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Feasibility and Practicality of Socio-Scientific Issues Based Student Worksheets (LKPD) on Pollution Material to Foster Critical Thinking Abilities 7th Grade Junior High School Students

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Abstract: This study aims to develop student worksheets (LKPD) based on Socio-scientific Issues in science learning to foster critical thinking skills of seventh grade students. This research is research and development (R&D) conducted at SMP 19 Bengkulu City on May 17 to June 28, 2021. Data collection techniques using interviews, observations, questionnaires and documentation, data validated by three validators, namely media expert validators, material experts and language experts. The stages carried out to produce LKPD are as follows: a) potential and problem stage; b) data collection; c) product design stage; d) design validation stage; e) design revision stage; f) product trial stage, g) product revision stage; h) final product stage. The material in the LKPD consists of three sub-materials, namely: a) soil pollution; b) water pollution; c) air pollution. At the end of the material there are questions that lead students to think critically. The product was validated by three validators, namely, linguists with a percentage of 90% (very feasible), material experts with a percentage of 88% (very feasible), and media/design experts with a percentage of 88.2% (very feasible). The results of student respondents to module teaching materials with a percentage of 86, 83% (very practical), the results of teacher respondents showed a percentage of 87% (very practical) it can be concluded that the developed module has a practical category and is suitable for use.

Keywords: Critical Thinking, Feasibility and Practicality, Science Student Worksheet, Socio-Scientific Issues,

1. Introduction

Education is a process to increase, improve, change the knowledge, skills, attitudes and behavior of a person or group of people in an effort to educate human life through teaching and training activities (Ratcliffe & Grace, 2003). In its development, the term education means guidance or help given deliberately to students by adults so that they become adults (Richey & Klein, 2014).

The process shows the existence of activity in the form of active action, where there is an interaction that is dynamic and carried out consciously in an effort to achieve the desired goal. Because educational actions are active and planned, education is an act or conscious action in order to change attitudes and behavior that is expected, namely human beings who are intelligent, skilled, independent, disciplined and have noble character (Bishop & Glynn, 2003).

In this era of globalization, there is a need for high-quality human resources to be able to develop the potential that exists within themselves. Science education can prepare individuals to improve their quality of life; besides that, science education can also guide students to think critically (Holmlund et al., 2018; Yılmaz & Malone, 2020). Science learning in schools is closely related to the systematic process of finding out about nature, so science is considered learning in the form of a discovery process (Dani & Donnelly, 2021). An educator occupies an important role in managing learning activities, both in the classroom and outside the classroom, so that the objectives of education can be achieved in accordance with what has been expected from the objectives of national education (Nafiqoh & Wulansuci, 2021).

Science and technology are developing rapidly, and the learning process in the classroom is no longer controlled by educators. Learners can learn from anywhere in the classroom, outside the classroom, and at home. Therefore, educators are required to be able to design learning so that the learning process can take place effectively and efficiently by utilizing one of them, namely learning media (Levinson, 2018).

Learning media can be defined as anything that is used to channel messages and can stimulate the thoughts, feelings, attention, and willingness of students so as to encourage the occurrence of a deliberate learning process. Some learning media are human-based media, visual-based media, audio-visual-based media, computer-based media, and print-based media. The media that will be developed by researchers is in the form of print (Ummah & Rifai, 2020).

Print media is a grouping of types of teaching materials consisting of handouts, student worksheets, self-study materials, and materials for group study. Teaching materials are all forms of materials used to assist teachers/instructors in carrying out teaching and learning activities in the classroom (Munadi, 2008). The material in question can be written or unwritten material. In other words, teaching materials are learning tools or means that contain material, methods, boundaries, and ways to evaluate which are systematically designed and attractive to achieve the expected competencies. Teaching materials will reduce the burden on teachers in presenting material (face-to-face), so that teachers have more time to guide and assist students in the learning process. Teaching materials are useful to assist educators in carrying out learning activities (Wiji, 2017).

Here, the researcher will develop one of the printed teaching materials to make it easier for teachers to educate students both at school and at home. There are several types of printed teaching materials images, for example: handouts, textbooks, modules, student worksheets (LKPD), brochures, photos / images and many others. Researchers are interested in developing student worksheets (LKPD) that can be used by students to gain insight both at school and at home (Hairida & Setyaningrum, 2020).

