Development of E-LKPD Based on Problem Based Learning on Excretory System Material for High Schools

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Abstract: Learning carried out using learning tools in the form of printed LKPD makes students easily bored. Lack of use of technology in learning also often makes students less motivated. Therefore, this research aims to develop more innovative learning tools and see their feasibility which will be validated by media experts and material experts. The product developed is a PBL-based E-LKPD on excretory system material. This research was carried out at the Madrasah Aliyah Laboratory in Jambi City. This research is development research (R&D) with the ADDIE development model. Data collection techniques use observation, interviews and documentation. The instruments used were questionnaires and teacher assessment sheets. The trial was carried out on 6 students and 15 students. Material validation was 87.5% in the "very good" category. The media validator assessment was 73.6% in the "very good" category. The biology teacher's assessment was 89.7% in the "very good" category so it can be tested on students. The small group's response was 81.8% in the "very good" category and the large group's response was 88% in the very good category. In this research, the implementation stage is just knowing the students' responses and it is hoped that implementation will be carried out in future research. Thus, it can be concluded that the development of E-LKPD based on Problem Based Learning on Excretory System Material for Class XI Students is suitable for use in the learning process.

Keywords: E-LKPD; Excretion system; Liveworksheet; Problem based learning

Introduction

Learning is a simplification of the words learning and teaching, teaching and learning process, or teaching and learning activities. Psychologically, the meaning of learning is a process carried out by individuals to obtain a comprehensive change in behavior, as a result of the individual's interaction with their environment. Learning is a process of learning where when studying an activity occurs that is carried out by someone deliberately to gain understanding or knowledge (Raudhah et al., 2018). It is hoped that proper learning can help students understand Biology material and apply Biology material in everyday life, so that it can increase students' interest and learning outcomes. The use of varied learning models is needed so that learning runs more actively, effectively, and to explore students' attitudes, knowledge and skills (Harlis et al., 2022). One thing that can be done to help the learning process is to use a learning model, such as the Problem Based Learning learning model.

PBL-based learning is learning that presents contextual problems in everyday life so that it stimulates students to learn (Supriatna et al., 2022). In PBL, students are free to carry out experiments or investigations either outside or inside the classroom. After that, the teacher helps students analyze the problem solving plan by providing simple examples to help students complete the task. PBL is learning based on cognitive theory which includes Constructivist learning theory.

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According to Constructivism theory, thinking and problem solving skills can be developed if students do it themselves, discover and transfer the complexity of existing knowledge.

The 21st century is currently marked by the very rapid development of various kinds of knowledge and information technology. According to Riawan et al. (2022) technological developments will actually always be developed to meet the needs of its users. Various technological advances have occurred where advances in science and technology have occurred. The development of technology in the 21st century in the field of education is marked by the most prominent characteristics, namely information and communication (Saripudin, 2015). Information technology is usually used in the education sector, especially in the learning process. With technology, the variety of learning plans used during learning will increase (Wicaksono et al., 2022).

Based on observations made at Madrasah Aliyah Laboratory in Jambi City, it is known that the school has inadequate facilities and infrastructure. The facilities available include a WiFi network that can be used by students. Lack of motivation to learn from students because the learning resources used are still in the form of Student Worksheets (LKS) which are displayed less attractively. According to Mayasari et al. (2023) the material presented on student worksheets only contains instant material without detailed explanations and lack of access and use for teachers and students which will make students less interested in the existing work twins. Based on the results of interviews conducted with Jambi City Laboratory MA Biology teachers, it is known that the learning process has been carried out offline, but the duration of class hours is still the same as during online learning (1 class hour 30 minutes), so the time available is less than optimal. Students who carry out the learning process lack motivation in learning, due to the lack of support that supports the learning process. Apart from that, learning is not accompanied by practicums. The lack of this means that learning achievement has not been achieved.

