
DEVELOPMENT OF STUDENT WORKSHEET IN THE WETLAND CONTEXT IN WATER POLLUTION SUB-MATERIAL IN GRADE VII OF JUNIOR HIGH SCHOOL

Aprilia¹, Mella Mutika Sari², Rizky Febriyani Putri³

Universitas Lambung Mangkurat, Banjarmasin, Indonesia

apriliah4410@gmail.com¹, mella.science.edu@ulm.ac.id², feby.science.edu@ulm.ac.id³

ABSTRACT

The teacher can use various learning methods to make it easier for students to process learning outcomes, and what has been planned can be achieved as well and as easily as possible by students. Therefore, the researcher wants to develop LKPD with Wetland Context on water pollution sub-materials. The wetlands presented in this study are rivers that will be directly observed for pollution that occurs in the river. This research is research and development using a 4D model (define, design, develop and disseminate). This research was conducted at SMP Negeri 15 Banjarmasin. The aims of the researchers in carrying out this development were 1) to validate the LKPD in the wetland context, 2) to determine the practicality of the LKPD in the wetland context, and 3) to determine the effectiveness of the LKPD in the wetland context. The research instruments include learning achievement tests, response questionnaires, and validation. LKPD obtains a validity value of 3.49 with valid criteria. Practicality gets a score of 82.00% with very practical criteria. Effectiveness with a gain calculation of 0.86 with high criteria. This LKPD is suitable for use in learning activities.

Keywords: development, student worksheet, wetland.

Corresponding Author: Aprilia

E-mail: apriliah4410@gmail.com



INTRODUCTION

Integrated science learning is a form of curriculum implementation ordered to be used at the basic education level, namely elementary and junior high schools. Professionalism from teachers is needed in the realization of science learning. The teacher must have material knowledge when conveying science knowledge as a whole. Then, a facility is needed to deliver this in an integrated manner, namely teaching materials and appropriate learning tools. The learning process certainly involves various parties, not only students and teachers.

Meaningful learning will instill an understanding of a concept in students (Peña-Ayala, 2021). The learning is obtained from the application of a scientific approach. The scientific approach is applied by utilizing learning resources as a place for students to seek knowledge. Learning resources can be interpreted as all aspects supporting the continuity of learning activities, the environment, teaching materials, newspapers, and so on (Hasibuan, 2016).

The debate that exists in education, one of which is that teaching materials or learning equipment are still limited, which should be able to provide students with experience, create knowledge and be active in students, and support problem-solving skills. These limitations can affect the quality of learning until it is necessary to develop an LKPD (Ariani, 2020). One of the learning resources commonly used in schools is Student Worksheets (LKPD) which are considered effective in learning process activities.

LKPD is a set of sheets containing students' activities in real terms with the objectives and problems being studied. Then LKPD is printed teaching material containing guidelines that students can use to increase their abilities. LKPD is also referred to as teaching material that can guide the course of learning, which contains several practice questions so that the learning material is practical. LKPD is useful as a role model for student learning and makes learning activities easier for students and teachers. Learning that utilizes LKPD is good for developing student learning outcomes, knowledge, intelligence, and attitudes (Suwastini et al., 2022). LKPD (student worksheet) is a sheet containing assignments that students must do, often in the form of instructions or steps, so that assignments can be completed based on the Basic Competency (KD) that will be realized.

LKPD arrangement is useful for understanding the material and the student's creative ability (Rosliana, 2019). The student worksheets can actively participate in the material (Wiranata & Sujana, 2021). Following the achievements of the preparation of the LKPD, even though students can learn on their own using the LKPD, the teacher still acts as a provider responsible for paying attention to student work during learning cannot be replaced (Khair, 2018).