Hairida & Setyaningrum (2020) stated that the Learner Activity Sheet (LKPD) is one of the right learning alternatives for students because LKPD helps students add information about the concepts learned through systematic learning activities.

Student worksheets are one of the most frequently used materials in the learning process at school. Thus, to foster critical thinking skills, it is necessary to improve the learning process through teaching material based on socio-scientific issues so that students can have competencies that will be optimally achieved (Rahayu, 2017).

Socio-Scientific Issues (SSI) are new to Indonesia, so SSI-based teaching materials are difficult to find (Dolan et al., 2011; Sadler & Zeidler, 2009). Socio-Scientific Issues take problems, issues, information, or news that are in the community environment and stimulate students to debate and solve a problem (Sadler & Zeidler, 2005; Zeidler et al., 2005). Socio-scientific issues are representations of issues in society that relate to science in social aspects. SSI gives learners the role of thinking like scientists in solving social issues in society (Chang, 2020; Fensham, 2018; Levinson, 2018).

The application of SSI in learning is the main step in fostering learners' critical thinking, which emphasizes the application of scientific reasoning. As well as helping learners transfer content knowledge and skills to their lives in modern times, based on the results of previous research, SSI has the potential to be used as the basis for science learning in schools (Lee & Witz, 2009; Levinson, 2018). One of the materials debated in the current environment is environmental pollution, where many humans are not aware of the dangers of pollution. The impacts of environmental pollution are many, for example, air pollution from smoke, water pollution from garbage and household waste, soil pollution from mining residues such as mercury and nuclear waste, and many more. All of this puts pressure on human health psychologically, biologically, economically, and ecologically. It is hoped that the Socio-Scientific Issues (SSI) learning model is able to foster the critical thinking of students in the 21st century.

Critical thinking is currently one of the life skills that need to be developed through the education process. Through the ability to think, a person will be able to scrutinize and find solutions to all the problems faced in his life. Therefore, during the industrial revolution 4.0, thinking skills became essential skills that must be possessed by every graduate at every level of education. Critical thinking skills are fundamental to solving problems. This skill is important for students to have in finding the source of the problem and how to find the right solution to the problem at hand. Critical thinking skills can be instilled in various disciplines (Mu'Minah & Aripin, 2019; Scott, 2015; Sengul, 2019).

The results of initial observations that researchers found in 4 schools out of a total of 25 public junior high schools in Bengkulu City showed that the student worksheets (LKPD) used by teachers in the first school found LKPD data that had an activity title component only. In the second school, the student worksheets (LKPD) used by teachers have components of activity titles, objectives, tools and materials, work procedures, data tables, and discussion materials. Furthermore, in the third school, the student worksheets (LKPD) used by teachers have components of activity titles, objectives, tools and materials, work procedures, and discussion materials. In the fourth grade, there were components of student worksheets

(LKPD) that had activity titles, objectives, tools and materials, work procedures, and discussion materials. From the data above, there are still weaknesses in the components of LKPD in 4 schools where researchers conducted initial field studies. So the researcher concluded that it was still necessary to develop LKPD by developing students' critical thinking skills.

The results of preliminary observations show that teachers only use conventional teaching materials and use student worksheets (LKPD), which have not fulfilled all the components of LKPD. Besides that, the LKPD used by teachers has not been effective in fostering students' critical thinking skills. Here, researchers are interested in applying it at SMPN 19 Bengkulu City because the school situation is close to the Pelindo II PLTU project Bai Island Bengkulu in accordance with the environmental pollution material to be studied. Considering the background mentioned above, the researcher is eager to begin research by raising the title Feasibility and Practicality of Socio-Scientific Issues Based Student Activity Sheets (LKPD) on Pollution Material to Foster Critical Thinking Abilities Class VII Junior High School Students.

2. Method

The development model used is the Research and Development (R&D) method. R&D is a research method used to produce certain products and test the effectiveness of these products (Sugiyono, 2014).To be able to produce certain products, research is used to analyze the needs and test the effectiveness of these products so that they can function in the wider community.

