

Article

Profile of Student Achievement Through PBL-Based Sound Wave Worksheets

Azrul Hamidi^{1,*}, Danang Habib Pratama¹, Jumadi¹, Sabar Nurohman¹

¹ Department of Science Education Master Program, Universitas Negeri Yogyakarta, Yogyakarta, Indonesia;
azrulhamidi.2022@student.uny.ac.id; dananghabib.2022@student.uny.ac.id; jumadi@uny.ac.id;
sabar_nurohman@uny.ac.id

* Correspondence

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Abstract: The purpose of this project is to create sound wave worksheets based on PBL that will enhance class VIII students' learning results. The development of the LKPD that was carried out obtained the result that the PBL-based sound wave LKPD was feasible to use to improve student learning outcomes. This study has a one-group posttest-only design and is a quasi-experimental investigation. The field test was carried out at SMP Negeri 24 Padang class VIII obtained the result that LKPD could improve student learning outcomes. Data analysis using SPSS 25 One Grub Posttest-Only Design with Sig. (2-tailed) 0.006. This learning outcome profile can provide an overview of students' understanding of the concept of noise pollution and their ability to identify, analyze, and find solutions to noise pollution problems after going through PBL learning using worksheets.

Keywords: Learning Outcomes; Sound Waves; PBL Models.

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1. Introduction

Science learning involves students in the process of scientific observation. This is in accordance with the nature of science learning which consists of processes, products, and procedures. In this case, the process is important because it provides a meaningful experience for students to build process abilities and skills through experimental activities [1]. Science education is understood as a means for students to study themselves and their environment, as well as prospects for further development in its application in everyday life [2]. Physics is one area of science that examines natural events.

Physics is an important subject in the educational curriculum. Physics is a science that studies natural phenomena and is inseparable from its application in everyday life [3]. To understand students about physical phenomena in real life, it is important to use experiments in learning physics. Students have the option to conduct their own experiments as part of this experiential way of learning, monitor processes, observe objects, analyze, prove and draw their own conclusions about objects, conditions or the course of something. The role of

educators in this experimental method is very important, especially in terms of accuracy and precision so that errors or mistakes do not occur in interpreting experimental activities in the learning process [4]. One way to avoid errors in the experiment is to design worksheets.

LKPD is one of the supporting materials in the form of sheets containing a series of materials that are arranged systematically with the aim of helping students learn well [5]. In physics learning, LKPD is used as a guide for students to carry out experimental activities to solve a given problem [6]. The use of LKPD is effective because students can play an active role in the learning process while the teacher acts as a guide. One of the physics experiments that can be designed using worksheets is the sound wave experiment.

A clean and healthy environment is the dream of all parties, but with the development of technology and science, various impacts arise, one of which is pollution [7]. WHO defines health as a condition of whole physical, mental, and social well-being rather than only the presence or absence of disease. A healthy city is a clean, comfortable, safe and healthy space for workers and the

community. Urban communities are vulnerable to noise pollution, so several policies need to be taken into account for healthy cities [8].

Based on this, it is necessary to develop student worksheets for students to see noise pollution in schools. Students conduct experiments at school and check how many decibels are in the school environment. The learning model used is PBL. PBL, or problem-based learning, is a teaching strategy that teaches students to approach addressing problems in their daily contexts with a positive mindset [9]. So that PBL-based LKPD is a series of materials that are arranged based on problems [10]. In this PBL-based LKPD, students are presented with real and meaningful problem situations according to the context of the topic to enable them to investigate the problem [11]. The hope is that by using the LKPD that has been designed with the PBL model, students are able to provide solutions related to noise pollution problems in the school environment.

2. Methods

This type of research is quasi-experimental. This research was conducted at SMP Negeri 24 Padang. The sample of this research is class VIII. This study used one group posttest only-design. Due to previous study conducted with the same population by other researchers, only one class could be used as a research sample, leading to the selection of this design. Also, among the many available meetings, it is not possible to pre-test.

The target of this research is PBL-based LKPD to improve sound pollution problem-solving skills in the school environment on sound waves for class VIII even semester. One group was given experimental treatment and then the dependent variable was measured (Posttest). Figure 1 shows how the design draft one group only.

With the research hypothesis: Using PBL-Based Sound Wave Worksheets

Statistical Hypothesis:

H_0 : the average value of learning outcomes $\bar{x} \leq 75$ (μ_0)

H_1 : $\bar{x} > 75$

The criteria for rejection of H_0 is the value of $t_{count} > t_{table}$ or the significance value $< \alpha$ (0,05). The KKM in Biology utilized by the school where this research was done, which is 75, was used to determine the criteria value of 75. At a significance level of 95% or $\alpha = 5\% = 0,05$, it indicates whether H_0 is accepted or not.

