



Development of Practicum Worksheet on Project Based Learning on Environmental Pollution Material

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Abstract

Problems that are often experienced in learning Environment Pollution material is the lack of participation of learners in the formation his knowledge, this is due to the learning provided only limited to theory without utilizing laboratory facilities for activities practicum. In addition, the teaching materials used are less able to hook material with contextual phenomena in everyday life, so that lack of opportunities for learners to conduct investigations. This research aims to develop practicum worksheet on Project Based Learning on environmental pollution material. The research method used is Research and Development (R&D). The preparation of practicum worksheet uses the ADDIE model, but in this study only focuses on the ADD (Analysis, Design, and Development) stage. Practicum worksheet design that has been prepared before being tested is measured for quality through validation activities by material experts and media experts. Validation was carried out by 2 material experts and 2 media experts, in this case lecturers from PGRI Semarang University. The final average score of validation results by material experts was 92.36% and media experts was 90.33%. This value included in the very valid category, so that the practicum worksheet that has been prepared is suitable for use in learning Environmental Pollution material.

How to Cite

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INTRODUCTION

In the science learning process, students are emphasized on strengthening the learning process not only for product mastery, but also mastery of process skills and scientific attitudes. Learning that is oriented to the activities of students by discovering for themselves a material concept using a scientific approach can create students who have the skills needed in the 21st century. Science process skills are learning approaches that can be developed through direct experiences as learning experiences (Hariningwang, 2020). One strategy in developing science process skills is through learning that can provide direct learning experiences to students. By developing science process skills, students will be able to find and develop their own facts and concepts of material.

Biology learning is often faced with various problems, one of which is that teachers convey more material concepts directly, so that students are less actively involved in the process of finding and forming their own understanding (Saputra, 2019). The results of the research of Arestu *et al.*, (2018) shows that the problem often experienced by teachers in learning environmental pollution material is the lack of ability of students to solve problems, this is caused by the learning provided is only limited to theory without providing opportunities for students to form their own understanding concepts. In learning, teachers tend to use learning media as a tool in the learning process of students (Nurwahyunani & Agustina, 2022). The use of inappropriate teaching materials is one of the obstacles that teachers often experience in delivering material. Teaching materials do not associate the material with contextual phenomena in everyday life. Teachers have so far only used worksheets from textbooks. This causes learning activities in worksheets to be less varied because educators only direct to record the reading on the worksheet, and in working on the questions students only observe the Figures on the worksheet and then answer the existing questions (Ariana *et al.*, 2022). The selection of the right teaching materials can foster student interest during learning (Hanifa *et al.*, 2018).

Practicum worksheet is a learning tool containing work steps that can be used as a guideline for students to rejuvenate in carrying out practicum activities (Hariningwang & Fitrihidajati, 2020). Practicum activities can make it easier for students to understand material concepts, foster and develop interest in learning science, and can foster a scientific attitude (Roza & Chania,

2018). Practicum worksheets can be an aid for students to be more active in the learning process, practicum worksheets are used as a guide for students to be able to learn independently (Khotimah *et al.*, 2023). Project-based learning is able to support learning recovery due to learning loss in character development (Rachmawati *et al.*, 2022). Project learning is considered important in character development because it can provide opportunities for students to learn through direct experience (experimental learning). The concept of the project learning model is student-centered and departs from a background problem to work on a project or real activity that will make students experience various contextual obstacles, so they must investigate and solve problems to be able to achieve the expected competencies.

A good practicum worksheet must meet the writing criteria and have appropriate components or structures. In general, the components in practicum worksheet consist of activity titles, classes, materials in accordance with basic competencies, learning objectives, tools and materials used, work procedures to be carried out, observation data tables, and discussion materials (Kartiani, 2014). The preparation of practicum worksheet must also pay attention to several stages, namely curriculum analysis, compiling practicum worksheet needs, determining the title of practicum worksheet, and writing practicum worksheet (Prastowo, 2013). Practicum worksheets that are made systematically can help students to learn more actively independently or in groups (Ariana *et al.*, 2022).

This research aims to develop practicum worksheet on Project Based Learning (PjBL) on environmental pollution material.

