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The Feasibility of PBL-Based LKPD Accompanied by KPS on Environmental Change Material Class X

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ABSTRACT

The change in the Merdeka Curriculum has made learning tools in various subjects including biology in class X inadequate. This study aims to determine the feasibility of Problem-Based Learning (PBL) based LKPD (student worksheet) accompanied by Science Process Skills (KPS) on the material of environmental changes in class X. The development model refers to the research and development (R&D) method with 5 stages. The stages are potential and problems, data collection, product design, design validation, and design revision. The research instruments used were instrument validation questionnaires and validation sheet questionnaires. The validated aspects are the format, content, language, and benefits/usability of LKPD. Validation was carried out by 5 validators. Analysis of validation results using face validity Aiken's V with criteria V = 0.87. The results showed that the LKPD met the valid criteria with a total average of 0.947. It can be concluded that problem-based learning-based LKPD accompanied by science process skills is declared valid and ready to proceed to the trial stage.

KEYWORDS

LKPD
Problem-Based Learning
Science Process Skills

1. Introduction

The curriculum change from the 2013 Curriculum to the Merdeka Curriculum is a form of educational progress in Indonesia. The Merdeka Curriculum is socialized and implemented in all educational units to update the learning process that is constrained by the pandemic (Maulida, 2022). Because of this curriculum change, various teacher teaching tools have also changed, including biology learning at the high school level. The characteristics of the Merdeka Curriculum are contextual and inquiry, which means that all teaching materials/learning tools that will be used in this learning activity must use current issues that are close to students and students are also required to be able to find their answers to the problems presented in learning activities.

The characteristics of the Merdeka Curriculum are to the PBL learning model. The problem-based learning (PBL) learning model is a learning model that is carried out by grouping students into small groups and then working together to provide motivation for continuous involvement in complex tasks and also to increase opportunities for joint investigation and dialogue and for the development of social skills (Arends, 2012). This learning model requires students to find out for themselves the answers to the cases presented to them based on local issues around them. The syntax of this problem-based learning model is 1) Provide orientation about the problem to learners, 2) Organize learners to research, 3) Assist independent and group investigations, 4) Developt and present work and exhibiting, 5) Analyze and evaluate the process of overcoming problems (Arends, 2012).

This PBL model will be even more complex when combined with science process skills (KPS), which are also required in the Merdeka Curriculum. KPS is a general process carried out by humans to understand information (Daud, 2018). In the Merdeka Curriculum, this KPS consists of six stages that must appear in classroom learning activities which are described in the core activities. Based on a copy of the decision of the Head of the Education Standards, Curriculum and Assessment Agency of the

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Ministry of Education, Culture, Research and Technology Number 003/H/KR/2022, in phase E, to be precise, class X SMA in biology subjects, there are at least 6 types of science process skills (KPS) that must be carried out by students. These process skills include (1) observing, (2) questioning and predicting, (3) planning and conducting investigations, (4) processing and analyzing data and information, (5) evaluating and reflecting, and (6) communicating results. It is hoped that the existence of these science process skills in the preparation of learning tools, and their implementation in the classroom can be useful and train students to be able to use these skills in everyday life.

Based on the results of an interview with a biology teacher at SMA Negeri 2 Ketapang, it was found that the implementation of the Merdeka Curriculum at the school only started in the 2023/2024 school year for grade X. However, because the implementation of the Merdeka Curriculum in this school is only the first year, teachers still lack teaching materials/learning tools, especially in biology subjects by the Merdeka Curriculum. Teachers at the school also did not receive training on making learning tools at the time of the interview, so the teachers still used learning tools from the previous curriculum. Learning activities in the classroom are still centered on the teacher who plays an active role in learning activities with the lecture method while students only listen to the teacher's explanation. Teachers also have never used the Problem-Based Learrning model on environmental change material. For the worksheets, the teacher also still uses the questions contained in the LKS sold at school (such as Intan Pariwara) and from the package book which still uses the previous curriculum.

One of the efforts that can be made to overcome the shortcomings in these schools is to develop learning tools that are by the Merdeka Curriculum. One of the learning tools that can be developed is LKPD. A learner worksheet (LKPD) is a sheet that must be done by students which is theoretical or practical in nature which contains discussion, summary, and how to do learning tasks (Prastowo in Pratiwi & Luh, 2023). LKPD is used as an aid for teachers in giving assignments to students in learning activities. This LKPD is needed to guide students to carry out a series of learning activities (Ramlawati et al., 2022).

