist Approach-based E-LKPD response test will be analyzed, including both quantitative and qualitative data. The research data from the Constructivist Approach-based E-LKPD validation research were analyzed based on the product feasibility formula (1) and Table 1. The research data from the student response test to the Constructivist Approach-based E-LKPD were analyzed based on the product feasibility formula (2). The results of the data analysis of this study will be concluded based on Table 2.

$$\text{Eligibility Percentage (\%)} = \frac{\text{X (Total Expert Validator Score)}}{\text{X}_\text{i}\text{ (Total Maximum Score)}} \times 100\% \quad (1)$$

$$\text{Eligibility Percentage (\%)} = \frac{\text{X (Total Student Score)}}{\text{X}_\text{i}\text{ (Total Maximum Score)}} \times 100\% \quad (2)$$

Table1. Assesment Score for Answer Choices (Sugiyono, 2014)

Score	Answer Choices
4	Very Agree/Appropriate/Interesting
3	Agree/Appropriate/Interesting
2	Don't Agree/Appropriate/Interesting
1	Very Don't Agree/Appropriate/Interesting

Table1. Percentage Scale Criteria (Riduwan, 2013)

Percentage of Achievement (%)	Assessment Criteria for Media and Material	Validation Assessment Criteria for Student Responses
81 – 100	Very Appropriate	Very Interesting
61 – 80	Appropriate	Interesting
41 – 60	Quate Appropriate	Quate Interesting
21 – 40	Less Appropriate	Less Interesting
0 – 21	Very Less Appropriate	Very Less Interesting

RESULT AND DISCUSSION

1. Result

The research conducted yielded research data related to the Constructivist-Based E-LKPD, both quantitative and qualitative, as follows:

a. Define

At this stage, various information was obtained to support the development of the Constructivist-Based E-LKPD for the Dynamic Electricity Phase F topic. Data were obtained based on information related to the curriculum at Mojoagung State High School and relevant high school Physics textbooks. The researcher adjusted the material to include the learning outcomes of the Independent Curriculum, as shown in Table 3.

Table 3. Phase F Science Learning Outcomes

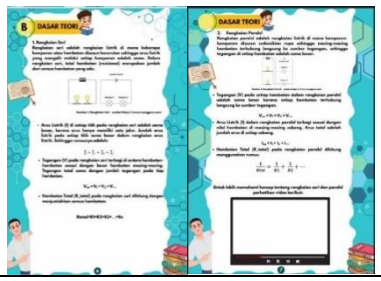
Science Learning Outcomes in Phase F of "Merdeka Curriculum"	
Physics Understanding	Students are able to understand the concept of motion, namely the relationship between force and motion and its use to explain natural phenomena, design, or structural engineering; the application of fluid laws in everyday life; the concept of heat and thermodynamics and their application to analyze the impact of climate change; wave phenomena and their application in everyday life; electrical circuits and electromagnetic phenomena; basic theories of modern physics and their influence on technological development; and basic digital theories and their use in everyday life.
Process Skills	1. Observing