This research was conducted at SMP Negeri 15 Banjarmasin. Based on the preliminary interviews that have been conducted, there are problems regarding the results of learning science, which turned out to be low. It is confirmed by getting several problems, including learning activities in science subjects that do not discuss experimental activities and direct observation of the material being taught, so students feel they are only listeners to teacher explanations. Their memorization is still racing on the textbook (Pure & Yasin, 2021). Teachers still use LKPD as a learning resource by giving assignments in the form of questions only and have never used LKPD in the context of wetlands in the water pollution sub-material, which will directly observe the events that occur. It is hoped that the LKPD in the context of wetlands can improve student learning outcomes.

This research will expand LKPD in the context of wetlands using Problem-Based Learning (PBL) steps. PBL is learning that focuses on problem-solving activities presented by the teacher. Teachers function more as providers of facilities and media to help students actively build knowledge (Yulianti & Gunawan, 2019).

Wetlands are temporary or permanent swamp areas with stagnant water. It can also be called a condition where the water is no more than 6 m at low tide (Ramsar Convention). Wetlands have an important function for humans in their lives. This function is not only understood as directly supporting life, such as a source of drinking water and a place to live for various creatures, but also has ecological benefits, namely preventing seawater intrusion, controlling floods, erosion, global climate, and pollution. If polluted, wetland areas will also be difficult to restore, and recovery will take years. Thus, in order for the benefits of wetland areas to be conserved as cycle regulators and providers of surface water and groundwater, water quality management and water pollution control need to be carried out properly by looking at ecological balance and the interests of generations, both present and future.

Research is a form of expanding teaching materials that fit the environment around students. The environment in South Kalimantan, precisely in Banjarmasin, has many rivers and swamps around it, so it is part of the wetland environment. The sub-material in this study is Water Pollution in the context of wetlands in Banjarmasin. Environmental pollution is divided into five types: air pollution, soil, sound, water, and radiation. This research only raised one pollution, namely water pollution.

Based on the explanation above, this study aimed to find out and analyze the Development of Student Worksheets in the Wetland Context in the Sub-Material of Water Pollution Class VII of Public Middle Schools. What is expected is to be able to find out students' learning outcomes before and after utilizing learning resources.

METHODS

The design used in this research is *Research and Development* (R&D), namely the development and validation of educational products (Saputro, 2021). The model used in this study is a 4D model that utilizes four steps, namely, *Define*. This step consists of 5 main steps: front and end analysis, student analysis, and task analysis and concept analysis (*concept analysis*), as well as analysis of learning objectives (*specification of an objective*), *Design* (Design) at the *design stage* consists of 3 stages, namely the arrangement of the reference test (*criterion-test construction*), media selection (*media selection*) and original design (*initial design*), *Development* (Development) in the Development stage is the stage of producing LKPD by conducting expert validation (*expert appraisal*) and trials (*development testing*), and *Dissemination* (Dissemination) is the distribution of LKPD in the context of wetlands. However, in this study, it only reached the development stage.

The data analysis technique is carried out on the development of LKPD in the context of wetlands, namely:

LKPD validity

The validity of LKPD in the context of wetlands was assessed by three expert validators: material, media, and lessons. Find the average score of validation results from all validators for each benchmark with the formula:

$$\overline{K_i} = \frac{\sum_{j=1}^n \overline{V_{ij}}}{n} \quad (1)$$

Description:

$\overline{K_i}$ = The mean (average) of criterion i

$\overline{V_{ij}}$ = The score resulting from the evaluation of criterion i by validator j

n = Numerous Validators

Table 1. Validity Level Standards

Mark	Standard
$3.5 \leq V \leq 4$	Very Valid
$2.5 \leq V < 3.5$	Valid
$1.2 \leq V < 2.5$	Valid Enough
$0 \leq V < 1.2$	Invalid

Description:

V = The average value of data validity from the expert semi-validator

LKPD practicality

Practicality can be seen from the students' responses to the developed LKPD. Questionnaires were given to students after following the learning process. This includes ease of use, benefits, and effectiveness. The course of practicality data analysis can be described as follows:

Determine the average score for each perspective with the formula:

$$\overline{K_i} = \frac{\sum_{j=1}^n \overline{K_{ij}}}{n} \quad (2)$$

Description:

$\overline{K_i}$ = Mean deviation from the i-th benchmark

$\overline{K_{ij}}$ = The evaluation score on benchmark i by validator j

N = Numerous Validators

Find the total average using the formula:

$$\bar{x} = \frac{\sum_{i=1}^n \overline{A_{ij}}}{n} \quad (3)$$

Description:

$\bar{X}$ = Average total

$\overline{A_i}$ = Score criteria to i

N = Numerous Validators

The results of the practicality test of LKPD in the context of wetlands can be seen from the instruments used by science teachers and students. This instrument uses a Likert scale with an explanation of a value of 1 (Very Poor), a value of 2 (Poor), a value of 3 (Moderate/Enough), a value of 4 (Good), and a value of 5 (Very Good).

The data obtained in this practicality test is then measured, and the average is converted in line with the practicality level benchmark. Analysis of the practicality level of LKPD in this practical test questionnaire can be described as follows (Kumalasan, 2018):

$$\frac{V_p = TSE_p}{S - max} \times 100\% \quad (4)$$

Information:

V_p = Practicality score of students

TSE_p = Student grades

S-max = Total maximum score

Table 2. Benchmarks of Practical LKPD

Benchmark	class	Explanation
75.01% - 100%	Very Practical	It can be used without repair
50.01% - 75.00%	Practical	It could use a little tweaking
25.01% - 50.00%	Less Practical	It is recommended not to use
00.00% - 25.00%	Impractical	Unusable

Source : (Kumalasan, 2018)

LKPD effectiveness

The effectiveness of learning activities will be measured based on learning outcomes in *the pretest* and *posttest*. Increasing the test of cognitive learning outcomes using the *normalized gain* equation (*N-gain*), as follows:

$$<g> = \frac{posttest\ score - pretest\ score}{maximum\ score - pretest\ score} \quad (5)$$

Table 3. LKPD Effectiveness Class

Intervals	Class
$g < 0.3$	Low
$0.3 \leq g < 0,7$	Currently
$g \geq 0.7$	Tall

Source : Hake, 1998

RESULTS AND DISCUSSION

This research is development research. The resulting product is Student Worksheets (LKPD) in the context of wetlands in the Water Pollution Sub-Material in Class VII Middle School. This LKPD contains wetlands that will directly observe the rivers around the school so that students know and observe real examples and the factors and impacts of water pollution in everyday life.

LKPD, in the context of water pollution material wetlands, discusses the notion of water pollution, the meaning of wetlands, water pollution factors, the impact of water pollution, river observation activities, exercises, and conclusions. LKPD in the context of wetlands is supported by using the Problem-Based Learning (BPL) learning model.

The research that has been done is research and development (R&D). This research has produced LKPD in the context of wetlands using the 4D model using four steps, namely Define, Design, Development, and Dissemination. In this study, only up to the third step, namely development or development only.

LKPD Validation Results

The validation results by the three validators state that the LKPD in the context of wetlands is said to be valid. Following are the results of LKPD validation in the context of wetlands in the water pollution sub-material. The results of LKPD validation in the context of wetlands can be seen in Table 4.

Table 4. LKPD Validation Results

Assessment Perspective	Score	Class
Presentation	3.52	Very Valid
Content Eligibility	3,43	Valid
language	3.63	Very Valid
Wetland Aspect	3,27	Valid
Average Total Validation	3.49	Valid

Presentation of data is one of the most important parts; before becoming LKPD in the context of wetlands on water pollution material that is good for use by students, the researcher will first ask the team of experts for an assessment of whether or not the LKPD to be used is appropriate. The assessment aspects include presentation, content feasibility, language, and wetland aspects.

According to the validation results of the three expert validators, it can be seen in Table 4 results obtained with a value of 3.49 so that the LKPD in the context of wetlands is categorized as valid for use. LKPD is declared valid if the score is $2.5 \leq V < 3.5$ (Hendriani & Gusteti, 2021). A valid LKPD means that the LKPD has been presented systematically, the details of the material are made in it, and the learning objectives are clear; it can support the smooth learning process, user responses, and stimuli (Siregar et al., 2020).