LKPD based on problem-based learning (PBL) accompanied by science process skills (KPS) needs to be developed because there is still a lack of learning tools that support the implementation of the Merdeka Curriculum in schools that have just implemented it. With the PBL-based LKPD accompanied by KPS, it is hoped that student activities will be more meaningful because the church is required to carry out the stages of the experimental process which will make it easier for students to obtain, develop, and apply legal concepts, and science theories independently (Ramlawati et al., 2022). In its application, LKPD has various advantages. The advantages of using LKPD are improving the quality of student learning in the classroom, increasing student understanding and making students more active, and being able to improve student learning outcomes (Gusyanti & Sujarwo, 2021).

Some studies related to LKPD, PBL, and KPS are presented as follows. According to Arestu et al (2018), LKPD from the development of problem-based learning is declared feasible and can improve students' problem-solving skills. Ramlawati et al (2022), LKPD is declared to have a high category in improving science process skills. Based on the description above, the purpose of this study is to determine the feasibility of Problem-Based Learning (PBL) based LKPD accompanied by Science Process Skills (KPS) on class X environmental change material.

2. Method

This development research refers to the research and development (R&D) method according to Sugiyono (2019). The stages of this research are only up to the fifth stage, namely the potential and problem stages, data collection, product design, design validation, and design revision because the purpose of this research is to produce products in the form of problem-based learning (PBL) based LKPD accompanied by science process skills (KPS).

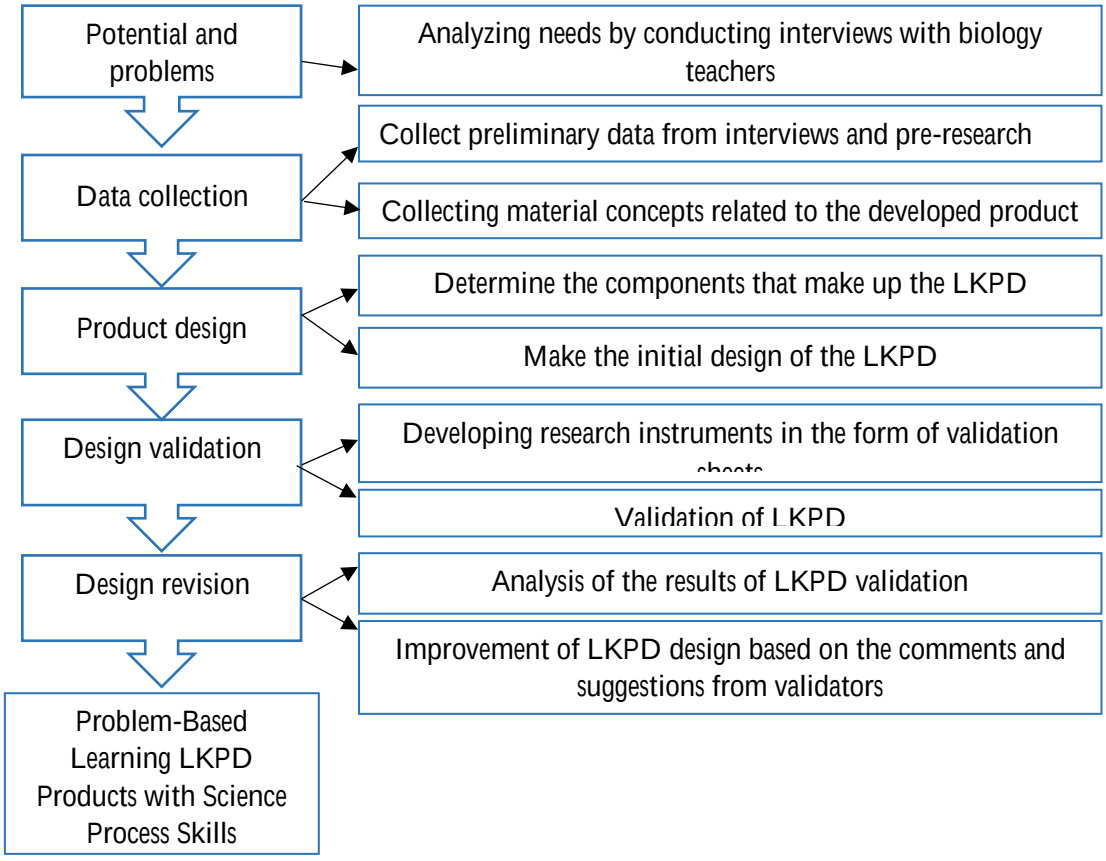

Figure 1. Research Design of LKPD Development

The subject of this research is LKPD based on problem-based learning (PBL) accompanied by science process skills (KPS) on the material of environmental changes in class X. The instruments used in this research are 1) the student worksheet instrument validation questionnaire and 2) the student worksheet validation sheet assessment questionnaire. Data on the development of problem-based learning (PBL) LKPD accompanied by science process skills (KPS) is obtained from research instruments.