The results of interviews with Jambi City Laboratory MA Biology teachers indicated that the material that was considered difficult in class XI Biology learning was the excretion system and cells. This is because the explanation of the material and mechanisms is not concrete (abstract) and is difficult to explain in words. This is also shown by the students' daily scores on the excretory system material. Based on the student needs questionnaire, it was discovered that some material was difficult. This is shown by the results of the questionnaire that 10 out of 24 students chose excretory system material as the most difficult material with a percentage of 41.7%, cell material with a percentage of

29.2% (7 people), then circulatory system material with a percentage of 16.7% (4 people) and the digestive system with a percentage of 12.5% (3 people). Based on the results of the questionnaire, it is known that the excretory system is one of the materials that is considered difficult in class XI. Apart from that, according to Zikra et al. (2016) the material on the excretory system in humans is one of the materials that is difficult to study because it is abstract.

According to Zainab et al. (2022), it is necessary to use technology so as not to hamper the process of conveying knowledge due to learning that seems monotonous, boring and less interesting for students. In current conditions, student worksheets in printed form are becoming less effective and less practical to use, so it is necessary to develop more practical and effective learning tools, one of which is E-LKPD. E-LKPD can be described as a new reference for students that is used for the teaching and learning process, it contains evaluations that must be carried out by students and guides students to build on the knowledge they have learned and use electronic devices to access it (Umaroh et al., 2022). LKPD functions to increase and deepen students' knowledge regarding the material provided, because in LKPD there are components that have been formed for the purpose of providing motivation or attraction in the form of problems related to daily activities (Lestari et al., 2021).

According to Mispa et al. (2022) and Rahmawati et al. (2022), it is known that E-LKPD live worksheet can be used in the learning process because it influences cognitive learning outcomes and students' learning processes. Liveworksheet sites can help teachers turn printed or paper worksheets into interactive online exercises. This liveworksheets site can also correct automatically, making it easier for teachers (Rahmawati et al., 2022). Students can immediately take quizzes and send their worksheets directly to the teacher online anywhere and at any time. Apart from that, E-LKPD can arouse students' interest in learning through its interesting features. Based on this background, the researcher conducted research with the title "Development of E-LKPD Based on Problem Based Learning on Excretory System Material for Class XI Students".

Method

This research uses a research and development (R&D) approach, with the ADDIE development model consisting of five stages, namely analyze, design, development, implementation and evaluation. This research was conducted to develop learning media using the Liveworksheet site

Development Procedure

The development procedure goes through 4 stages including: The Analyze stage validates performance gaps, sets instructional goals (solutions), analyzes student characteristics, identifies available resources consisting of human resources, technology and content, prepares a work plan consisting of a schedule development, development team. The design stage is carried out by a design process in the form of compiling the things needed for development such as flowcharts, storyboards, product specifications and product designs. The development stage is carried out in the process, namely producing a product, followed by developing the product, revision of material validation and product revision from the expert team, assessment by the subject teacher and product trials are carried out consisting of student trials consisting of small group trials and trials large group; The evaluation stage carries out an evaluation consisting of formative evaluation.

Test Subjects

According to Setyosari (2012) the subjects for small group trials are 6-8 people and for large group trials 15-30 people. The test subjects in this research were class XI students of Jambi City Laboratory Madrasah Aliyah. The trials carried out on students were carried out in two trials, namely a small group trial with 6 subjects and a large group trial with 15 subjects.

Data Analysis Technique

Data analysis is a process of processing and interpreting data with the aim of putting together various information so that it has clear meaning and significance based on the research objectives. The data analysis technique used in this research is qualitative and quantitative descriptive analysis. The data analyzed includes quantitative data on assessment scores from material experts and media design experts, student and teacher questionnaires using a Likert scale. Qualitative data was obtained from interviews with biology teachers.

Result and Discussion

Result
Analyze

The stages carried out start from analyzing the learning process carried out to identify problems in learning and find out the causes of these problems. From the results of observations, interviews with biology study teachers and questionnaires filled out by students, several problems were found, namely: Analysis carried out on class XII MIPA MA Jambi City Laboratory students by distributing questionnaires via Google Form regarding biology learning by distributing questionnaires online participatory with a total of 24 students. The results obtained were that 10 people with a percentage of 41.7% considered the excretory system to be difficult material, then there were cells with a percentage of 29.2% (7 people), the circulatory system 16.7% (4 people) and the digestive system 12.5% (3 people). The learning tools used to assist learning are in the form of media such as learning videos, worksheets and teaching aids.