The research procedure that will be used by researchers is the Borg & Gall development model developed by Sugiyono. Research and development, according to Borg and Gall (1983), is a process used to develop and validate educational products (Sukmadinata, 2017). The stages of the research and development process usually form a consistent cycle to produce a certain product according to needs, through the steps of initial product design, initial product trials to find various weaknesses, retesting, and improvement until finally a product is found that is considered ideal. According to Borg and Gall, the research and development (R&D) approach in education includes ten steps.

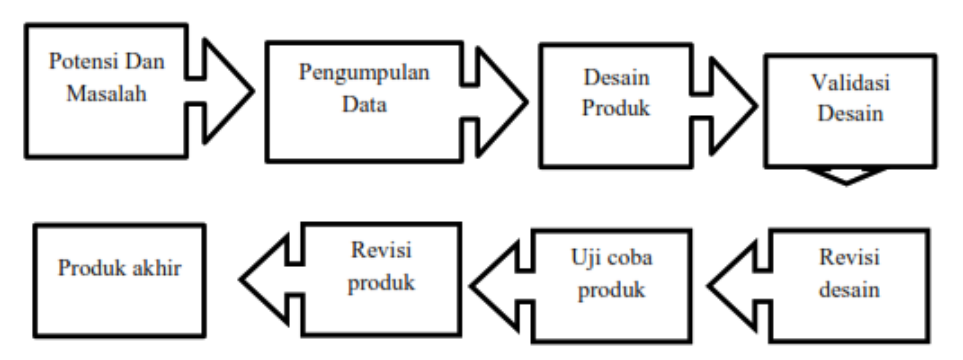


Figure 1. The steps of the R&D method have been adjusted by the researcher.

According to Sugiyono (2014), the position and amount of data collection in research and development will depend on the level of research. as has been stated methodologically design at level 1 researchers research without testing, not testing the product widely. The research and development procedure is simplified to 8 steps due to time and cost constraints, so that these steps are simplified by researchers only until the development stage does not include trials of use and mass production.

1. Potential and Problems

Research can depart from the existence of potential or problems. Potential is everything that, when empowered, will be useful so that it has added value. A problem is something that is expected to be different from what happens. Potential and problems raised in research must be shown with empirical data. Data on potentials and problems does not have to be searched for themselves but can be based on other people's research reports or documentation of activity reports from certain individuals or agencies that are still up-to-date.

Learning in SMP Negeri Kota Bengkulu is carried out online. The LKPD used is still less interesting and still not in accordance with the predetermined components, then the existing LKPD has not fostered critical thinking of students, the presentation of material in the LKPD is still unable to attract students' learning power so that the existing material feels ordinary, even students feel bored in studying LKPD which is difficult for students to understand. Therefore, the researchers want to develop LKPD that has an attractive appearance and illustrations.

2. Collecting Data

Researchers collected data by conducting initial observations at 4 Junior High School of Bengkulu City, observation in the form of asking the teacher's LKPD to be a sample in the development of existing LKPDs by taking seventh grade science subjects on environmental pollution material. Data collection in the first stage is carried out when researchers conduct research to explore the potential and problems that exist in the object under study.

3. Product Design

LKPD based on Socio Scientific Issues (SSI) is designed with an attractive appearance and raises the theme of environmental pollution. The following is the cover design for making LKPD:

Figure 2. Cover Frame and Layout of LKPD content

4. Design Validation

Design validation is validated by media experts to determine whether or not the media used is feasible. Judging from the material and design aspects. Product validation can be done by presenting several experienced experts or experts to assess the new product designed.

The validator selection criteria are based on input from the supervisor and consider the validator's expertise in the fields of material, media, and language. The validators chosen are 3 IAIN Bengkulu City lecturers in their respective fields, namely: Mrs. Munawaroh, M.P.D., as a material expert; Mrs. Nurlia Latipah, M.P.D., as a media expert; and Mr. Vebby Andra, M.P.D., as a language expert. The questionnaire grid for validators can be presented as the following table.