The LKPD in the context of wetlands only gets valid criteria because the contents in the LKPD are still incomplete, such as there are no core competencies, prefaces, conclusions, and pictures presented in the form of animations so that the ratings from the validators are low. Even though the criteria are valid, the researcher will still make improvements according to the suggestions from the validator so that the LKPD in the context of wetlands becomes a good LKPD and is appropriate for students to use in the course of learning.

Based on the results of the LKPD validity analysis, it was found that the presentation aspect in the LKPD met the very valid category with a score of 3.52. The research indicators included are the LKPD format, presentation techniques, coherence, and completeness of presentation. On the feasibility aspect, the LKPD meets valid criteria with a value of 3.43. Assessment indicators include compliance with LKPD, accurate material, encouraging curiosity, up-to-date usability, and benefits of LKPD. The linguistic aspect in LKPD meets very valid criteria with a value of 3.63. Assessment indicators include communication, straightforwardness, suitability of student development, and fitting Indonesian language rules. The wetland perspective in LKPD meets valid criteria with a value of 3.27. The scoring indicators include wetlands as a process of inquiry.

The results of the validation are the results of the data obtained from the validation sheet that has been discussed with the validator and then measured in order to calculate the feasibility of the LKPD in the context of wetlands at SMP Negeri 15 Banjarmasin in class VII G.

Learning Outcomes Validation Results

The validation results by the three validators resulted in a decision that the learning outcomes test had very valid criteria. The validation of the learning outcomes test can be seen in Table 5.

Table 5. Validation of Learning Outcomes Test

Assessment Perspective	Average $\overline{K_1}$	Information
Multiple choice	3.84	Very Valid
Average Total Validation	3.84	Very Valid

The development of LKPD in the context of water pollution in SMP Negeri 15 Banjarmasin went through several validation and testing stages. According to the validation results of the three expert validators, it can be seen in Table 5 that they obtained a value of 3.84, so the questions used are in the very valid category to use. According to Trianto (2015), LKPD is declared very valid if the value obtained is between $3.5 \leq V \leq 4$.

The study results test consists of 15 multiple-choice questions. Item number 1 received suggestions from the validator to match the indicators, namely questions about the definition of environmental pollution. The researcher was wrong in choosing the domain being tested, previously using C2 and then corrected by the validator to use C1.

Learning outcomes tests in research are used in order to be able to calculate the effectiveness of the developed LKPD. LKPD is calculated by exams given to students to see how much the achievement of skills in running science increases the effectiveness of LKPD (Rahmania et al., 2020). developed for the course of learning (Alfiriani & Hutabri, 2017). Teaching material is called effective if it can provide results that are in line with the research objectives that have been set. Thus, it becomes a necessity to validate the learning outcomes test in order to determine the validity of the instrument used.

LKPD practicality

The trial was carried out after the product in the form of LKPD in the wetlands went through the validation and improvement stages in line with comments and suggestions from expert validators. Trials were carried out in order to know the feasibility of the LKPD in the context of wetlands that had been made. The practical conclusions of LKPD can be seen in Table 6.

Table 6. Practical LKPD

Assessment Aspects	Mark	Information
Ease of Use	84,20	Very Practical
Benefit	81,16	Very Practical
effectiveness	80.15	Very Practical

The trial was carried out after the product in the form of a wetland context LKPD went through the validation and improvement stages in line with the comments and suggestions from the expert validator. The trial was carried out to determine the feasibility of the LKPD with the status of a wetland that had been created. The trial was carried out with the respondents, namely 33 students. The researcher carried out the trial face-to-face with the respondents by providing LKPD in the context of wetlands, and data collection was carried out by distributing student questionnaires to the respondents.