This development research instrument aims to assess the products that have been developed. The instruments used have been validated by validators. The analysis of the instrument is as follows:

2.1. Learner Worksheet Instrument Validation Analysis

In analyzing the learner worksheet instrument, using a Guttman scale consisting of two criteria, namely Yes (Y) and No (T). This instrument is intended to validate the validation sheet that will be used to assess the developed product. Instrument validation was carried out by two validators, namely biology education lecturers FKIP Untan. This instrument contains an assessment for format, content, and construction. In this assessment, all aspects were declared feasible. Suggestions and comments obtained are that the sentences used adjust to PUEBI, and the presentation of PBL stages on LKPD needs to be improved.

2.2. Learner Worksheet Validation Analysis

In the analysis of the validation sheet of the student worksheet, using a Likert scale with 4 rating scales. The rating scale in this questionnaire is a Likert scale, namely strongly agree (4), agree (3), disagree (2), and strongly disagree (1). Validation was carried out by five validators who would then be analyzed using Aiken's V face validity and Microsoft Excel to see its validity. LKPD is said to be valid if the results of Aiken's V calculation are greater than the value of V = 0.87. The criteria assessed in this validation sheet are 16 questions with aspects of format, content, language, and usefulness/usefulness of LKPD.

The formula of Aiken's V face validity for data analysis is as follows.

$$V = \frac{\sum s}{[n(c-1)]}$$

With:
s : r-lo
lo : the lowest validity assessment number
c : the highest validity assessment number
r : the number given by an assessor
n : number of raters (Aiken, 1985).

3. Results and Discussion

3.1 Result

3.1.1 Potential and Problems Stage

The results of the analysis of potential and problems for research purposes were carried out by interviewing the biology teacher of class X IPA at SMA Negeri 2 Ketapang, the interview was held on Friday, January 6, 2023. The results of the interview produced some information needed by researchers regarding the learning tools used by teachers in the Merdeka Curriculum. Researchers obtained information from the results of the interview that the learning process in the classroom was still teacher-centered where students received explanations from the teacher while learning was taking place. The teaching materials used in the Merdeka Curriculum are also still minimal because the school is only implementing it for the first year. As for the material on environmental changes, the teacher only teaches armed with worksheets on LKS/package books without the help of other devices/media. As well as on the material of environmental changes in the Merdeka Curriculum, the teacher has never developed a Problem-Based Learning-based learning tool. Based on the results of this interview, the researcher has a problem that will be solved by developing learning tools tailored to the teacher's needs, namely by developing problem-based learning-based LKPDs accompanied by science process skills.

3.1.2 Data Collection Stage

The results of interviews that have been conducted with class X biology teachers at SMA Negeri 2 Ketapang are then collected and compiled into preliminary data from problems that will be followed up by offering solutions and as an initial design of the product to be made, namely problem-based learning tool LKPD based on problem-based learning accompanied by science process skills on environmental change material. Other preliminary data collected by researchers are students' daily test scores on environmental change material in class X IPA in the 2022/2023 school year when the school is still implementing the 2013 Curriculum and teacher lesson plans on environmental change material.

At this stage, researchers also determined the material to be developed, namely environmental changes consisting of four sub-materials and will be delivered in 4 learning activities. The sub-materials are environmental change and environmental pollution, environmental conservation adaptation and mitigation, types of waste, and the 3R recycling process (Reduce, Reuse, Recycle). Then this material will be developed into a Problem Based Learning-based learning tool with science process skills.

3.1.3 Product Design Stage

At this stage, the researcher makes a product design of the device to be developed. Namely, Problem-Based Learning based LKPD accompanied by science process skills on class X environmental change material for four meetings with four sub-materials namely 1) environmental change and environmental pollution, 2) environmental conservation, adaptation, and mitigation, 3) types of waste, and 4) 3R recycling process (Reduce, Reuse, Recycle).