Table. 1 Media Validation Questionnaire Grid

Criteria	Assessment Indicator	Question Number
Quality of LKPD	Size	1, 2
	Design	3, 4, 5, 6, 7
	Content design	8, 9, 10, 11, 12, 13, 14, 15

Table. 2 Language Validation Questionnaire Grid

Criteria	Assessment Indicator	Question Number
Language quality in LKPD	Straightforwardness	1, 2, 3
	Communicative	4
	Usage, Terms, Symbols and icons	5, 6
	Conformity with learner development	7, 8
	Conformity with language rules	9, 10

Table. 3 Material Validation Questionnaire Grid

Criteria	Assessment Indicator	Question Number
Quality of Material in the LKPD	Suitability of material with SK and KD	1, 2, 3
	Quality of Content	4, 5, 6, 7, 8
	Presentation	9, 10, 11
	Accuracy of Material	12, 13, 14, 15

5. Design Revision

After the product design is validated through discussions with experts and other experts, the weaknesses will be known. The weaknesses are then tried to be reduced by means of research that will produce the desired product.

6. Product Trial

After revising the design, the product will be field tested The product will be tested at SMPN 19 Bengkulu City with a trial of 10 students (a small-scale trial).

Testing using quantitative methods: in this step, a student response questionnaire is used and a test is used to get the critical thinking of students This trial was conducted to determine the weaknesses and advantages of the shortcomings in the media.

The Student Worksheet (LKPD) made is an effort from the researcher to solve the problem in the formulation of the researcher's problem. Of course, the research subject, namely the teacher and students themselves, must assess the practicality of the LKPD that has been made. The practicality questionnaire contains student responses to ease of use, learning time efficiency, attractiveness, and usefulness. The questionnaire grids to measure teacher and student responses are presented in the following table.

Table. 4 Teacher response questionnaire grid

Criteria	Assessment Indicator	Question Number
Teacher Response	Interest	1, 2, 3, 4, 5, 6, 7, 8, 13, 14, 15, 16, 17
	Display of LKPD	12, 10, 18
	Material	9

Table. 5 Student response questionnaire grid

Criteria	Assessment Indicator	Question Number
Student Response	Interest	1, 2, 3, 4, 5, 6, 7, 8, 9, 13, 14, 15, 16
	Display of LKPD	12, 10
	Material	17

7. Product Revision

After the product is used, if there are still weaknesses, it needs to be revised. In the main field testing, opinions from users are prioritized as material for revision.

8. Final Product

The final product is the result of development based on the assessment of media experts, linguists, and material experts. As well as the teacher's response to using the media.

In the process of analyzing feasibility data, researchers made a validation bar containing statements. Then the validator filled out the questionnaire by checking the categories provided by the researcher based on a Likert scale consisting of 5 assessment scores as follows:

Table. 6 Expert Validation Assessment Score

Description	Score
Very good	5
Good	4
Fair	3
Less	2
Very Less	1

The validation results that have been listed in the LKPD validation form will be analyzed using the following formula:

$$P = \frac{f}{N} \, x \, 100\%$$

Description:
P = Percentage number of questionnaire data
f = Number of scores obtained
N = Total maximum score

Furthermore, the percentage of feasibility obtained is then interpreted into categories based on the following table:

Table. 7 Feasibility Criteria

Description	Score
81≤ P ≤ 100%	Very Feasible
61≤ P < 80%	Feasible
41≤ P < 61%	Fairly Feasible
21≤ P < 41%	Not Feasible
0≤ P < 20%	Very Not Feasible

Teaching materials in the form of LKPD based on socio-scientific issues are declared theoretically feasible if the percentage of feasibility is ≥ 51% (Gunawan, 2022).

To measure the practicality of LKPD teaching materials, it is evident from the results of the analysis of teacher and student response questionnaires by category based on the Likert scale, which consists of 5 assessments as follows,

Table. 8 Category on Practicality Questionnaire

Description	Score
Strongly agree (SS)	5
Agree (S)	4
Less agree (KS)	3
Disagree (TS)	2
Strongly disagree (STS)	1

The results of the teacher and learner response questionnaires will be analyzed using the following formula,

$$P = \frac{f}{N} \, x \, 100\%$$

Description:
P = Percentage number of questionnaire data
f = Number of scores obtained
N = Total maximum score

Furthermore, the percentage results obtained are grouped into the criteria for the results of the data above so that a conclusion can be drawn about the response of the teachers and students, as follows

Table. 9 Teacher and Learner Response Practicality Criteria

Description	Score
81≤ P ≤ 100%	Very practical
61≤ P < 80%	Practical
41≤ P < 61%	Fair
21≤ P < 41%	Less Practical
0≤ P < 20%	Very Not practical

Teaching materials in the form of LKPD based on socio-scientific issues are declared theoretically practical if the percentage of feasibility is ≥ 51%.