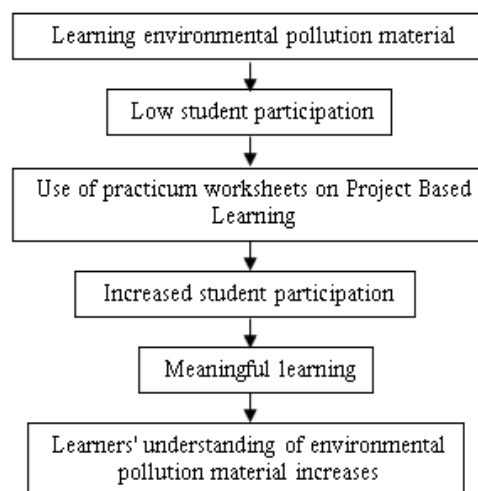


Figure 1. Conceptual framework

METHOD

This research will be conducted in April 2023 at PGRI University Semarang. The research method used is Research and Development. The preparation of practicum worksheet uses the ADDIE model developed by Dick & Carry (1996), but in this study focuses on the ADD (Analysis, Design, and Development) stage because it is an implementation of the results of the research.



Figure 2. ADD model

Techniques in data collection use indirect communication techniques. This data collection technique uses questionnaires. The questionnaire in this study is in the form of a validation assessment sheet for practicum worksheets for material experts and media experts.

The practicum worksheet design that has been prepared before being tested needs to be measured for quality by validation. The validation activity aims to obtain input in the form of criticism, suggestions, and responses from validators on the quality of practicum worksheet that has been developed, so as to find out the conformity of practicum worksheet with predetermined standards.

The validation instrument used is a questionnaire to test product quality from the aspect of material and media. The questionnaire is arranged in the form of a Linkert scale with a score level of 1-4 each aspect. The calculation of questionnaire value data is analyzed on a scale (%) using the following formula:

$$P = (\text{earned value}) / (\text{maximum value}) \times 100\%$$

The value obtained is then adjusted to a theory in which the evaluation state and evaluation results of the product reach the appropriate word (Agustin, 2018). Assessment criteria of LKPD can be seen in **Table 1**.

Table 1. Assessment criteria of LKPD

Interval (%)	Information
81 - 100	Worth using (no revision)
61 - 80	Worth using (revision < 25%)
41 - 60	Worth using (revision < 50%)
21 - 40	Worth using (revision < 75%)
0 - 20	Not worth using

Source: Roza & Chania (2018)

RESULTS AND DISCUSSION

The preparation of practicum worksheet on Project Based Learning (PjBL) was carried out using the ADDIE model developed by Dick & Carry (1996), but in this study only focused on the ADD (Analysis, Design, and Development) stage.

Analysis Phase

At this stage, researchers conduct an analysis of the needs and character of students, as well as the type of curriculum that applies. Needs analysis is carried out to determine the state of teaching materials needed by students and how much material is needed in the preparation of practicum worksheet, in this case, Environmental Pollution material. As has been conveyed on the background that the problem that is often experienced by students in the learning process of Environmental Pollution material is the lack of ability of teaching materials in associating material with contextual phenomena in everyday life, so that students have difficulty in forming their own knowledge concepts.

Then a character analysis is carried out to find out how students behave in the learning process, so that the practicum worksheet that is compiled later can be in accordance with the character of students. In learning Environmental Pollution material, students are less actively involved in the process of forming knowledge, so the practicum worksheet that is developed must be able to involve the role of students actively, namely through project practicum activities.

Curriculum analysis is carried out by paying attention to the characteristics of the curriculum used, so that the development of practicum worksheet can be in accordance with the demands of the applicable curriculum. In this study, practicum worksheet was developed in accordance with the Independent Curriculum Phase E, namely students are expected to be able to have the ability to create solutions to problems based on national and global issues related to environmental change.

Design Phase

This stage is the realization of the results of the analysis that has been carried out by the researcher. The practicum worksheet developed will be designed as effectively as possible in order to facilitate students in the learning process. The application of Project Based Learning (PjBL) syntax in practicum worksheet is as follows:

Start with essential question.

Take a topic that fits the realities of the real world and start with an in-depth investigation. Essential questions, asked to provoke knowledge, responses, criticisms and ideas of learners regarding the theme of the project to be raised (Sartika, 2022). At this stage, practicum worksheet presents an essential question to lead students' opinions regarding problems to be discussed and solutions are sought through project activities. Learning begins with essential questions, which are questions that can assign students to do an activity (Afriana, 2015). The basic questions are contained in the activities "Find Out Let's Find Out" and "You Know No".

