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LKPD Development on Circulation System Material of High School Students Based on Implementation of Research Results

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Abstract

The development of this LKPD is not based on a survey or applied directly in schools, but is based on pure research results that are implemented in the field of education as one of the requirements in the preparation of the thesis. The LKPD development process in this implementation uses the ADD (analysis, design, development) stages. This LKPD uses the 2013 curriculum with KD 3.6 and 4.6. to find out the eligibility criteria for LKPD and can be accepted as valid if used in direct learning at school, it must be validated by a validator (Material and Media Expert). The final result of validation by material and media experts with a value of 72 and after being accumulated using the formula determined by the eligibility criteria, it is obtained "sufficient" on condition that the aspects that are still less than perfect are perfected.

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INTRODUCTION

One of the determining factors for the success of teaching and learning activities in the classroom is the use of learning media. One of the benefits of using learning tools is to help educators convey messages and materials effectively and efficiently to students. For students, the media can be a bridge to think and understand concepts and can be used as an alternative for teachers, especially science teachers, to implement integrated science learning in accordance with the standards of science curriculum content appropriately and can assist teachers in designing the development of integrated science learning tools correctly (Nisak & Susantini, 2013).

One form of application that can be applied is through the Student Worksheet (LKPD) which can visualize the material being studied. LKPD contains a set of basic activities that must be carried out by students to maximize understanding in an effort to form basic abilities according to indicators of achievement of learning outcomes. LKPD is a sheet that is done by students which contains procedures for conducting experiments, identifying parts, making tables, making observations, using a microscope or other observation tools, writing or drawing the results of their observations, taking measurements and recording measurement data, analyzing measurement data and drawing interesting results. conclusion. Its function is to make it easier for students to carry out learning processes, so LKPD is used (Pratama & Saregar, 2019).

During the teaching and learning process, the presence of the media has a very important meaning. One of the media that can convey learning messages with the experimental method is the Student Worksheet (LKPD). LKPD is an understanding medium for exercises on developing cognitive aspects as well as guidelines for developing learning aspects in the form of guides or experiments (Cicilia & Vebrianto, 2020).

The LKPD developed is an implementation of the results of research on the Effect of Adding Herbal Sulemen on Blood Cholesterol and Hemoglobin Content of Tilapia (*Oreochromis niloticus*) with the results of adding 5% and 15% herbal supplements to blood cholesterol and hemoglobin. The results of the study show that the significance of the difference is not too significant. This is indicated by the two samples of data obtained are still in normal levels. The results of this study are the main basis for developing LKPD material of the circulation system for High School Students which is expected to meet

the competency skills and knowledge of students in the syllabus in the 2013 curriculum. The 2013 curriculum currently applied directs the learning methods used must be able to guide students. in order to achieve the expected competency standards and also require students to be more active (Dermawati et al., 2019).

LKPD used in learning activities should be in accordance with the demands of Basic Competence (KD), can motivate students, and attract the interest and attention of students to learn (Pratama & Saregar, 2019)

The implementation stage is the stage to produce learning device products that have been validated and approved for feasibility by experts (Pratama & Saregar, 2019). Validation was carried out by several experts, namely material experts and learning media experts. Validation carried out by experts aims to test the feasibility of learning media to be used. In this process using a validation instrument that will be filled in by the validators.

Based on the description above, the results of research with parameters of blood cholesterol and hemoglobin of tilapia are implemented in the field of education in the form of developing LKPD Materials for the Structure and Function of Circulation System in SMA IPA Class XI.

METHOD

The method used in developing LKPD is the development of instructional design using the ADDIE model, consist of analysis, design, development, implementation and evaluation (Cahyadi, 2019). However, in this study the development of LKPD was carried out only up to the ADD stage. The following is a chart of the stages of LKPD development:

Analisis stage

The process of developing biology learning media in the form of LKPD begins with the analysis phase, namely conducting curriculum analysis; competency standards, basic competencies, indicators, and learning materials, as well as meeting time allocation. analyze the syllabus and choose alternative learning activities that best suit the results of the analysis of SK, KD, and indicators. Analyze the RPP and determine the activity steps. Prepare LKPD in accordance with exploration activities in the RPP.