3. Result and Discussion

This research and development aims to develop a socio-scientific issue-based student worksheet (LKPD) in science learning to foster critical thinking skills of seventh grade students of SMP Negeri 19 Bengkulu City. The developed LKPD is declared feasible to use based on the results of the validation assessment of media experts, linguists, and material experts, the results of teacher practicality tests, and student responses.

The procedure for making products starts with analyzing the initial information obtained by researchers in the field, where the LKPD has not fulfilled all LKPD components. After that, design and development are then validated by validators and assessed by respondents, namely teachers and students of SMP Negeri 19 Bengkulu City, class VII. validated by validators and then assessed by respondents, namely teachers and students of SMP Negeri 19 Bengkulu City, class VII, as the main subject of LKPD users.

Results of Research Analysis and Collecting Initial Information

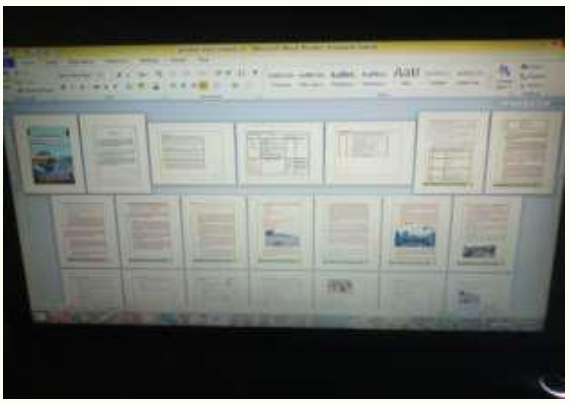
The results of initial observations that researchers found in 4 schools out of a total of 25 public junior high schools in Bengkulu City showed that the student worksheets (LKPD) used by teachers in the first school found LKPD data that had an activity title component only. In the second school, the learner worksheets (LKPD) used by teachers have components of activity titles, objectives, tools and materials, work procedures, data tables, and discussion materials. In the third school, the learner worksheets (LKPD) used by teachers have components of activity titles, objectives, tools and materials, work procedures, and discussion materials. In the fourth school, the components of the learner workbook (LKPD) that had the title of the activity, objectives, tools and materials, work procedures, and discussion materials were found. From the data above, there are still weaknesses in the components of the LKPD in the 4 schools where researchers conducted initial field studies. So the researcher concludes that it is still necessary to develop LKPD with the critical thinking skills of students.

Results of Initial Product Design and Development

The subject matter in this LKPD is environmental pollution material for VII grade junior high school students, the first step in making LKPD is to find materials and materials. The sources of materials in this LKPD can be seen in the following table,

Table. 10 Steps for Design and Development of LKPD

Steps	Details of Activities Performed	Result Display
Determination of the LKPD color palette	The determination of the color palette in the LKPD is adjusted to the level of student interest and the material discussed. Contrast and cheerful colors are chosen by the author for the contents of the LKPD	
LKPD content design	LKPD content design is designed in advance, starting from the initial page until completion, in order to facilitate the work of the layout in the editing process later	 
Layout design	Working on layout design (layout) can be done after getting LKPD components and materials, determining the color in the LKPD design (Pallette), and LKPD content design. In order to make the reading arrangement more neat and interesting. In the process of preparing the layout, including determining the paper or print media to be used, determining the margins (New Guide Layout) of 2 cm, determining the font and point letters used, and	

	determining the layout of images and letters	
Making LKPD products	The applications used in making LKPD are Microsoft Word 2010 and the Pixellab application. The steps are as follows: a) Checking the material that has been obtained and correcting the wrong writing (Microsoft Word 2010); b) The next step is to export the file to the PixelLab application. The next step is to export the file to the PixelLab application; c) edit the layout of images and write on A4 media (Pixellab); d) put the file into one document in Microsoft Word	

After the initial design of LKPD teaching materials has been developed, the next step is to conduct validity (feasibility) and practicality tests. At the test stage, the validator provides criticism and suggestions for the LKPD using an assessment questionnaire. To validate the feasibility of LKPD, there are three validators who are lecturers who are experts in their fields. Including language validation (Vebby Andra, M.Pd), material validation (Munawaroh, M.Pd), and design validation (Nurlia Latipah, M.Pd).