The trial results, which involved 33 students of SMP Negeri 15 Banjarmasin, obtained data from the LKPD in the context of wetlands through the distribution of student response questionnaires. There were 20 statements in the questionnaire, and a total percentage of 82.00 was obtained. The results of the student questionnaire data show that the LKPD in the context of wetlands is a very practical LKPD to be used as student teaching material. LKPD is very practical if the value is between 75.01% - 100% (Kumalasan, 2018). According to (Delfita et al., 2018), if the LKPD gets a very practical category, then it states that the LKPD that has been developed is easy so that it can be understood by students because the language used is simple, the material the LKPD is more practical than the textbooks that students usually use and the contents LKPD about the state of water pollution that occurs in everyday life so that it makes students like the learning methods that researchers have developed.

On the results of the student response questionnaire that the researcher has analyzed. Two students scored 75.00% and 73.75%, so the practicality criteria obtained became practical. This is because the statements about numbers 4, 6, 7, 12, 16, 17, and 20 get a score of 1 or 2 from students based on positive and negative statements. The rest, 31 other students, scored above 75.01%, which makes the practicality criteria very practical.

This questionnaire consists of 3 aspects, namely aspects of ease of use, benefits aspects, and effectiveness aspects, with 20 statements consisting of use, benefits aspects, and effectiveness aspects, with 20 statements consisting of 14 positive statements and six negative statements. The value of ease of use in LKPD can be seen in Figure 1.

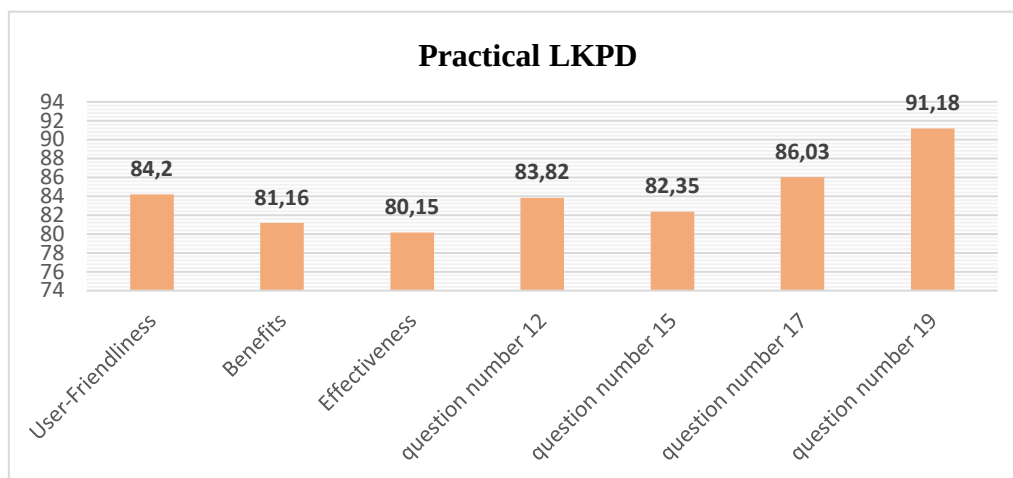


Figure 1. LKPD Practicality Diagram

The statements in the ease of use aspect are numbers 1, 9, 10, 12, 15, 17, and 19. This aspect contains four positive statements at numbers 1, 9, 12, and 19 and 3 negative statements at numbers 10, 15, and 17. Based on the diagram above, the value per aspect obtained is 84.20% with a very practical group. Statements seen in the perspective of ease of use are numbers 2, 3, 4, 5, 8, 11, 13 and 18. This aspect contains all positive statements. Based on the diagram above, the value per aspect obtained is 81.16%, with a very practical group. The statements in the ease of use aspect are numbers 6, 7, 14, 16, and 20. In this aspect, there are two positive statements in numbers 14 and 20 and 3 negative statements in numbers 6, 7, and 16. Based on the diagram above, the value per aspect obtained is 80.15%, with a very practical category.