The Learner Worksheet in this study was developed to meet the elements of science process skills consisting of 6 processes, namely 1) observing, 2) questioning and predicting, 3) planning and conducting investigations, 4) processing, analyzing data and information, 5) evaluating and reflecting, and 6) communicating results, then collaborating with the Problem-Based Learning learning model, the LKPD was slightly modified in structure. This LKPD is made using Microsoft Word using A4 size

BC paper (21 cm x 29.7 cm) with various shapes and sizes of writing. The components of the teaching module based on Problem-Based Learning are as follows: cover, learning goals, introductory material, tools and materials, instructions for use, problem statement, observation result table, problem analysis and evaluation, conclusion.

The appearance of the product design that has been developed is as follows (Figure 1):

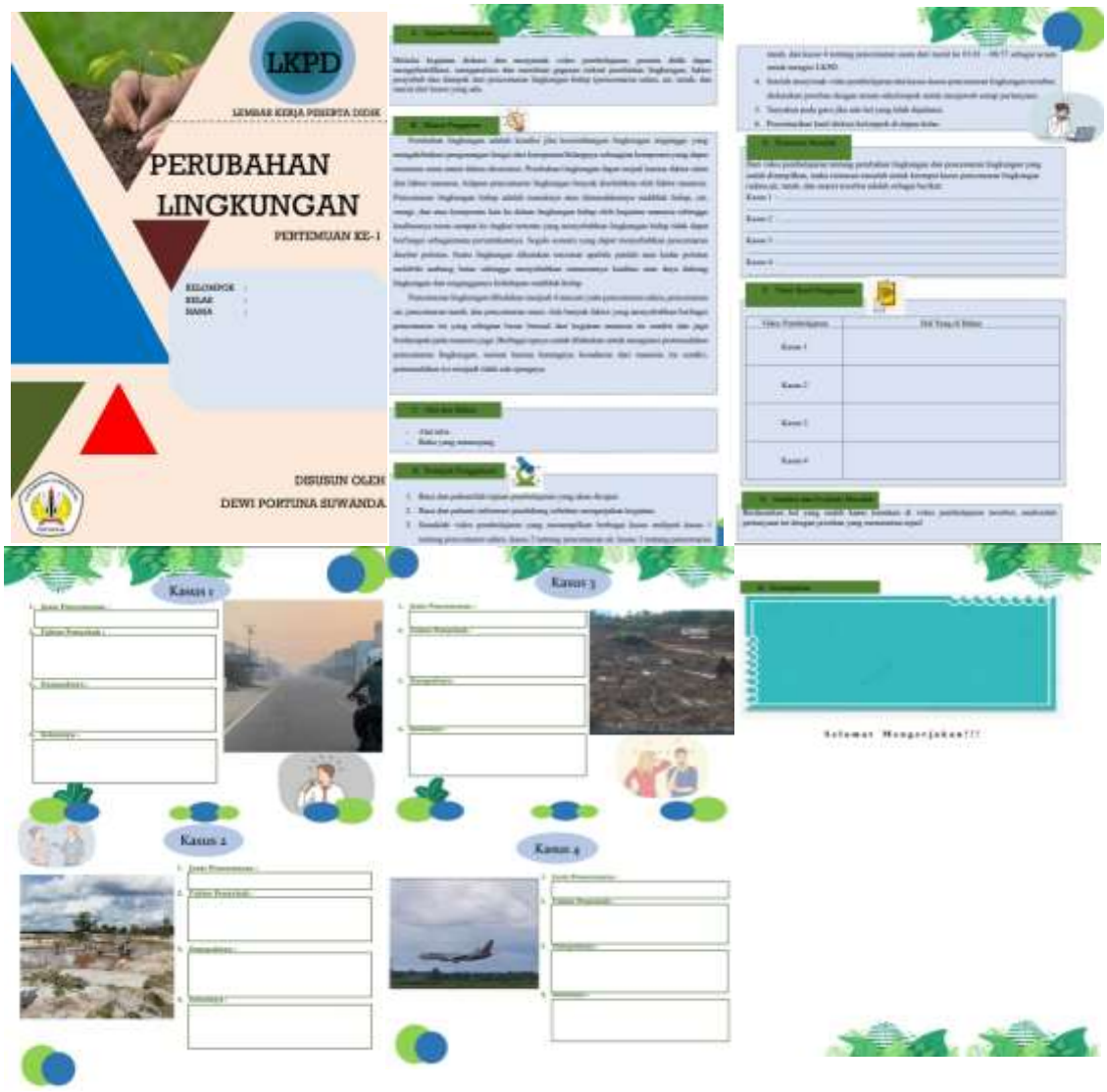

Figure 2. Design of LKPD for Meeting 1

As for the other meeting, LKPDs can be accessed via the following Google Drive link https://drive.google.com/drive/folders/1Qzm-TJ9vV4sVF9_GSjqh6m0c4BTHIRb?usp=drive_link