Design stage

The activity was continued by realizing the product design, by making LKPD as a learning

medium for students which refers to the stages of curriculum analysis, KD, materials, image selection, and selection of questions and evaluation tools.

Development stage

This is the validation stage by material experts and media experts to determine the feasibility level of the LKPD. The assessment results obtained from the validator are descriptive in the form of suggestions and comments as well as quantitative data obtained from the assessment aspect using 4 levels of the rating scale with the following criteria:

Score	Criteria
1	Invalid
2	Not valid
3	Quite valid
4	valid

The value obtained from the results of data collection is then analyzed using the percentage data analysis technique using the formula:

$$P = \frac{n}{N} \times 100$$

Information :

P= Rating

n = total score obtained

N= maximum number of values (Rahayu & Festiyed, 2018)

RESULT AND DISCUSSION

The development of the LKPD material on the Structure and Function of the Circulation System of Class XI SMA includes the research phase on the Addition of Herbal Supplements to the Cholesterol and Hemoglobin Content of Tilapia (*Oreochromis nilotikus*), Analysis, Design, Development (ADD). At the research stage, research was conducted on blood cholesterol and hemoglobin levels of tilapia, the results of the research were data and images from the study which were used as the basis for developing LKPD. The following are some excerpts of the research results used in the development of LKPD.

The first stage in making LKPD is to analyze the curriculum, of the curriculum used is the 2013 curriculum. The existence of curriculum analysis has a positive impact on changes for the better. Curriculum analysis has the same goals and functions to achieve the goals of national education. Curriculum analysis will actually continue to go hand in hand with the implementation

of the curriculum. Curriculum analysis does not stand alone, this curriculum analysis has a scope in it, so that a good curriculum analysis can be carried out. When we want to carry out curriculum analysis, we also need to know what is contained in the curriculum analysis (Nur, 2021)

Furthermore, the selection of KD which if in accordance with the material to be raised, from the many existing KD was chosen KD 3.6 which reads to analyze the relationship between the structure of the tissues making up the organs in the circulatory system in relation to bioprocesses and functional disorders that occur in the human circulatory system. And KD 4.6 which reads to present a paper about abnormalities in the structure and function of the blood, heart, blood vessels that cause disturbances to the human circulatory system and its relation to technology through literature studies. This is in accordance with the research conducted (Firdaus & Wilujeng, 2018)

The next step is making concept analysis, formulating indicators, setting learning objectives, compiling lesson plans. Therefore, to achieve the two Basic Competencies (KD), KI 3. Understand, apply, and analyze factual, conceptual, procedural, and metacognitive knowledge based on their curiosity about science, technology, arts, culture, and humanities with insight. humanity, nationality, state, and civilization related to the causes of phenomena and events, as well as applying procedural knowledge in specific fields of study according to their talents and interests to solve problems. While KI 4. Processing, reasoning, and presenting in the concrete and abstract realms related to the development of what they learn in school independently, acting effectively and creatively, and being able to use methods according to scientific rules. (Noprinda & Soleh, 2019)

As for facilitating students to achieve a certain competence or learning objectives. Learning objectives ideally reflect the knowledge, attitudes, and skills that can be obtained by students after taking the learning process. After selecting KD and KI and learning objectives, the next step is to prepare RPP to simplify, expedite and improve the results of the teaching and learning process, and predict learning programs as a logical and planned framework (Hendratmoko et al., 2017)

The second stage in making LKPD is planning or design, which includes all the contents of the LKPD starting from the cover of the LKPD as a print media, of course it must contain things that attract students' reading interest, starting with cover planning (Widyokusumo, 2012)



Figure 1. LKPD Cover

The cover design above generally meets the criteria, where there is already a LKPD title so that it is easily recognized by students, a picture of the circulation of fish blood which is expected to be able to clarify the intent, purpose, content and discussion of the material from the LKPD, there are also class targets who take the material and the authors or compilers of the contents of the LKPD. When designing a cover, we are required to create an interesting creativity, cover design can be in the form of photography, typography (letter design), illustration images or it can be a combination of all these elements. The cover design must be specific to the LKPD concept or other tools so that students can easily recognize and be interested in reading it (Widyokusumo, 2012)

The results of the analysis of the curriculum, KD and KI as well as the preparation of the RPP, a LKPD based on the results of research on the effect of giving herbal supplements on the blood cholesterol and hemoglobin content of tilapia was made with the title "Structure and Function of the Circulatory System" which was considered relevant by the researcher with the parameters of the study.