LKPD effectiveness

The effectiveness of the LKPD used was measured by giving 15 multiple-choice questions to students. The exams were given before and after utilizing the developed LKPD (*pretest*) and the developed teaching materials (*posttest*). The successful use of this LKPD can be seen from the test of student learning outcomes. Examination of student learning outcomes is obtained by calculating n-gain. The calculation results can be seen. The results of the n-gain criteria obtained by class VII G can pay attention in Table 7.

Table 7. N-gain measurement results

Many Students	N-Gain	N-Gain Criterion
33 people	0.86	Tall

The effectiveness of the LKPD used was measured by giving 15 multiple-choice questions to students. The exams given were before and after using the developed LKPD. The successful use of this LKPD can be seen from the test of student learning outcomes. The questions are designed according to the learning objectives guided by basic competencies. The evaluation given to students determines the LKPD's success in achieving learning objectives. The learning outcomes of this researcher were calculated by taking into account the *pretest* and *posttest* results. The *pretest* was distributed before learning began using the LKPD in the wetland context. The *posttest* was distributed after learning using the LKPD in the wetland context.

The *Pretest* result was 36.79, and the *posttest average result* was 91.36. The increased learning outcomes can be seen from the difference in learning outcomes. Learning is called effective if

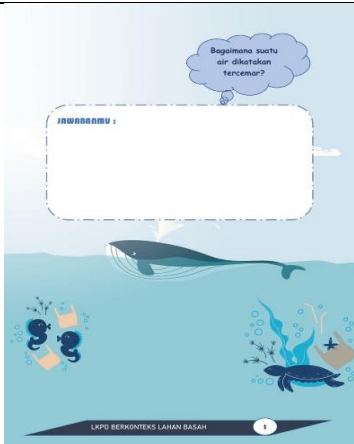
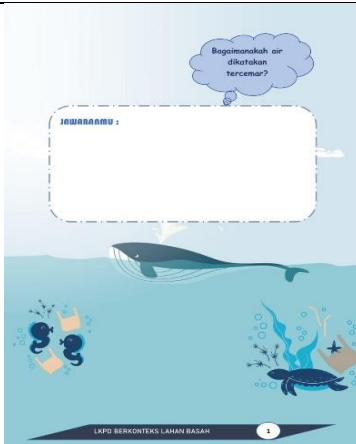
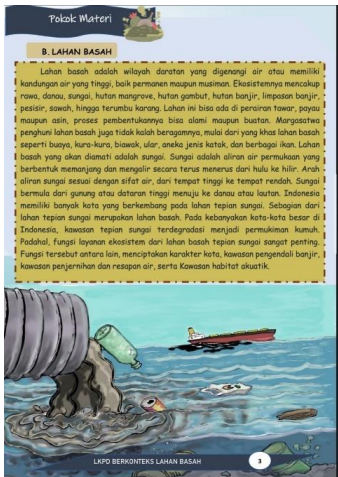
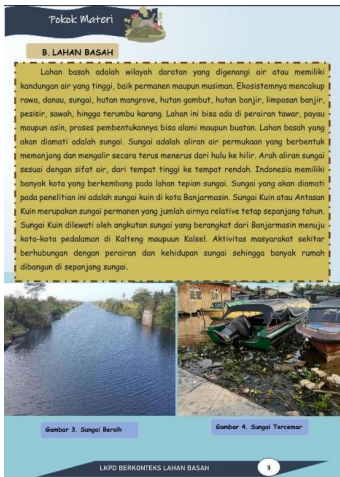
students can understand the learning concepts that the teacher has taught (Sumarni, 2013). This is seen in the aftermath of learning by utilizing LKPD. Student learning outcomes before and after LKPD looked different, as shown by the results of the *pretest* and *posttest* scores. This follows the words (of Fonna & Mursalin 2019); (and Peniati, 2012), which mention the advantages of learning, one of which is by using LKPD, namely that students can achieve learning outcomes that align with their abilities. The difference between *the pretest* and *posttest* scores after learning is called the gain. Based on the results of the N-Gain calculations, it can be observed in Table 7 obtain a value of 0.86 with high criteria. LKPD is declared high if the value is between $g \geq 0.7$.