Design

The design stage is the stage of creating an E-LKPD draft on Canva and continued with the Liveworksheet site which has been adapted to the information and materials that have been collected previously. In making E-LKPD, this is done by searching for material, creativity and ideas which are then expressed in the form of an attractive display for students with various pictures, videos and interactive questions regarding the excretion system material.

Development

The development stage aims to produce learning media products and validate the products. This is done so that the products produced comply with the learning media criteria. Product validation is carried out using a questionnaire designed based on the assessment instrument grid. The product validation results are as follows.

Table 1. Material Validation Results

Assessment Aspects	Validation Results		
	1	2	3
Content Eligibility	57	71	93
Language	58	67	92
Material	54	67	92
Evaluation	50	75	87
Average (%)	54.1	69.4	87.5
Categories	Not good	Good	Very good

Based on the results of the material expert validation, it is known that the material validation was carried out 3 times, where in the first validation the results were 54.1%, which was categorized as not good, where there were several suggestions from the validator. Next, a second validation was carried out, where in this second validation an improvement was obtained where the result was 69.4 in the good category but several suggestions were still obtained. Then in the third validation the results were 87.5% in the very good category and ready to be tested. The results of media validation can be seen in figures 1, 2 and 3.

During material validation, several suggestions were obtained, including adding videos, changing questions and adding QR codes. Adding videos to

material such as picture 1 so that the display is not monotonous and there is additional material from the video. Then improvements to the material where there is additional material using a QR code so that there is more material. Change the questions to the problems provided so as not to confuse students. In improving the questions, words are added that will make it easier for students to understand the questions provided.
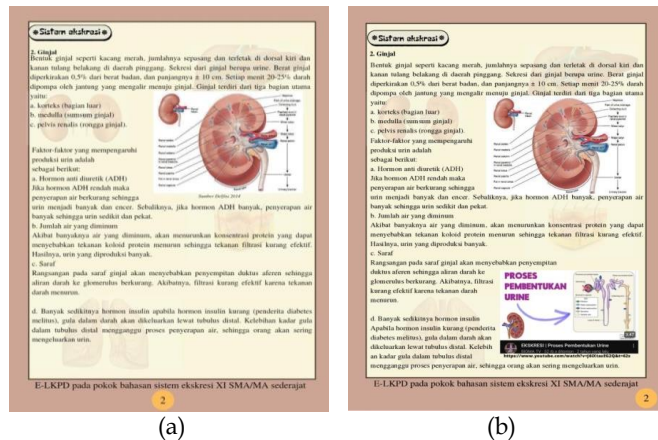

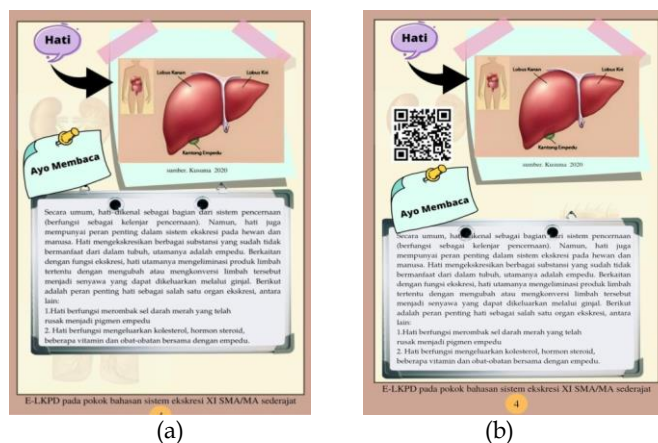**Figure 1.** Added video. (a) before revision (b) after revision