3.1.4. Design Validation Stage

After the product has been developed, the researchers will then carry out the design validation stage with the validators. In this learning device development research activity, product validation was carried out by 5 validators with a Likert scale with 4 assessments so that the index value V = 0.87 was obtained. If the results of the validation analysis exceed the value of V = 0.87 then the learning device is declared valid.

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The Likert scale score for this assessment is as follows (Table 1):

Table 1. Likert Scale Scoring

Assessment	*Score*
Very suitable (SS)	4
Suitable (S)	3
Not suitable (TS)	2
Very unsuitable (STS)	1

Validation of LKPD is done with four different aspects with criteria of as many as 16 questions. The format aspect consists of 6 questions, the content aspect consists of 5 questions, the language aspect consists of 3 questions, and the benefits/usability aspect of the LKPD consists of 2 questions. The criteria assessed for the format aspect are as follows (Table 2):

Table 2. Format Aspect Criteria

Aspect	*Criteria*
Format	1. The instructions for using the LKPD are clear 2. Attractive appearance and design 3. The type and size of letters are appropriate and easy to read 4. The color of the text is appropriate 5. Appropriateness of the layout of images/tables/writing 6. Text and illustrations are balanced

The criteria assessed for the content aspect are as follows (Table 3):

Table 3. Format Content Criteria

Aspect	*Criteria*
Content	1. The content of the LKPD is easy to understand and contextual 2. Student activities are formulated 3. The suitability of the content of the material and tasks with the existing time allocation 4. The content of the LKPD is by the problem-based learning model 4. 5. Encourage the curiosity of students

The criteria assessed for the language aspect are as follows Table 4):

Table 4. Format Language Criteria

Aspect	*Criteria*
Language	1. Understanding of messages and materials 2. The language and terms used in the LKPD are easy to understand 3. The language used is correct according to the Refined Spelling using clear directions/instructions that do not lead to multiple interpretations

The criteria assessed for the benefits/usability aspects of the LKPD are as follows (Table 5):

Table 5. Format Language Criteria

Aspect	*Criteria*
Benefits/usability aspects of the LKPD	1. The use of LKPD as teaching materials for teachers on environmental change material 2. The use of LKPD as a learning guide for students on environmental change material

Based on the validation activities that have been carried out on LKPD, with these 4 aspects, the validation results from the five validators are as follows (Table 6):

Table 6. Results of LKPD Validation Analysis

No	*Aspect*	$\bar{x}$ *Aspect*	*Description*
1.	Format	0,967	Valid
2.	Content	0,933	Valid
3.	Language	0,956	Valid
4.	Benefits/usability aspects of the LKPD	0,933	Valid
	Total Average	0,947	Valid

The results of this LKPD validation show that the average assessment is 0.947. The validation results are classified as valid because the total average value> V value = 0.87

3.1.5. Design Revision Stage

Based on the results of validation conducted by validators and obtained criticism suggestions and input, then revisions will be made to the research design that has been made. The design revision is intended to correct the shortcomings of the product that has been made so that the Problem-Based Learning-based student worksheet learning device accompanied by science process skills on environmental change material is declared feasible.

The revised parts and types of revisions/suggestions from Problem-Based Learning-based student worksheets can be seen in Table 7.

Table 7. Learner Worksheet Revision List

Revised Part	*Advice*
Paper	- Changing the type of paper from HVS paper to BC paper so that the print results are clearer.
Design	- Make the LKPD design more attractive by adding some decorative points to the LKPD.
Color selection	- Make the colors in the table the same color and avoid using colors that are too bright.
Instructions for use	- Improve the sentences in points number 3 and 4 in the instructions for use column by adding the sub-material discussed and the duration of the learning video for each LKPD, which also applies to the next meeting LKPD.
Problem Statement	- Adding sub-material to the formulation of the problem being discussed which is adjusted to the number of cases in the video, also applies to the next meeting's LKPD.
Problem Analysis and Evaluation	- Replace the word "question" with "problem analysis and evaluation", which also applies to the next meeting's LKPD.
Problem Analysis and Evaluation Design of each LKPD	- Change the design of the question section and answer column of LKPD meetings 1, 2, 3, and 4 to be more attractive by adding pictures and decoration points with softer colors.

