

Development of Interactive E-LKPD Liveworksheet Based on Contextual Teaching and Learning (CTL) on Biodiversity Materials as Student Teaching Materials

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Abstract

The development of teaching materials in the form of E-LKPD was motivated by the limitations of teaching materials used at SMAN 1 Beber. This study aims to produce interactive e-LKPD-based biodiversity liveworksheets (CTL) as valid and practical teaching materials for class X students. This research uses the (R&D) method. The instruments used are needs analysis instruments, validation sheets for material experts and media experts, and questionnaires for teacher and student responses. The feasibility results of the E-LKPD based on the assessment of material experts reached a value of 0.60 with the criteria of "High" validity level and media experts gave an assessment of 0.93 with the criteria of "Very High" validity level. The result of the product trial based on responses from educators was 92.42% "Very Feasible". According to the questionnaire, the student response showed a score of 77% with the criteria of "Feasible". This shows that E-LKPD meets the criteria of being very valid, very practical and suitable for use in learning by teachers and students.

Keywords: Biodiversity, Contextual Teaching and Learning, E-LKPD, Liveworksheets.

Introduction

Teaching materials are the most common learning tool used by educators to achieve educational goals. In a study conducted by Dianingrum (2019), it was found that the teaching materials used, both educator handbooks and student package books, were not very interesting to students, so students were not interested in using them. The results of the researchers' interviews with teachers also showed that the learning method that only uses handbooks has many shortcomings, so additional sources from the internet are needed.

Technological advances can significantly affect the way teaching materials are packaged so that anyone can access them at any time in the field of education. Additional teaching materials for the main teaching materials can be created by taking advantage of technological advancements. Teaching materials are one of the resources that educators use as a roadmap to support student learning in the classroom (Andini et al., 2022).

The learning media used in the teaching and learning process has an important role in determining success in learning. Therefore, teachers are required to be able to apply effective and efficient learning media that can improve learning outcomes after carrying out teaching and learning activities. The benefit of learning media is to improve a more conducive learning atmosphere by involving more aspects of student intelligence or in other words students are

directed to carry out independent learning activities with proportional supervision by teachers (Nurlatipah et al., 2015).

Student Worksheets (LKPD) are teaching materials that focus on improving students' thinking skills. According to Prastowo (2014, p. 204), LKPD is a printed teaching material that contains materials, summaries, and instructions for the implementation of the lesson plan. It focuses on the basic competencies that students must have. With technological advancements, LKPD can be provided in electronic form, also called E-LKPD. Monika's research (2018) shows that teaching materials in the form of E-LKPD on colligatic material solutions get a "good" validator assessment and get a very good response from students with a percentage of 92.2%, which indicates that it is suitable to be used as a teaching material.

Teachers can use this liveworksheet-based E-LKPD to help achieve learning goals, especially in the learning process where generally students tend to feel bored and bored quickly because the teaching materials presented are only in the form of summaries and practice questions, the papers presented on the LKPD are blurry, then the pictures in the biology book are still incomplete and interesting so that students feel bored during the learning process. The LKPD used by teachers has basically not been able to help students to improve their understanding of the concept of Biodiversity material. The limitations of teaching materials make students tend to memorize material and tend to be passive in learning activities.

One of the free online sites used to create or compile interactive LKPDs is Liveworksheets. The site can be accessed on www.liveworksheets.com for free, but users must sign up for an account. The types of questions that can be made on this site are very diverse. Teachers can choose drop-downs, multiple choice, checkboxes, join arrows, drag and drop or listen to speak (Hazlita, 2021).

Liveworksheets is a platform in the form of a website that provides services to educators to be able to use the available E-LKPD and create their own E-LKPD interactively online. This liveworksheet-based interactive LKPD can provide learning variations to students so that learning is not boring. In addition, this interactive LKPD encourages students to be active in learning and provides convenience in online learning (Prastika & Masniladevi, 2021).

Biology is a science that investigates real events that occur in nature and the relationships that exist in it (Triyanti and Nulhakim, 2018). Biodiversity material is an important part of the biology curriculum at the high school level, especially grade X. By using this material, the development of E-Learning is an important part of the biology curriculum. By using this material, the development of interactive E-LKPD will be in line with the demands of the curriculum and provide a learning experience that is in accordance with the basic competencies that students must achieve. This material is very important because it discusses the diversity of species and ecosystems in Indonesia, a country with the highest biodiversity in the world. Understanding biodiversity will help students to appreciate and protect existing natural resources, which is an important provision in environmental education.