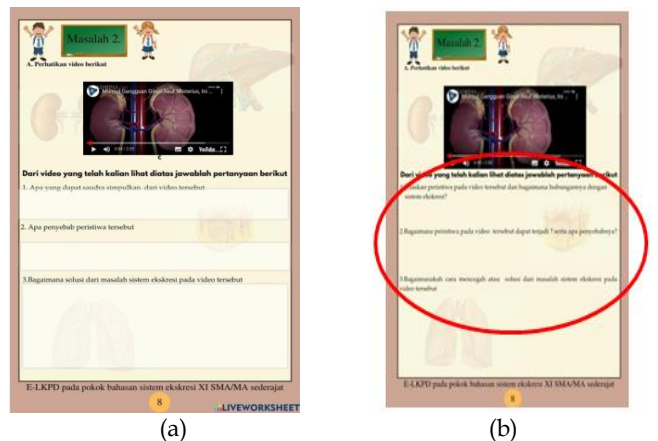**Figure 2.** Addition of Qr code (a). before revision (b) after revision

Figure 3. Addition of questions (a). before revision (b) after revision

Table 2. Media Validation Results

Assessment Aspects	Validation Results	
	1	2
Suitability of images, symbols and material	86	89
Design	67	83
Language	65	80
Average (%)	73.61	84.7
Categories	Good	Very good

Based on Table 2, it is known that media expert validation was carried out twice, and there was an increase in the percentage of each aspect assessed between the first validation and the second validation. The first media validation showed that the product had a percentage of 73.61%, which met the good category with the general conclusion that it was worth testing with revisions. However, to get better results, product revisions are carried out in accordance with the directions and suggestions of media validators. In the second validation, it was found that the product had a percentage of 84.7%, which met the very good category with the general conclusion that it was worth testing. There is an increase in validation results both in general and in terms of indicators. Improvements in media validation can be seen in figures 4, 5, 6 and 7.
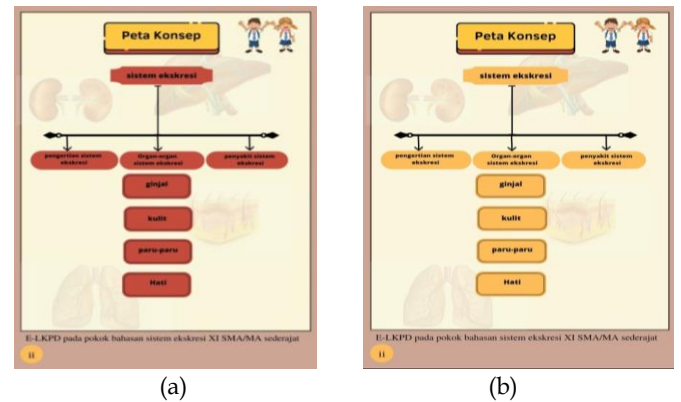

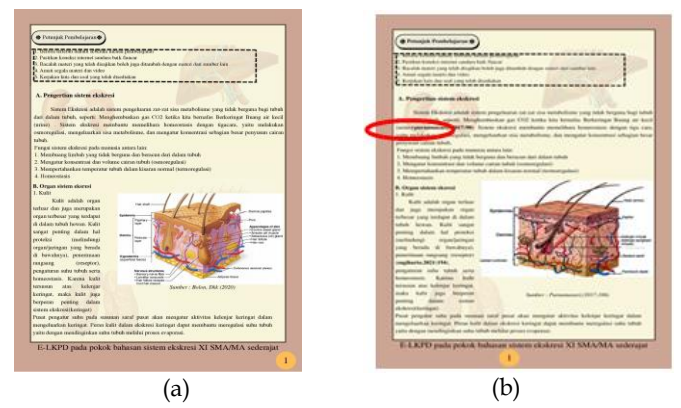**Figure 4.** Change of background color (a). before revision (b) after revision