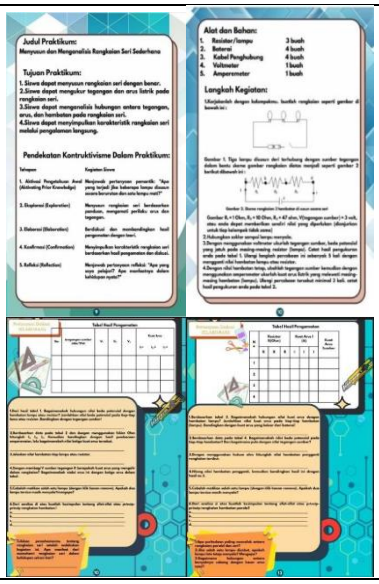
	Students are able to optimize the potential of using a variety of tools to conduct observations. 2. Questioning and Predicting Students are able to question and predict based on observation results, formulate existing problems, and ask key questions to solve them. 3. Planning and Conducting Investigations Students identify the background of the problem, formulate objectives, and use references in research planning. Students differentiate variables, including controlled and independent variables, using instruments appropriate to the research objectives. Students determine the work steps and data collection methods. 4. Processing and analyzing data and information Students prepare appropriate equipment/instruments for scientific research, use measuring instruments carefully and correctly, and understand the limitations and advantages of the measuring instruments used. Students apply data collection techniques/processes, process data according to its type/needs, analyze data, draw conclusions from research results, and provide follow-up recommendations/suggestions based on the results. 5. Creating Students are able to use the results of data and information analysis to generate ideas, solutions, or designs to solve problems. 6. Evaluating and Reflect Students are courageous and polite in asking questions and arguing, developing curiosity, and showing concern for the environment. Students present scientific and critical arguments, boldly proposing improvements to a condition, and are responsible for their proposals. Students are honest about data/facts found. 7. Communicating Result Students prepare a written report on research results and communicate research results, data acquisition procedures, data processing and analysis methods, and communicate appropriate conclusions to address research/investigation problems. Students present data processing results in tables, graphs, flowcharts, and/or concept maps, presenting data correctly using international symbols and standards, and using appropriate media to present data processing results. Students describe trends, relationships, patterns, and interconnections of variables and use language, symbols, and terminology appropriate to the field of Physics.
Learning Objective	Students analyze electrical circuits and their uses in everyday life.

b. Design

At this stage, researchers select the product development media, namely, the product development will be presented in the form of an instructional video. The instructional video will be created using a camera and edited using the Canva and CapCut applications. After selecting the media, the format and design will be selected (Table 4).

Table 4. Storyline Learning Video

No	Section	Description
1	*Cover* 	Contains: - Class - Group - Student Name
2	*Introduction* 	Contains: - Foreword - Table of Contents - Instructions for Using E-LKPD - Learning Outcomes
3	Materials and Practical Work 	Contains: - Basic Electrical Theory - Electrical Video - Practical Activities - Learning Evaluation

		
4	*Closing* 	Contains: - Bibliography - Author Biography

c. Develop

During the development phase, the Constructivist-based E-LKPD (Figure 2) will be validated by experts to determine its feasibility based on assessments by: 1) media experts competent in the field of learning media, 2) material experts competent in the field of Physics Education, and 3) Physics subject educators. The results of the student response questionnaire regarding the Constructivist-based E-LKPD for Dynamic Electricity were used to determine its readability. The results of the media and material validation by the validators for the Constructivist-based E-LKPD for Dynamic Electricity are presented in Figure 3, with a score of 84% (Very Feasible) for media validation and 71% (Feasible) for material validation in Figure 4. The results of the student response questionnaire regarding the Constructivist-based E-LKPD for Dynamic Electricity are presented in Table5.

Figure 2. QR Code for E-LKPD Based on a Constructivist Approach for Dynamic Electricity Material