Biodiversity has a broad and interesting scope of material, covering a wide range of topics such as the classification of living things, ecosystems, and the role of diversity in life. The grouping of biodiversity utilization in Indonesia consists of food sources, medicines, cosmetics, clothing, boards and cultural aspects (Irnaningtyas, 2013). So far, several research results show that biodiversity materials have been delivered using learning media, including multimedia mobile learning modules (Suryanda et al., 2016), flashcards (Due, et al., 2013) and pocket books (Setiawan et al., 2013). With this material, the use of the Contextual Teaching and Learning (CTL) approach will be more effective because students can connect learning with the surrounding environment. Biodiversity materials allow for optimal application of the

CTL approach. Students can be invited to observe the surrounding environment, explore biodiversity firsthand, and understand the importance of maintaining the balance of the ecosystem. This encourages learning that is more meaningful and relevant to daily life. Through interactive and CTL-based learning, students are expected to increase awareness and responsibility for biodiversity conservation.

The interactive E-LKPD allows students to engage in more dynamic and interactive learning, making learning more interesting and enjoyable. Achieving quality learning outcomes can be done through a quality learning process. If the learning process is not optimal at first, it is very difficult to expect high-quality learning outcomes. Therefore, it can be concluded that the root of the problem of the level of development of education quality lies in the problem of education processing where the smooth processing of education is supported by several components of education, namely students, teaching staff, curriculum, educational facilities, and the surrounding community (Tirtaraharja et al., 2005).

Today's challenges are increasingly complex, supported by the sophistication of science and technology, which has an impact on various aspects, one of which is biodiversity (Martin et al., 2016). The increase in population is directly proportional to the potential for biodiversity extinction (Edet et al., 2014). Most human activities in the form of illegal logging, aquaculture shift activities, domestic industrialization, agricultural intensification, hunting, species introduction, and animal trade can gradually reduce the intensity of biodiversity in Indonesia which ends in extinction (Apriyadi & Winata., 2019). However, some studies reveal that students still have low reasoning abilities as indicated by their answers to essay questions (Destriyani et al., 2022). Most students are less able to explain problems using pictures, unable to provide logical arguments to solve problems, less thorough in analyzing and solving problems, and less precise in drawing conclusions, especially when proving theorems (Apriani et al., 2020).

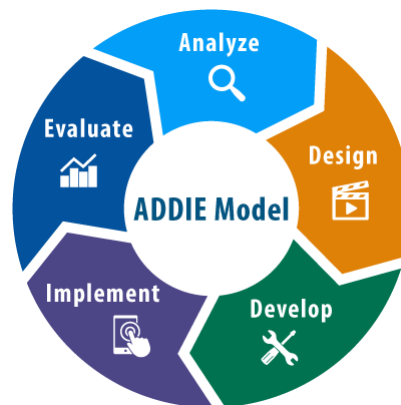
By choosing biodiversity materials, this CTL-based interactive E-LKPD can help students understand the importance of safeguarding and preserving the environment, while increasing their learning motivation through a relevant and contextual approach. There are various obstacles and needs that have been explained, as educators are expected to be able to innovate to meet the needs of students, and find solutions to obstacles that hinder learning, one of which is by making good and electronic-based teaching materials that are in accordance with technological developments. Science learning, especially biology learning in schools, should not be theoretical but should involve practicum and connect learning with natural phenomena, so that students can apply what they have learned (Kusuma et al., 2015). According to Istifarida et al. (2018), learning media must contain clear content so that learning materials can be conveyed effectively.

Based on the introduction above, as one of the solutions to various problems, teaching materials in the form of E-LKPD can be made contextual and interactive using a website made by Google, namely Liveworksheets. As conveyed by Sholehah (2021), Liveworksheets display learning content in audio-visual form and allow students to access E-LKPD anywhere, whether using desktop computers, laptops, or internet-connected devices. Therefore, the researcher is interested in developing "Development of Interactive E-LKPD Liveworksheet Based on Contextual Teaching and Learning (CTL) on Biodiversity Materials as Teaching Materials for Class X Students".

From the description above, this study aims to produce an interactive E-LKPD liveworksheet based on contextual biodiversity teaching and learning (CTL) material as a valid and practical teaching material for grade X students.