Figure 5. Addition of quotations (a). before revision (b) after revision
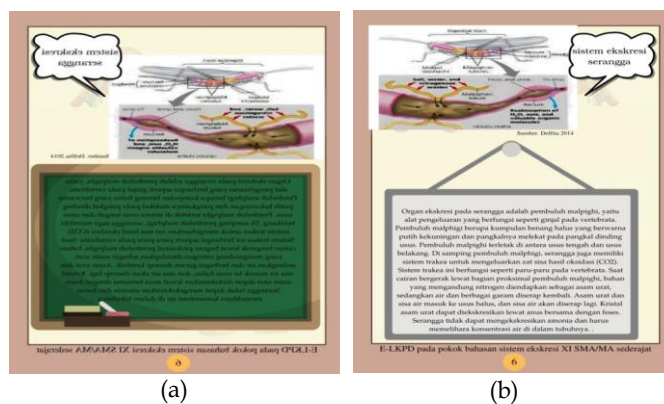
Figure 6. Background changes (a). before revision (b) after revision

During material validation, several suggestions were obtained, including changing the color of the concept map background, adding quotes and changing the material background. When changing the background color of the material and concept map, the color that is difficult to distinguish between the writing and the background is changed to a color that is easier to read the available writing. The addition of quotations is done to indicate that the material presented was obtained from a clear and relevant source to be used as a learning tool.

Table 3. Teacher Assessment Results

Assessment Aspects	Teacher Assessment Results (%)
Display	96
Language	75
Material completeness	87
Usefulness	100
Average (%)	89.7
Categories	Very good

Before the learning tools are tried out on students, the biology subject teacher assesses the learning tools that have been developed. This stage is carried out by filling out a questionnaire by the biology subject teacher covering aspects of appearance, language, completeness of the material, and usefulness. From the assessment of subject teachers, an average result of 89.7% was obtained, which was in the very good category.

Table 4. Results of Small Group Trials

Assessment Aspects	Results of Small Group Trials (%)
Display	91
Content	90
Language	87
Evaluation	88
Average (%)	81.8
Category	Very good

Based on table 4, the test results for small groups of students in class XI Madrasah Aliyah Laboratorium were obtained average score of 81.8% so that the E-LKPD learning tools created are categorized as very good and ready to be used in learning.

Table 5. Results of Large Group Trials

Assessment Aspects	Results of Large Group Trials (%)
Display	87
Content	89
Language	86
Evaluation	90
Average (%)	88.1
Category	Very good

Based on Table 5, the test results for the small group of students in class XI Madrasah Aliyah Laboratorium with an average score of 88.8% so that the E-LKPD learning tools created are categorized as very good and ready to be used in learning.

Evaluation

The final stage is evaluation where the evaluation stage is carried out to see deficiencies at each stage so that they can be evaluated for improvement (Rusmayana, 2021). Based on the evaluation results at each stage, suggestions and comments are considered so that they can be used as a reference to improve so that the E-LKPD developed is suitable for use in the learning process.

Discussion

The development of PBL-based E-LKPD on excretory system material was developed using research and development. Research and Development is a research method used to produce certain products and test the effectiveness of these products (Rustandi et al., 2021). The stages used consist of analysis, design, development, implementation and evaluation stages. The first stage carried out is analysis where this analysis stage consists of several steps, namely needs analysis, setting instructional objectives, identifying student characteristics (In the analysis of students is carried out from several aspects including moral, emotional and intellectual aspects), identifying resources and compiling work plan. The analysis was carried out to determine the needs and conditions of students where the analysis stage was carried out by conducting interviews with biology teachers and the results of questionnaires that had been distributed to students in class XII MA Laboratorium Jambi City.

Based on the results of interviews with Jambi City Laboratory MA biology teachers, it was found that the excretory system material was difficult material, this could also be seen from the grades obtained in the excretory system material. This is also supported by the results of a questionnaire that was distributed to 24

students which showed that 10 out of 24 students chose excretory system material as the most difficult material with a percentage of 41.7%, cell material with a percentage of 29.2% (7 people), then material on the circulatory system with a percentage of 16.7% (4 people) and the digestive system with a percentage of 12.5% (3 people). The difficulties experienced by students are because this material is abstract, where, as explained by Zikra et al. (2016), the material on the excretory system in humans is one of the materials that is difficult to learn because it is abstract. Apart from that, the lack of interest of students is due to the learning process using worksheets and printed books which are less interesting, where there is material that is difficult to understand and cannot be explained logically. According to Sandri et al. (2023) external factors that influence students' interest in learning are learning methods, learning tools, learning media and school facilities and infrastructure.