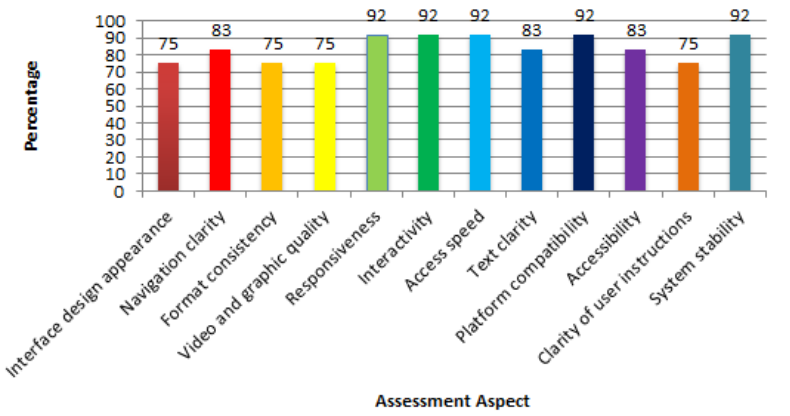


Figure 3. Media Expert Validation Results

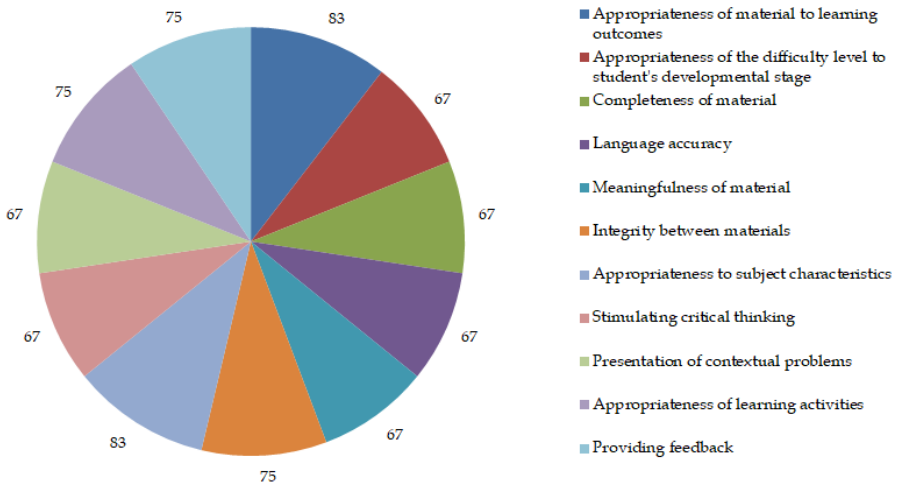


Figure 4. Material Expert Validation Results

Table 5. Student Response Questionnaire Result

No	Assessment Aspect	Precentage (%)	Description
1	I found it easy to understand the material presented in this E-LKPD.	88	Very Interesting
2	The E-LKPD's appearance is attractive and makes me more enthusiastic about learning.	88	Very Interesting
3	The instructions in the E-LKPD are clear and easy to follow.	91	Very Interesting
4	The E-LKPD helps me complete assignments more effectively.	90	Very Interesting
5	The E-LKPD provides practice questions that are relevant to the material.	89	Very Interesting
6	I feel more challenged to think critically and creatively through the E-LKPD.	86	Very Interesting
7	The time it takes me to complete the E-LKPD is within my capabilities.	88	Very Interesting

8	The use of multimedia (images, videos) in the E-LKPD helps me understand the material better.	91	Very Interesting
9	I feel that E-LKPD can be used anytime and anywhere without difficulty.	86	Very Interesting
10	Overall, I am satisfied with the use of E-LKPD as a learning medium.	88	Very Interesting
	Average Precentage	**88**	**Very Interesting**

2. Discussion

Based on Figure 3 and Figure 4, the average result for media assessment was 85.8% with a very decent category and the average result for material assessment was 82.5% with a decent category. In media validation, it was found that the aspects of interface design appearance, format consistency, video and graphic quality, and clarity of usage instructions had low values compared to other aspects. This is indeed believed by researchers, where the aspect of interface design appears in E-LKPD Based on a Constructivist Approach where the appearance does not show the topic of the material so that it needs to be improved in terms of the display design according to dynamic electricity material. This is in accordance with research (Suryani & Rini, 2023) that E-LKPD which is designed interactively can increase student involvement in the learning process. In the aspect of format consistency, there were differences in formats that did not match the existing LKPD format. According (M. F. A. Putri et al., 2025) to if the E-LKPD format is complete, it will provide adequate space for students to fill in the E-LKPD. The quality of video and graphics was poor where there were images whose image quality was not good so that their quality needed to be improved. In addition, the instructions for using E-LKPD based on a constructivist approach were unclear and the use of language was not good so that good grammar was improved. This is in line with research (Siregar et al., 2024) where the interactive features provided can facilitate student interaction with media in the process of exploring and elaborating new knowledge.

The results of the material validation also provide several important notes on the following aspects: a) Suitability of the level of difficulty with the developmental stage of students, b) Completeness of the material, c) Accuracy of language, d) Meaningfulness of the material, e) Stimulation of critical thinking, and f) Presentation of contextual problems. All of these aspects lead to the suitability of the content of the material in the E-LKPD Based on a Constructivist Approach which is considered less in-depth, where there is no application of Physics concepts related to dynamic electricity in everyday life so that researchers make improvements by adding phenomena and problems of everyday life related to the material of dynamic electricity. In addition, the arrangement of sentences and language used do need to be improved so that they are easily understood by students. This is based on research by (Wulansari & Nuryadi, 2022), which showed that the use of e-LKPD, which involves students in the problem-solving process to construct new knowledge, effectively improves students' conceptual understanding. According to (Siregar et al., 2024), students can directly see how the material they are learning relates to everyday life, thus contributing to a better understanding of the material's concepts. In addition to the assessment of media and materials, the results of the assessment of student responses to the E-LKPD Based on a Constructivist Approach show that the E-LKPD is in the very interesting category with a percentage of 88%.