Method

This research uses the ADDIE Model as a guideline to develop effective products. The ADDIE model is made with structured activity steps as an effort to solve problems related to learning (Widyastuti & Susiana, 2019, p.2).



Picture 1. Addie Model Steps

The ADDIE model is implemented in order to create a basic concept in learning, namely developing learning products. This model is centered on long-term and systematic individualized learning (Hidayat & Nizar, 2021, p. 29). The ADDIE model is a model used for the development of learning products (Furwana & Syam, 2021, p. 56). In this model, continuous evaluation is carried out at each stage. So that it can produce products that are valid, efficient, effective and in accordance with the learning goals to be achieved. This model is a simple and not very complicated model, but its systematic implementation and continuous evaluation can make this model a development model whose validity can be recognized. ADDIE is an acronym for five stages, namely Analyze, Design, Development, Implementation, Evaluation. In the development of teaching materials using the ADDIE model, emphasizing the repetitive process if during the evaluation it is found that things need to be revised or improved, the development process can return to the previous stage (Simarmata & Mujiarto, 2019: 180).

This research method is oriented to the development and production of a product and to validate the effectiveness of the product Dwitiyanti et al. (2020, p. 126). The subject of this research is expert practitioners and students of class X.4 of SMAN 1 Beber, located in West Java Province in Indonesia. The data analysis methods used are quantitative data analysis and qualitative data. The instruments used are needs analysis instruments, validation sheets for material experts and media experts, and questionnaires for educator and student responses. The stages of development are shown in Figure 1. With the following explanation.

1) Analysis Stage

At this stage, a needs analysis and problem identification are carried out. The researcher made observations at SMAN 1 Beber and also conducted interviews with the school, namely the Biology Teacher and the Curriculum Section regarding how learning has been carried out by the school with students. The results of the interview were that educators only used the teacher's handbook in teaching, educators needed to find other sources of material through the internet, the approach used was usual, students sometimes got bored with the

delivery of the material presented, students had difficulty understanding the theory in biology lessons. Educators only use package books, learning videos and LKPD for 1 material only. When studying biodiversity material, students only rely on textbooks, so when asked to give examples of biodiversity around them, they are only mentioned examples in textbooks.

The scope of the material is determined based on the results of interviews conducted between researchers and educators. During the interviews, the educators expressed a strong desire for electronic teaching materials that are aligned with technological advancements. They also fully support the development of teaching materials in the form of E-LKPD (Electronic Student Worksheets), with the hope that biological concepts such as biodiversity can be presented through visualizations such as images, animations, explainer videos, and interesting interactive features. Students stated that more biology content needed to be connected to real-life contexts. This approach will help students better understand biology, which is often considered challenging, while also assisting educators in conveying material that is not adequately covered in existing textbooks.

2) Design Stage

At this stage, the researcher begins to prepare tests, design products (in the form of Story Boards), select product formats, initially design learning tools and prepare research instruments.

The products that will be developed by researchers are adjusted to the needs of materials and students so that they can support the achievement of learning goals. The selection of the format is adjusted to the content of the material and the approach used in learning, namely the CTL approach which includes constructivism, inquiry, questioning, learning community, modeling, reflection, and authentic assessment.

The purpose of choosing this format is so that the E-LKPD developed is in accordance with good criteria so that it is suitable for use in learning. The CTL-based electronic student worksheet (E-LKPD) format developed contains cover elements, preface, table of contents, instructions for use, competencies to be achieved, materials, student worksheets and bibliography. The following is a view of the Story Board for the development of LKPD based on CTL biodiversity material:

Rancangan Awal	Hasil Rancangan
Judul Materi Topik 1	
Gambar-gambar	
Isi Materi	
Gambar-gambar	

Picture 2. Storyboard E-LKPD Design

3) Development Stage

The third step is to realize the design concept by developing a product in the form of LKPD (Student Worksheet) based on CTL (Contextual Teaching and Learning) on biodiversity materials. The product developed was then validated by two subject matter experts and two media experts using instruments that had been prepared beforehand. This instrument uses the Likert scale. At this stage, the development and validation of the Interactive E-LKPD was carried out using Liveworksheets, based on CTL on biodiversity materials.