The validation results from the three validators can be presented in the following table:

Table. 11 Validation Results from Media, Language and Material Validators

Validator	Number of Items	Ideal Score	Score Obtained	Percentage (%)	Qualification
Media	17	85	75	88,2	Very feasible
Language	6	30	27	90	Very feasible
Material	15	75	66	88	Very feasible

Based on the validator's assessment, the LKPD developed by researchers in terms of language 90%, material 88%, and media 88.2% is very feasible to use. This is based on the interpretation scale of the LKPD feasibility assessment score of 81 < P < 100%, which is classified as teaching materials that are very feasible to use. Thus, based on these feasibility indicators, it is said to be valid and very feasible to apply because it is in the score range of 81<P<100%. This percentage indicates that the media developed can be used in accordance with the revisions of the experts.

The practicality of the socio-scientific issues-based LKPD is obtained from the responses of students and teachers using a questionnaire sheet. This practicality test refers to the condition of the learning LKPD developed and whether it can be easily understood by students so that the learning carried out is meaningful, interesting, fun, and useful for their lives and can increase their creativity in

learning. The practicality test of LKPD products was carried out using the small-scale method. The research subjects in this response test involved 10 7th grade students and one 7th grade science teacher. Based on the data from the analysis of teacher and student responses to the practicality of the LKPD, it is listed in the table below.

Table. 12 Practicality Test Results from Teacher and Student Response

Respondents	Maximum Score	Score Obtained	Percentage (%)	Qualification
Teacher	100	87	87	Very practical
Students	600	521	86,83	Very practical

Based on the data above, it can be concluded that the LKPD developed by researchers is practical for use by junior high school students in grade VII. From the response questionnaire filled in by the teacher, the average value of practicality is 86.83%, with a very practical category. Meanwhile, from the response questionnaire filled in by students, the average value of practicality is 87%, with a very practical category. The practicality test of an LKPD is very important before it is applied in the learning process. This is in line with Nieveen's statement, which states that the quality of development products must be practical in the sense that learning media must be easily used by students so that learning objectives can be achieved in accordance with the expected goals (Marks et al., 2014).

The resulting LKPD is based on socio-scientific issues on environmental pollution material. LKPD is based on socio-scientific issues, namely issues that are complex and controversial with scientific ideas and principles, which can be interpreted as a case-based approach and context-based learning (Evagorou, 2020).

In the application of socio-scientific issue-based learning, it is very necessary for teachers and school staff to support the socio-scientific issue curriculum approach. In making LKPD, researchers see and hear viral social issues that are related to environmental science material, namely the case of turtle deaths in Teluk Sepang allegedly due to the Bai Island PLTU, which discharges PLTU waste. Before getting environmental science material, researchers analyze it from the SSI indicator itself.

LKPDs made by researchers are expected to foster critical thinking of students, especially class VII junior high school, where the exercise questions have been designed in such a way by looking at the indicators of critical thinking and input from IAIN Bengkulu lecturers, while the indicators according to Facione include interpretation, analysis, evaluation, inference, explanation, and self regulation.

LKPDs made by researchers also do not escape the components that must be in the LKPD; the material and questions are designed in detail so that students can easily understand them. LKPD Components: LKPD Number, Activity Title, Objectives, Tools and Materials, Work Procedures, Data Tables, Discussion Materials. In the choice of colors and images for LKPD, researchers match the existing theme so that they change the design several times and then get the appropriate color.

4. Conclusion

Based on the results and discussion of this research and development, it can be concluded that the socio-scientific issue-based LKPD in science learning to foster the critical thinking skills of 7th grade junior high school students was developed through stages 1) the potential and problem stage; 2) data collection; 3) product design stage; 4) design validation stage; 5) design revision stage; 6) product trial stage; 7) product revision stage; 8) final product stage. The results of the feasibility validation test conducted by three validators, namely, language experts with a percentage of 90% (very feasible), material experts with a percentage of 88% (very feasible), and media/design experts with a percentage of 88.2% (very feasible),. The results of the practicality test obtained the results of student respondents to LKPD teaching materials with a percentage of 86.83% (very practical); the results of teacher respondents showed a percentage of 87% (very practical). Through these results it can be concluded that the developed LKPD has a practical category and is suitable for use in the process of learning activities.

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