E-LKPD does have a significant impact on classroom learning. The use of constructivism-based E-LKPD has a positive contribution to student learning outcomes (Afifah & Junaedi, 2024; Firtsanianta & Khofifah, 2022; Prabowo, 2021; P. Ramadhani et al., 2022; Zulfa & Indana, 2025). The results of a study by (Kiane et al., 2024) stated that the impact of implementing E-LKPD has various impacts, namely improving several student abilities such as critical thinking, creative thinking, scientific literacy, and science process skills, in addition to increasing student learning motivation and learning outcomes in science learning. This is supported by (Hendra et al., 2024) where the use of Discovery Learning-Based E-LKPD is able to improve students' Science Process Skills with an N-Gain value of 0.728. In addition, e-LKPD can improve students' conceptual understanding (Ariyansah et al., 2021; Wulansari & Nuryadi, 2022), critical thinking skills (Melani et al., 2023; D. Ramadhani & Rahayu, 2024; Septian et al., 2022; Yulanda et al., 2023), and problem-solving skills (Risamasu & Pieter, 2024; I. A. G. S. Wahyuni et al., 2024). E-LKPD can also significantly increase students' learning motivation (N.W.B. Artini et al., 2023; Suharsono & Handayani, 2022; Syafar et al., 2024; Untung et al., 2023).

In addition, E-LKPD based on the Constructivist approach allows for increased student learning motivation. (Khair et al., 2020; Ningtyas & Rahayu, 2022; Suharsono & Handayani, 2022) added that through E-LKPD, teachers can increase student learning motivation which is influenced by several factors including: (1) being able to arouse curiosity and enthusiasm for learning, and (2) E-LKPD is equipped with sound in the form of images, music, explanatory illustrations, and animations. This is in line with (Ayuni et al., 2025; Kasmini et al., 2023; Syafar et al., 2024; Untung et al., 2023) where E-LKPD has many advantages, including its interactive nature, integration with multimedia, and accessibility anytime and anywhere as well as providing fast feedback, flexible for use on various devices, and offering interesting features such as videos, animations, or simulations. The characteristic of E-LKPD is that it has an attractive design containing videos, images and colors and is multimedia in nature which can make students motivated and enthusiastic in carrying out learning activities, so that it has implications for improving learning outcomes and science process skills (Syafar et al., 2024).

E-LKPD based on the Constructivist Approach is expected to improve students' understanding of Physics concepts, particularly Dynamic Electricity, and can also increase student learning motivation. LKPD can be used as a guide for Physics learning and experiments in the laboratory. Creative LKPD for practical work can arouse enthusiasm and motivation in students, so that students will be more interested in learning or conducting Physics research in the classroom and laboratory (W. A. S. Putri et al., 2022). Furthermore, for the implementation of E-LKPD based on the Constructivist Approach to be carried out, support efforts are needed from educational institutions to facilitate adequate facilities and infrastructure and provide support in improving educator competencies in accordance with developments in science and technology.

CONCLUSION

This study used a 4D (Define, Design, Develop, and Disseminate) development model with the limitation of not conducting a dissemination stage. Validation results from media experts indicated a very good level of feasibility with an average percentage of 84%. Validation by material experts gave a feasibility score of 71%, indicating it is suitable for use, although there are several notes for material improvement. Student responses to the E-LKPD were very positive, with an average percentage of 88%, indicating that this medium is engaging, easy to understand, and helpful in the learning process. The E-LKPD based on a constructivist approach is suitable for use as a supporting medium for physics learning on dynamic electricity to improve student learning outcomes and skills. This study can be continued to the dissemination stage through the implementation of E-LKPD in the classroom to assess the effectiveness of E-LKPD based on a constructivist approach on both learning outcomes and students' science process skills.

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