4) Implementation Stage

After the development stage is completed and the product is declared suitable for use, CTL-based Liveworksheets E-LKPD can be implemented in schools. This stage involves testing the product with educators and students. The researcher conducted a limited application of the E-LKPD developed to collect feedback or responses regarding the product.

5) Evaluation Stage

In the final stage, the validated and tested product is evaluated. This evaluation aims to produce high-quality Interactive LKPD based on Liveworksheets. This involves compiling all the improvement suggestions provided by the validator. After incorporating the necessary revisions, the product is finalized and becomes a final product that meets feasibility and effectiveness.

Results and Discussion

The following outlines the steps to develop learning media and teaching materials using the ADDIE model (Hajati & Amaliah, 2022, pp. 94–95):

1. Analysis

In this first stage, the researcher carried out six steps, namely needs analysis, determination of the scope of the material, curriculum analysis, identification of student characteristics, determination and collection of material sources, and compiling the flow of the research development process. The needs analysis was carried out in the first step of the research to find out what kind of teaching materials are needed in the biology learning scheme by educators and students. The activities carried out in this needs analysis step include interviews with educators, and distributing needs analysis questionnaires to students. Through this interview, the teaching style of educators and the competencies that will be contained in the needs of teaching materials can be analyzed (Apriliyani & Mulyatna, 2021). The general steps in the analysis phase are as follows (Cahyadi, 2019).

a. Needs Analysis:

In this activity, researchers collected information about the need to develop teaching materials through interviews with educators and by distributing needs analysis questionnaires to students.

Based on the student needs analysis questionnaire, several obstacles were found in the learning scheme in the classroom. Many students think that chemistry is a difficult subject for them. This can be seen in the results of data on students' responses to biology subjects which are considered quite difficult for students. The percentage of student responses showed that 0% strongly agreed, 71.4% agreed, 25.7% disagreed, and 2.9% strongly disagreed. Prabowowati & Hadisaputro, (2014) revealed that difficulties in learning biology are due to the imbalance between understanding the concept and its application, so that it is difficult to learn it.

The data obtained from the needs analysis questionnaire was also strengthened by the results of the researcher's interview with the educator who taught biology subjects at the school. The information obtained from this interview activity is that educators only use the teacher's handbook in teaching, educators need to look for other sources of material through the internet. This is like the findings of Darmawati et al., (2019), which is that generally educators still use the lecture method (lecturing) and use learning resources in the form of BSE package books. Meanwhile, in reality, the development of students' abilities in the learning scheme is so rapid, that learning resources are needed that are able to increase interest in learning. In addition, the approach used is ordinary, students are sometimes bored with the presentation of the material being delivered, students have difficulty understanding the theory of biodiversity material.

Based on the obstacles and needs of educators presented, the researcher tried to offer a solution, namely developing products in the form of E-LKPD. Suryaningsih & Nurlita (2021) revealed that teaching materials in the form of innovative E-LKPD to be developed because they are urgently needed by students. This is also in line with the expectations of educators, educators feel that the development of teaching materials in the form of E-LKPD needs to be carried out as an innovation in supporting the learning process, especially in biology materials.

b. Determining the Scope of Material:

This is based on the results of interviews between researchers and educators. Educators expressed a strong desire for electronic teaching materials that are in line with technological advances and fully support the development of teaching materials in the form of E-LKPD. They hope that biological concepts such as biodiversity can be presented through visual elements, animations, explainer videos, and engaging interactive features. Students emphasized the need for more biology content to be connected to real-life contexts. This will help students better understand the often challenging concepts of biology while assisting educators in addressing gaps in existing textbooks. These expectations and aspirations are based on student response data, as shown in the questionnaire results.

c. Curriculum Analysis:

It aims to identify the current curriculum used by educators so that researchers can determine learning outcomes and create storyboards for E-LKPD teaching materials.

d. Identifying Student Characteristics:

This was carried out in the needs analysis activity using a response questionnaire filled out by Class X.4 students at SMAN 1 Beber.

2. Design

The second step involves product design, product format selection, initial planning of learning tools, and preparation of research instruments. At this stage, the product design is made in the form of a storyboard. After the design stage is complete, the researcher downloads the storyboard in PDF format to upload it to the Liveworksheets app. This makes E-LKPD more interesting, interactive, and easier for students to use during the learning process.



Figure 3. The E-LKPD design stage before uploading to Liveworksheets.