Design project.

Planning contains the rules of the game, the selection of activities that can support in answering essential questions, by integrating various possible subjects, and knowing the tools and materials that can be accessed to help complete the project (Sartika, 2022). At this stage, in practicum worksheet directions are presented to students to design a project activity in solving environmental problems. Planning contains the rules of the game, the selection of activities that can support in answering important questions, by integrating various possible materials, and knowing the tools and materials that can be accessed to help complete the project (Afriana, 2015). The direction is presented in the activity "Time for Practice".

Create schedule.

Teacher and student collaboratively develop a schedule of activities to complete projects. This schedule is prepared to find out how long it will take to work on the project (Sartika, 2022). At this stage, in practicum worksheet directions are presented to students to design a schedule for the implementation of project tasks that have been prepared in an effort to solve environmental problems. Activities at this stage include creating a schedule for completing the project and determining the end time for project completion (Afriana, 2015).

Monitoring the student and progress of project.

The teacher is responsible for monitoring the activities of students during the completion of the project. Monitoring is carried out by facilitating students in each process (Sartika, 2022). At this stage, the practicum worksheet presents a logbook of project progress that can be used as

material for monitoring student performance during project completion. Monitoring carried out by facilitating students in each process (Afriana, 2015).

Asses the outcome.

Assessment is carried out to assist educators in measuring the achievement of standards, play a role in evaluating the progress of each student, provide feedback on the level of understanding that has been achieved by students, assist educators in developing the next learning strategy (Sartika, 2022). Assessment is carried out to assist teachers in evaluating the progress of each student, and assist teachers in developing the next learning strategy (Afriana, 2015). At this stage, in practicum worksheet directions are presented to students to carry out experimental activities in accordance with the project design that has been prepared previously. An "Observation Table" is presented to record experimental results.

Evaluation the experience.

At the end of the learning process, educators and students reflect on the activities and results of projects that have been carried out. The reflection process is carried out both individually and in groups. At this stage learners are asked to express their feelings and experiences during the completion of the project (Sartika, 2022). At the end of the learning process, teachers and students reflect on the activities and results of projects that have been carried out (Afriana, 2015). At this stage, in practicum worksheet directions are presented to students to compile final reports of projects and enrichment questions are presented as reflection and evaluation.

Development Phase

At this stage, the practicum worksheet design that has been prepared before being tested needs to be measured for quality through validation activities by material experts and media experts. The validation activity aims to obtain input in the form of criticism, suggestions, and responses from validators on the quality of the practicum worksheet that has been prepared, so that they can find out the conformity of the practicum worksheet with predetermined standards. Validation was carried out by 2 material experts and 2 media experts at PGRI Semarang University. Validation instruments can be seen at **Figure 3** and **Figure 4**.

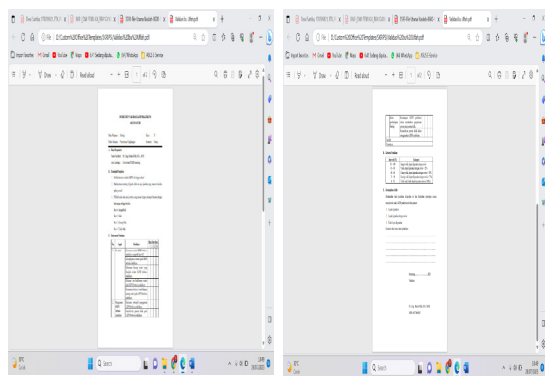


Figure 3. Material expert validation instruments

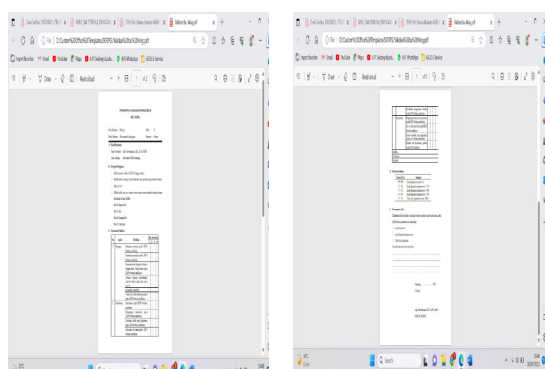


Figure 4. Media expert validation instruments

The results of material expert validation can be seen in **Table 2**.