3.2 Discussion

The research conducted is development research that aims to determine the feasibility of problem-based learning-based LKPD accompanied by science process skills. Learning tools developed by researchers in the form of problem-based learning-based LKPD accompanied by science process skills on class X environmental change material consisting of 4 sub-materials with 4 meetings. The sub-materials for each meeting are 1) environmental change and environmental pollution, 2) environmental conservation, adaptation, and mitigation, 3) types of waste, and 4) the 3R recycling process (reduce, reuse, recycle). This learning activity is carried out in four meetings with a time allocation of 4 x (3 JP x 45 Minutes). This LKPD is used as a means for students to learn independently. Accustoming students to construct their knowledge requires supporting teaching materials (Rachmawati et al., 2019).

At the potential and problem stage, interviews were conducted with biology teachers. The aim is to see and know the reality in the field regarding the use of learning tools in the teaching and learning process (Asminah et al., 2022). According to the teacher, the change from the 2013 Curriculum to the Merdeka Curriculum made teachers lack learning tools, especially in class X biology subjects. Learning is also still teacher-centered and in the material on environmental changes, the teacher only teaches armed with worksheets in the LKS/package book without the help of other devices/media. As well as on environmental change material in the Merdeka Curriculum, the teacher has never developed a Problem-Based Learning-based learning tool.

At the stage of collecting data from the results of interview activities with biology teachers that have been carried out, the data is collected and compiled into preliminary data from further problems. Other data obtained are students daily test scores on environmental change material in the 2013 Curriculum for the 2022/2023 school year.

The product design stage, begins with making problem-based learning-based LKPDs accompanied by science process skills on environmental change material consisting of 4 sub-materials. This LKPD was made using Microsoft Word using A4 size BC paper (21 cm x 29.7 cm) with various shapes and sizes of writing. In it, there are stages of problem-based learning accompanied by science process skills that are illustrated in the stages in the LKPD. The components of the LKPD consist of

cover, learning objectives, introductory material, tools and materials, instructions for use, problem formulation, observation table, problem analysis and evaluation, and conclusion.

The application of the problem-based learning model supports the implementation of active, creative, effective, and fun learning (PAKEM). Students will be fully involved in the learning process because students act as subjects in learning (student-centered learning) (Hartatik, 2022). The learning tools developed with the problem-based learning model are considered sufficient to fulfill what must be achieved in the Merdeka Curriculum, namely using a contextual and inquiry approach coupled with the use of KPS in the stages of the LKPD. This can be seen in the learning tools that have been developed by researchers.

At the design validation stage, it was carried out by 5 validators with 4 rating scales. LKPD validation activities, with a total of four aspects and with question criteria totaling 16 items filled in by the validators. The validated aspects include the format, content, language, and benefits/usability of LKPD. The format aspect consists of 6 questions, namely clear instructions for using the LKPD, attractive appearance and design, appropriate font type and size, and easy to read, getting an Aiken's V calculation score of 1. The color criteria in the text are appropriate, and the suitability of the layout of images/tables/writing, text, and illustrations is balanced by Aiken's V calculation score of 0.933. The content aspect consists of 5 questions, namely the content of the LKPD is easy to understand and contextual, student activities are formulated, the suitability of the content of the material and tasks with the existing time allocation, the content of the LKPD is by the problem-based learning model, and encourages the curiosity of students, all of which get an Aiken's V calculation score of 0.933. The language aspect consists of 3 questions, namely understanding the message and information, the language and terms used in the LKPD are easy to understand, getting an Aiken's V calculation score of 1, the language used is correct according to the Refined Spelling and uses an Aiken's V calculation score of 0.933, clear directions/instructions that do not cause multiple interpretations get an Aiken's V calculation score of 0.933. The benefits/usability aspect of LKPD consists of 2 questions, namely the use of LKPD as teaching material for teachers on environmental change material and the use of LKPD as a guide for students on environmental change material getting an Aiken's V calculation score of 0.933.