An example of an image included in this LKPD is a tilapia taken from the research, indirectly informing the reader that the author has conducted research related to tilapia. Inclusion of image sources in a book writing, scientific work

or so on is intended to avoid copyright infringement or piracy. It must be admitted that adding photos and images will make scientific work that was previously uninteresting become more interesting. Rigid scientific work will blend well with the added images and photos. Because these photos and images are flexible, easy to understand. A good picture for LKPD is one that can convey the message/content of the picture effectively to LKPD users. (Umbaryati, 2016)



Figure 2. Examples of pictures in LKPD taken from research

Perlakuan (Dosis)	Ulangan					Jumlah Perlakuan	Rata-Rata Perlakuan
	1	2	3	4	5		
P0 (0%)	7,6	5	9,1	7,5	6,1	35,3	7,06
P1 (5%)	6,6	6,5	6,1	5,2	6	30,4	6,08
P2 (15%)	5,5	5,8	6,7	5,9	5,4	29,3	5,86

Figure 3. Adaptation of research results in the form of tables into LKPD

The table image above is a sample of hemoglobin level data obtained during data collection during the study. The data is included in the LKPD as a support for the linkage of research results with the material and discussion of the LKPD which is made as an implementation in the field of education. The preparation of questions in an LKPD also cannot be separated from attention, the questions must be in accordance with the indicators, meaning that the questions must ask the behavior and material to be measured in accordance with the demands of the indicators, the limits of the questions and answers that are expected to be clear, the content of the material must be in accordance with the measurement, the content the material asked is in accordance with the level, type of school, or grade level. Question is an evaluation tool used to measure students' ability to master a competency in learning (Febriani et al., 2013)

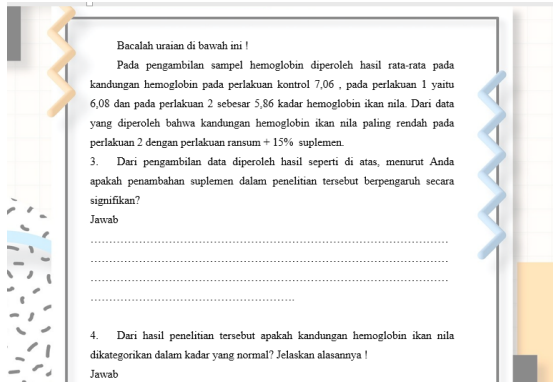


Figure 4. Examples of LKPD questions

There are 5 questions listed in the LKPD, some of which are related to the results of research on tilapia as the final product of implementation in the field of education. The preparation of these questions that enter the planning or design stage also goes through the review stage by the validator so that it is considered more appropriate and appropriate if given to students.

The third stage in the preparation of LKPD is development or validation. This validation is to determine the final result of the feasibility of a device in this case is the LKPD based on research results. According to (Aisyah Aini et al., 2021) validation is carried out on the initial product used to correct deficiencies in the LKPD. The first stage in validation is to ask for the willingness of the validator (on this occasion it is a supervisor). Then ask the validator's willingness to provide a feasibility assessment of the LKPD that has been made based on the items in the validation test questionnaire and is pleased to provide suggestions for the perfection of the LKPD. If each validator has given a value, then it is calculated using the formula used to determine the eligibility criteria for the LKPD.