Table 2. Material expert validation results

Validator	Validation 1	Validation 2	Average
Validator 1	80,56%	100%	90,28%
Validator 2	94,44%	-	94,44%
Total			92,36%

Details of material expert validation can be seen in **Table 3**.

In the material aspect, revisions were made by adding material on Bioremediation and adding research documentation as an illustration of material in practicum worksheet.

In the aspect of use, revisions are carried out by adding activities that spur process experience.

The results of media expert validation can be seen in **Table 4**.

Table 3. Details of material validation

Validator	Validation 1	Validation 2
1	Worth using with a 25% revision: Add instructions for using practicum worksheet. List the approach and learning model used. Add material enrichment about practicum worksheet. Add enrichment questions at the end of practicum activities Add an assessment instrument to the enrichment problem.	Worth using without revision
2	Worth using without revision	-

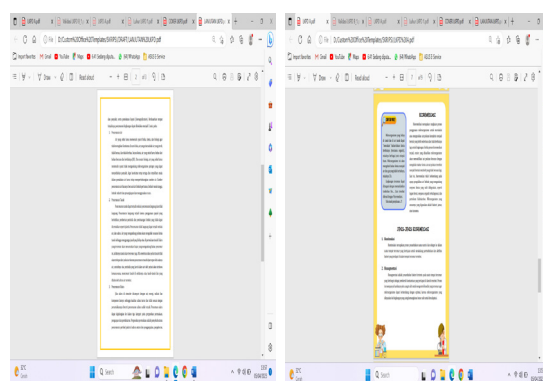


Figure 5. Practicum worksheet material

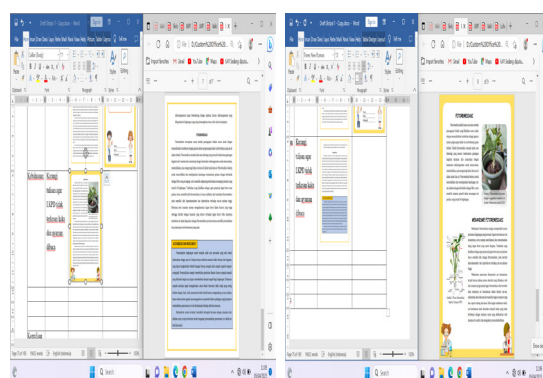
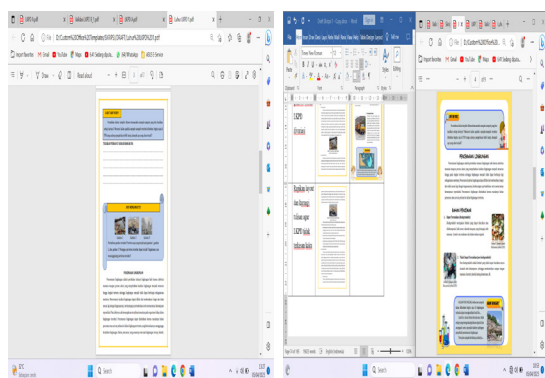
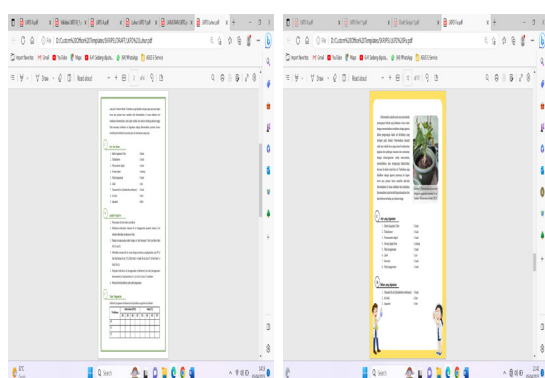


Figure 6. Material illustration



Before validation

After validation

Figure 7. Activities in practicum worksheet


Before validation

After validation

Figure 8. Writing tools and materials

Table 4. Media expert validation results

Validator	Validation 1	Validation 2	Average
Validator 1	85%	93%	89%
Validator 2	91,67%	-	91,67%
Total			90,33%

Details of media expert validation can be seen in Table 5.