Based on the validation activities, the average value for each aspect assessed was obtained. The format aspect based on the validation results obtained an $\bar{x}$aspect of 0.967 and was declared valid. The content aspect based on the validation results obtained an $\bar{x}$aspect of 0.933 and was declared valid. The language aspect based on the validation results obtained the $\bar{x}$ aspect of 0.956. The benefit/usefulness aspect of the LKPD based on the validation results obtained $\bar{x}$aspect of 0.933 and declared valid. Problem-based learning-based LKPD accompanied by science process skills is declared valid with an average total indicator of 0.947 with valid criteria. These results can be seen in Table 1. Researchers also received some input and suggestions from the validators to improve the problem-bassed learning-based LKPD to make it even better.

In the design revision stage obtained from suggestions and comments both carried out in the validation sheet and verbally (Sulistyorini et al., 2018), some suggestions and input obtained from validation activities for improving LKPD include the type of paper used, appearance design, color selection, instructions for use, problem formulation, problem analysis and evaluation, and design of problem analysis and evaluation in each LKPD. The types of revisions/suggestions obtained by researchers in LKPD validation activities can be seen in Table 2. Suggestions and input from validators are very useful for researchers in improving LKPD to make it even better.

Based on the LKPD that has been developed, activities related to the problem-based learning model can be seen from the activities in the LKPD. The advantage of LKPD for teachers is to facilitate them in carrying out learning and then for students to learn independently to understand and carry out a written task (Emy & Juru, 2019). This can be clearly illustrated in the activities in the LKPD which are used simultaneously with learning videos. Students are given a learning video according to the

submaterial being worked on in which in the learning video students watch cases related to environmental issues around them. After watching the learning video, students will fill in and analyze it using various questions in the LKPD. For example, by discussing and analyzing what happened in the video, how the problem was formulated from the video, and what was observed in the learning video, then students must fill in several questions related to the learning video. Students also have to make conclusions from the activities that have been carried out then present and communicate them in front of the class. Problem-based learning is one of the learning models that can help students improve the skills needed in the current era of globalization (Hotimah, 2020). The stages of the activities in this LKPD already reflect the problem-based learning model. Problem-based learning refers to an approach that focuses on solving problems by acquiring the necessary knowledge (Assegaf & Uep, 2016).

Science process skills are also clearly illustrated in this LKPD. LKPD accompanied by science process skills developed is easy to use by teachers and makes it easier to achieve learning objectives (Aldi et al., 2022). The use of learning media can also foster student interest in learning new things in the subject matter delivered by the teacher so that it will be easier to understand (Gusrianti, et al., 2023). In science process skills, observing is illustrated by the activities of students watching learning videos. Questioning and predicting activities are seen from the activities in the LKPD, namely, when making problem formulations. The activities of planning and conducting investigations are seen from the activities in the observation table, namely students must write down what is discussed in the learning video for each case shown. The activity of processing and analyzing data and information can be seen from the activity of answering various questions in the problem analysis and evaluation section. The activity of evaluating and reflecting is seen in the activity of making conclusions. The activity of communicating the results is seen in the presentation of the results of the discussion in front of the class. The science process skills collaborated with the problem-based learning model is a perfect combination, because the learning method uses the problem as the first step in combining new knowledge according to real experiences and activities (Asbari & Gunawan, 2023).

The use of problem-based learning-based LKPD accompanied by science process skills must be used in conjunction with the use of learning video media on environmental change material developed by researchers. This is because to be able to fill in the LKPD, students must listen to the learning video displayed as teaching material for them to fill in the LKPD. LKPD can make it easier to understand the material and practice experiments both inside and outside the classroom and at home (Suwastini et al., 2022).

Based on the validation activities of problem-based learning tools based on LKPD accompanied by science process skills, the results showed that the learning tools developed were declared valid and feasible for use in classroom learning activities on environmental change material in class X SMA.

4. Conclusion

Based on the results of data analysis and discussion, it can be concluded that the problem-based learning tool LKPD based on problem-based learning accompanied by science process skills on environmental change material class X is declared valid with an average total indicator of 0.967 and feasible for use in learning activities.

This study is limited to the feasibility of the LKPD product (worksheet) assessed by experts. The product needs to be tested on users, both students and teachers, to test the practicality and effectiveness of LKPD. Testing can be done by considering student demographics, school diversity, so that more comprehensive results can be obtained.

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