The results of the N-gain analysis received high criteria because the *pretest* and *posttest* scores had a significant difference. Previously, the *pretest* scores of 33 students got low scores, then after learning to use the LKPD and observations, the students understood and got high scores on the *posttest*.

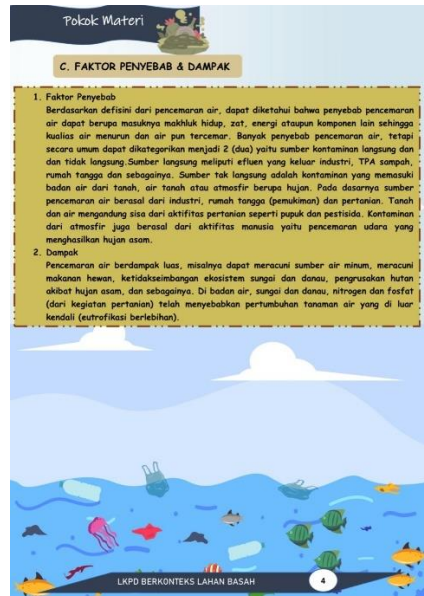
LKPD Revision Results

The LKPD in the context of wetlands before and after being revised by the validator are:

Table 8. LKPD Before and After Repair

Before Repair	After Repair
 There is a sentence, "How one."	 Comments & Suggestions: Changing the prefix of the interrogative sentence to "how."
	

The images used are animated images.

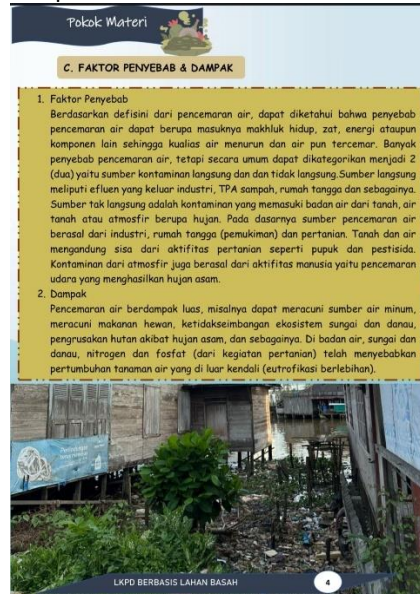


The image used is an animated image of water pollution



In the problem orientation section, researchers make questions about where the condition of the river is

Comments & Suggestions: It is better to use original images of water pollution in wetlands (rivers), both uncontaminated and polluted.



Comments & Suggestions: It is better to use the original image of the polluted river to be studied



Comments & Suggestions: It is better if the orientation on the problem replaces the question with what students think about the existing pictures.

As for some other suggestions from the validator, namely 1) Adding an introductory word that contains about wetlands (in the context of wetlands in LKPD), then adding a description of the image, and it is best if the image adapts to the wetland shown. Other validator suggestions are 2) Several aspects need to be added. Some aspects are not in the LKPD in the context of wetlands, KI, and tools and materials need to be added to the LKPD; KD 4.8 needs to clarify instructions in student activities

and add material to the explanation. Another validator's suggestion is 3) it is better to add general information/state of the Kuin River to the subject matter, to the subject matter about wetlands, it is better also to add the state of the wetlands around the school, then add a sentence of invitation to student observation activities, and add conclusions to the LKPD. This LKPD was presented in two meetings. The first meeting of the researchers explained general about water pollution through PPT media. In the second meeting, the researchers invited students to observe the wetlands around the river and answer the questions in the LKPD.

CONCLUSION

According to the results of the research and discussion, it was concluded that the LKPD in the context of wetlands that the researchers developed in the learning process stated that the LKPD in the context of wetlands that was developed was identified as valid with the mean value obtained from the three validators of 3.49. The LKPD in the wetland context was stated to be very practical from the student response questionnaire, scoring 82.00. LKPD in the context of wetlands is declared effective with high criteria to obtain an n-gain of 0.86.

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