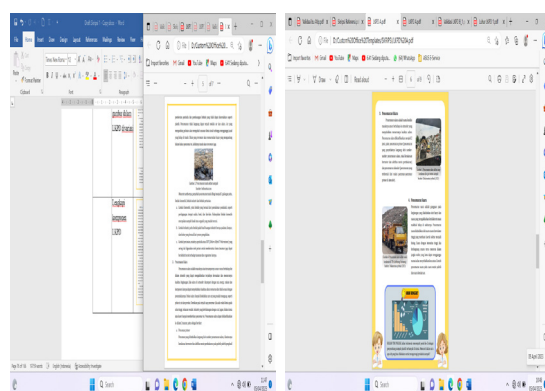
In a Presentation spec, a revision of the layout of the presentation of images and practicum worksheet components is carried out.

In the Linguistic aspect, revisions were made by reducing the writing so that practicum worksheet did not seem stiff and more comfortable to read.

In the Graphic aspect, revisions were made to the practicum worksheet layout which included font type and size, spacing, and display design so that the practicum worksheet did not seem full.

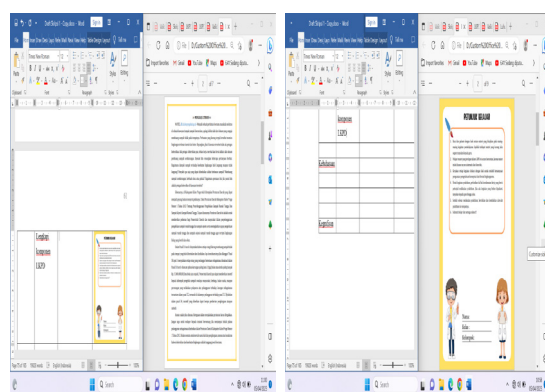
Table 5. Details of media validation

Validator	Revised aspects	
	Validation 1	Validation 2
1	Worth using with a 25% revision: Complete the components on the practicum worksheet. Tidy up the layout of the practicum worksheet. Use images from personal documentation. Add points that students must write in the discussion section. Add an assessment rubik's	Worth using without revision
2	Worth using without revision	-



Before validation

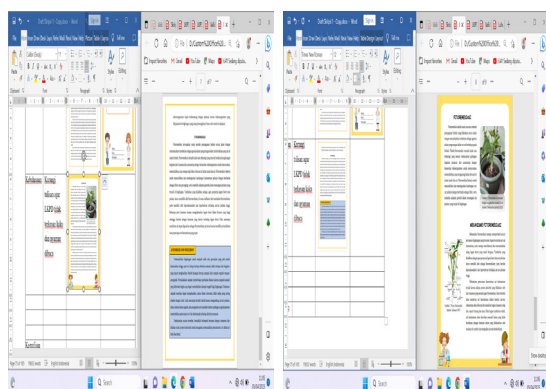
After validation

Figure 9. Image presentation layout


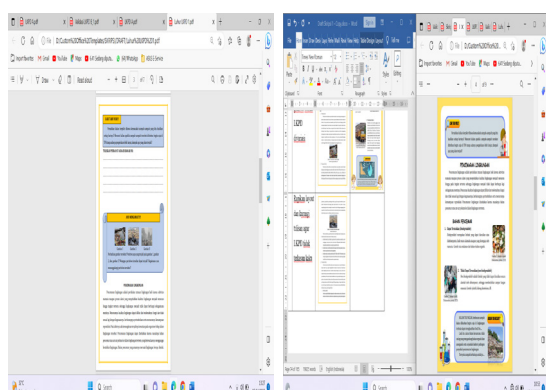
Before validation

After validation

Figure 10. Components of practicum worksheet



Before validation After validation
Figure 11. Language of practicum worksheet



Before validation After validation
Figure 12. Layout of practicum worksheet

The improvement of practicum worksheet is adjusted to the suggestions and inputs that have been given by expert validators. The final average score of validation results by material experts was 92.36% and media experts was 90.33%. This value is included in the very valid category, so that the practicum worksheet that has been prepared is suitable for use in class X Biology learning on Environmental Pollution material.

CONSLUSION

The preparation of practicum worksheet on Project Based Learning (PjBL) was carried out using the ADDIE model, but in this study only focused on the ADD (Analysis, Design, and Development) stage.

The results of validation by material experts were 92.36% and validation by media experts was 90.33%. This value is included in the very valid category, so that the practicum worksheet that has been prepared is suitable for use in learning Environmental Pollution material.

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