This stage involves identifying the elements of the E-LKPD structuring, the worksheet framework, and a summary of the material to be used as a guide in developing the content of the E-LKPD. Before creating an interactive E-LKPD, researchers designed worksheets using the Canva app, as it provides a lot of animations and images that can be incorporated into the E-LKPD. As shown in Figure 3, the design of the E-LKPD includes a cover, preface, table of contents, instructions for use, learning objectives, content of the material, LKPD that incorporates Contextual Teaching and Learning (CTL) indicators, and a bibliography.

3. Development Stage

The E-LKPD will be validated by two lecturers who are media experts and two lecturers who are subject matter experts. The validation process involves reviewing the assessment instruments that have been developed to measure and evaluate the validity and feasibility of various aspects, including the content component, presentation, language, and CTL component, covering a total of 15 indicators. This validation is carried out to collect feedback and suggestions from experts, allowing for improvement and refinement of the E-LKPD before it is implemented to students in the learning process. The researcher also analyzed the results of the instruments completed by the media and subject matter experts to determine the level of validity of the E-LKPD.

a. Material Expert Validation Results

Table 1. Material Expert Validation Results

Expert Member 1		Expert Member 2	
Less relevant (Score 1-2)	Relevant (Score 3-4)	Less relevant (Score 1-2)	Relevant (Score 3-4)
1,2,3,5,6	4,7,8,9,10,11,12,, 13,14,15	-	1,2,3,4,5,6,7,8,9, 10,11,12,13,14,1 5

Table 1. shows the results of the validation of two lecturers who are experts in the material. The numbers in the bottom row of the table are the indicator numbers in the assessment questionnaire that are declared to be less relevant or relevant. The validation results from expert 1 stated that indicators 1,2,3,5,6 were less relevant while indicators



4,7,8,9,10,11,12,,13,14,15 were relevant and expert 2 stated that all indicators, namely as many as 15 items were relevant in the CTL-Based Interactive E-LKPD Liveworksheets. The results of the assessment are then put into a cross-tabulation (Gregory Matrix) to obtain a feasibility score on the material aspect. The results of the feasibility in the cross tabulation (Gregory Matrix) are presented in table 2.:

Table 2. Results of Cross-Tabulation of Material Experts

Gregory's Tabulation Matrix (2x2)		Member 1	
		Less relevant (score 1-2)	Highly relevant (score 3-4)
Member 2	Less relevant (score 1-2)	A (0)	B (0)
	Highly relevant (score 3-4)	C (5)	D (10)

Then the data was entered into the content validity formula (Gregory formula) and the following results were obtained:

$$CV = \left(\frac{10}{0+0+5+10} \right) = 0,6 \text{ Height}$$

The results of the validation of the Interactive E-LKPD Liveworksheet Based on Contextual Teaching and Learning on the material aspect analyzed using the Gregorian formula obtained a score of 0.6. Based on the criteria or validity coefficient that has been determined in chapter 3, this value is included in the "High" criterion (range 0.6-0.79). This means that the presentation of material in the Interactive E-LKPD Liveworksheet Based on Contextual Teaching and Learning made by this researcher can be said to be feasible and in accordance with the learning objectives.

b. Media Expert Validation Results

Table 3. Media Expert Validation Results

Expert Member 1		Expert Member 2	
Less relevant (Score 1-2)	Relevant (Score 3-4)	Less relevant (Score 1-2)	Relevant (Score 3-4)
-	1,2,3,4,5,6,7,8,9, 10,11,12,13,14,15	12	1,2,3,4,5,6,7,8,9, 10,11,13,14,15
5			

Table 3. shows the results of the validation of two media expert lecturers. The numbers in the bottom row of the table are the indicator numbers in the assessment questionnaire that are declared to be less relevant or relevant. The validation results from expert/expert 1 stated that all indicators, namely 15 relevant items, while expert/expert 2 stated that 1 indicator was less relevant and 14 indicators were relevant in the Interactive E-LKPD Liveworksheet Based on Contextual Teaching and Learning. The results of the assessment are then included in the cross-tabulation (Gregory Matrix) to obtain a feasibility score on the media aspect. The feasibility results in the cross-tabulation (Gregory Matrix) are presented in table 4:

Table 4. Results of Cross-Tabulation of Media Experts

<i>Gregory's Tabulation Matrix (2x2)</i>		<i>Member 1</i>	
		<i>Less relevant (score 1-2)</i>	<i>Highly relevant (score 3-4)</i>
<i>Member 2</i>	<i>Less relevant (score 1-2)</i>	<i>A (0)</i>	<i>B (1)</i>
	<i>Highly relevant (score 3-4)</i>	<i>C (0)</i>	<i>D (14)</i>

Then the data was entered into the content validity formula (Gregory's formula) and the following results were obtained:

$$CV = \left(\frac{14}{0+1+0+14} = 0,93 \right)$$

The results of the validation of the Interactive E-LKPD Liveworksheet Based on Contextual Teaching and Learning on the media aspect analyzed using the Gregory formula obtained a score of 0.93. Based on the criteria or validity coefficient that has been determined in chapter 3, this value is included in the "Very High" criterion (range 0.80 – 1.00). This means that the exposure in the media made by researchers is very suitable to be used as teaching materials in learning activities.

4. Implementation Stage

The next stage is the implementation or application of E-LKPD to educators and students. At this stage, the researcher tries to apply the E-LKPD that has been developed in a limited way with the aim of finding out the response or response to the product that has been developed.

a) Educator Response Test

The next limited trial of CTL-based E-LKPD development is for educators. The educator's response was obtained from two Biology educators and one ICT practitioner from SMAN 1 Beber. The purpose of this limited trial of teaching materials for educators is to find out the response of educators to the E-LKPD that has been developed. Responses were obtained using questionnaire 4 on the Likert scale with two aspects, namely the content and display components, as well as aspects of the CTL learning component. The following is the data from the results of the CTL-based E-LKPD limited trial for educators;



Table 5. Results of Educators' Response to E-LKPD

No.	Respondent's name	Total Score
1	R1	69
2	R2	88
3	R3	87
<i>Sum</i>		244

$$\begin{aligned}
 \text{Highest score (ST)} &= 4 \\
 \text{Number of Statements} &= 22 \\
 \text{Number of respondents} &= 3 \\
 \text{Total max score (N)} &= ST \times JP \times JR \\
 &= 4 \times 22 \times 3 \\
 &= 264 \\
 \text{Total score (F)} &= 244 \\
 \text{Percentage of questionnaires} &= \frac{F}{N} \times 100 \% \\
 &= \frac{244}{264} \times 100 \% \\
 &= 92.42\% \text{ (Very Feasible)}
 \end{aligned}$$

Table 5. The percentage result of the content and display component aspect was 92.42% (Very Decent) This was obtained from the value of 22 indicators.

b) Student Response Test

The contextual-based E-LKPD that has been developed is then tested on students to get responses. In this trial, 35 students from Class X.4 SMAN 1 Beber participated. User responses were obtained using a questionnaire with a scale of 4 and scores were obtained from 4 aspects, namely interest in E-LKPD, mastery of the material, display, and implementation. The results of the student response data to the contextual-based E-LKPD are shown below.

Table 6. Results of Students' Responses to E-LKPD

No.	Aspects	Percentage	Criterion
1.	Interest in E-LKPD	74%	Excellent
2.	Mastery of the Material	75%	Excellent
3.	Display	79%	Excellent
4.	Feasibility	80%	Excellent
<i>Overall Percentage</i>		77%	Excellent

Based on Table 4.6, it is known that the percentage of interest in E-LKPD is 74% with very good criteria, the material mastery aspect is 75% with very good criteria, the appearance aspect is 79% with very good criteria, and the implementation aspect is 80% with very good criteria.

Conclusion

Based on the results and discussion, it can be concluded that the development of interactive E-LKPD Liveworksheet based on Contextual Teaching and Learning (CTL) utilizes the ADDIE development model. The feasibility of the Interactive E-LKPD Liveworksheets material on Biodiversity as a teaching material for Class X students was validated by two subject matter expert lecturers, achieving a score of 0.60 with a validity criterion of "High".

Meanwhile, two media expert lecturers gave a score of 0.93 with a validity criterion of "Very High". The results of the product trial showed that the response from educators was 92.42%, categorized as "Very Feasible". Meanwhile, the response from students at SMA Negeri 1 Beber was 77%, categorized as "Feasible". These findings show that the E-LKPD developed is attractive to educators and students, making it a suitable teaching material to support the learning process.

Recommendations for further research include expanding the development of E-LKPD on other biology materials using a customized teaching model and incorporating more interactive applications.

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