Based on these problems, a solution is needed where the solution needed to make learning easier is by using an attractive learning tool in the form of E-LKPD. Through E-LKPD, learning will be more interesting and fun, besides that abstract material can be explained more easily because it contains pictures and videos. According to Arvianto (2020) the development of learning tools is useful in improving students' cognitive abilities. The use of E-LKPD learning devices is also supported by school facilities, where the Madrasah Aliyah Laboratory Jambi City School has allowed students to bring cellphones and the school environment also has a Wi-Fi network available. Therefore, researchers want to develop E-LKPD based on problem based learning on excretory system material for class XI students. According to Astuti et al. (2018), PBL-based LKPD is used to activate and construct students' critical thinking abilities by providing problems in the LKPD activities. And by using Problem Based Learning (PBL) based LKPD you can hone and improve students' critical thinking skills because with PBL based LKPD students are able to use critical thinking skills, be fully involved in pursuing an effective learning process, learning in solving problems related to life real and students are actively involved in the learning process.

The second stage is the design or drafting stage. This design stage consists of several stages, namely creating a flowchart and storyboard. Then it was designed using the Canva application and continued with the Liveworksheet website to create a link that could be accessed by students. This liveworksheet site can help teachers turn printed or paper worksheets into interactive online exercises. This liveworksheets site can also correct automatically, making it easier for teachers (Nurbayani et al., 2021).

Next, it is developed in the development or development stage. At the development stage, material and media feasibility tests are carried out, where this validation aims to determine the feasibility of the product that has been created by the researcher (Hutabri, 2022). Suggestions and comments from material experts and media experts will be used as a reference for making improvements so that it will be suitable for testing in the field. Material validation was carried out 3 times while media validation was carried out 2 times. Based on the validation results from material experts, it is known that material validation was carried out 3 times, where in the first validation the results were 54.1%, which was categorized as not good, where there were several suggestions from the validator. Next, a second validation was carried out, where in this second validation an improvement was obtained where the result was 69.4 in the good category but several suggestions were still obtained. Then in the third validation the results were 87.5% in the very good category and ready to be tested. In media validation, it was also found that the category increased from good to very good and was ready to be tested. After obtaining validation results from the material and media validator, an assessment is then carried out by the biology subject teacher. In the biology teacher assessment, the results were 89% in the very good category. After the assessment is carried out by the subject teacher, small group and large group trials are then carried out. Small group trials were carried out with 6 students and large groups with 15 students. The results of the small group and large group trials were in the very good category. In small and large group results, very good results were obtained because students felt happy with the existence of electronic-based learning tools because students would actively interact with various learning resources so that students achieved effective learning (Budiana et al., 2015).

The final stage is evaluation where the evaluation stage is carried out to see deficiencies at each stage so that they can be evaluated for improvement (Rusmayana, 2021). Based on the evaluation results at each stage, suggestions and comments are considered so that they can be used as a reference to improve so that the E-LKPD developed is suitable for use in the learning process.

Conclusion

Based on the results of the research and development that has been carried out, it can be concluded that the E-LKPD being developed is equipped with pictures, learning videos, quizzes, evaluations and structured material that can foster students' interest in carrying out the learning process in class. The E-LKPD that was developed was designed

using the Canva application and continued with a live worksheet site for creating the E-LKPD. The E-LKPD developed uses the analysis, planning or design, development and evaluation stages; and the E-LKPD that was developed was suitable for use after obtaining final material validation results of 87.5% in the "very good" category. The media validator assessment was 73.6% in the "very good" category. The biology teacher's assessment was 89.7% in the "very good" category so it can be tested on students. The small group response was 81.8% in the "very good" category and the large group response was 88% in the very good category.

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