If each validator has given a value, then it is calculated using the formula used to determine the eligibility criteria for the LKPD. After determining the eligibility criteria, the last step is to do what must be done in accordance with the results of the validation, if there are deficiencies and suggestions from the validator in the LKPD then make revisions to improve the LKPD so that it is allowed to be used in implementation in the field of education. The results of this validation analysis aim to obtain validity in using LKPD including validation and construct validity (Asriani et al., 2021)

Aspects of assessment in the validation by V1 and V2 include the accuracy of the material, the use of LKPD in learning, language and writing. In this case, what is observed is the validity

of the content of the LKPD, as well as the language style and words used in the module. The contents of the worksheets are compared with the underlying theoretical concepts, while the use of language styles and words in the module is directed at simple and easy to understand (Ayriza, 2013)

Validation of learning media must meet certain criteria or aspects (Syamsurizal*, 2017). These aspects are further divided into several aspects that are observed and there are scores of 1-4 which will later be calculated according to the formula and will become the final score and determine the criteria that apply to the feasibility of using the LKPD.

Table 1. Validation results by material and media experts

Aspects	Score	
	V1	V2
Material accuracy	15	14
The use of LKPD in learning	12	8
Language and writing	10	13
Total	37	35

$$\begin{aligned} \text{Total} &= V1 + V2 = 72 \\ \text{Average} &= 36 \\ P &= n/N \times 100 \\ P &= 36/56 \times 100 = 64,2 \end{aligned}$$

Perhatikan tabel di bawah ini!

Perlakuan (Dosis)	Ulangan					Jumlah Perlakuan	Rata-Rata Perlakuan
	1	2	3	4	5		
0%	7,6	5	9,1	7,5	6,1	35,3	7,06
5%	6,6	6,5	6,1	5,2	6	30,4	6,08
15%	5,5	5,8	6,7	5,9	5,4	29,3	5,86

Berdasarkan tabel di atas dapat dilihat bahwa hemoglobin pada ikan nila dengan penambahan suplemen herbal wadah pemeliharaan diperoleh hasil pada perlakuan P0 (kontrol) 7,06 mg/dL pada perlakuan P1 yaitu 6,08 mg/dL dan pada perlakuan P2 yaitu 5,86 mg/dL hemoglobin darah ikan nila. Dari hasil data yang diperoleh diketahui bahwa kolestrol ikan

Figure 5. Review the accuracy of the material

The results of the validation by V1 (material expert) got a score of 37 & V2 (media expert) got a score of 35. The total score obtained was 72, the final result of the calculation got a score of 64.2 in this case it means that it falls into the "enough" category of eligibility.

The results of the review by V2 outline the aspect of assessing the accuracy of the material getting a score of 3, but at point 5 it only gets a score of 2 which means it is not valid. At this point the observed aspect is the ease of students to understand the material.

The second aspect of using LKPD in lear-

ning all points get a score of 2, in this aspect there are still many shortcomings of LKPD made by researchers, for example the clarity of instructions for using activity sheets which are still considered unclear.

The third aspect, namely language and writing, is still considered lacking in the point 13 of the readability of writing by students and 14 of the clarity of language structure getting a score of 2. At this point the validator gets the most input. This is acceptable because it is in accordance with the input by the validator regarding the results of the screenshot below which there is no correct explanation and table.

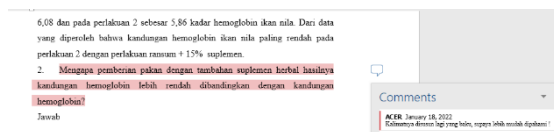


Figure 6. Review aspects of language and writing

The input above is related to sentences that are less standard in a question and may create a misconception between what the teacher asks the students.



Figure 7. Review aspects of using LKPD in learning

The review above concerns the overall review of the results of this pure research which is implemented in the field of education in the form of LKPD and the lack of documentation at the time of research and questions related to research are also only 1 number.

The total value given by material experts and media experts is 64.2, thus the eligibility criteria for the LKPD material on the structure and function of the circulation system is “sufficient” but by adding whatever is lacking according to the validator, including adding pictures or documentation and data during research, as well as adding questions related to research, and rearranging the language so that it is easily understood by students.

CONCLUSION

The results showed that the development of LKPD based on the implementation of the re-

search results showed a validation number with sufficient criteria. The validation value obtained from material experts and media experts is 72. It's means that LKPD is suitable for use, but requires revision.

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