3. Results and Discussion

This LKPD relates sound wave physics material to sound noise. The designed LKPD is validated based on Didactic, Construction, as well as technical and language aspects. Table 1 explains the indicators of these three aspects.

Based on table 1, there are five educators and practitioners who support the preparation of this LKPD and provide direction and input related to its implementation. LKPD is prepared based on PBL syntax consisting of 5 syntaxes. The following is the LKPD according to the PBL syntax used, as shown in Figure 2 to Figure 5.

Furthermore, the validated LKPD as shown in Figures 2 to 5, was tested in the field. The school used for the field trial was class VIII B of SMP Negeri 24 Padang. The number of students consisted of 31 children. LKPD was tested on Friday, 12 May 2023 with 5 children distributed group. The following are some student activities that carry out experiments on noise or noise pollution in the school environment, as shown in pictures 6 to 9.

Next, a Posttest question is given to see the learning outcomes of students after conducting the experiment. Student learning outcomes were analyzed using SPSS 25 One Grub Posttest-Only Design. The following results were obtained, as shown in Table 2.

Table 1. Didactic, construction, as well as technical and language aspect validation indicators.

Didactic indicator
1. Compatibility with the curriculum.
2. Compatibility with basic competence.
3. Suitability and clarity with indicators.
4. Clarity of learning objectives achieved.
5. Clarity and appropriateness of the material presented.
Construction Indicator
1. The LKPD format's objectivity and clarity.
2. Wholeness and clarity of the image.
3. The video's thoroughness and clarity.
4. clarity and completeness of the tables.
5. LKPD's originality and innovation.
Technical and Language Indicators
1. Interesting LKPD design.
2. Proportionate LKPD layout.
3. Conformity of LKPD language with EYD.
4. The effectiveness of using LKPD sentences.
5. Interactive and conversational LKPD language.

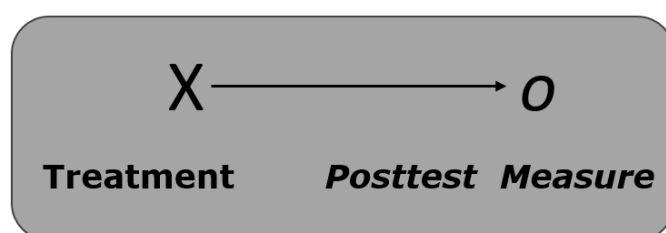
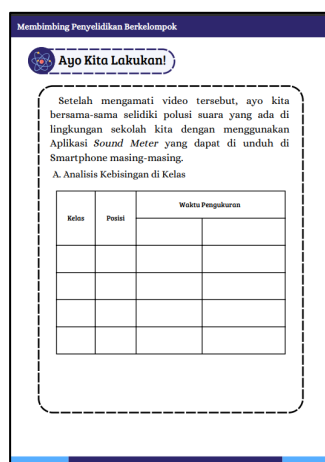
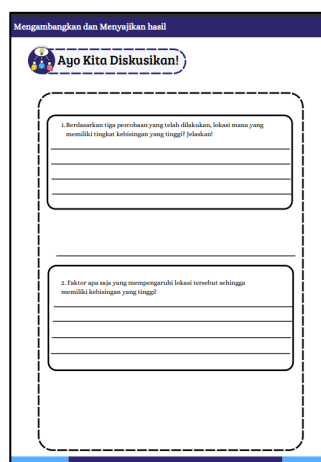
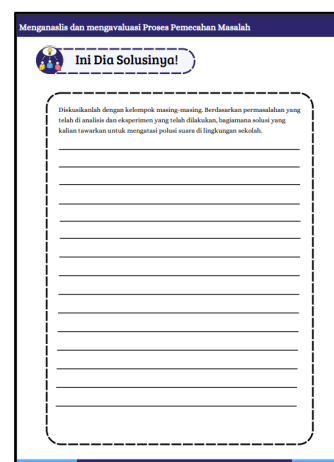


Figure 1. Design One group only

Table 2. Student learning outcomes.

One-Sample Test (Test Value = 75)					
	t	df	Sig. (2-tailed)	Mean Difference	95% Confidence Interval of the Difference
					Lower Upper
Result	5.250	4	.006	21.000	9.89 32.11

**Figure 2.** Student Orientation to Problems**Figure 3.** Guiding Group Investigations and organize for learning**Figure 4.** Develop and present Results**Figure 5.** Analyze and evaluate the problem solving process**Figure 6.** Experiment in class**Figure 9.** Experiment at the school gate**Figure 7.** Experiment outside the classroom**Figure 8.** Experiment in the school canteen

Based on table 2, the analysis results are obtained, namely the P-value = 0.006. This result shows a significance value $< \alpha$ (0.05), so it is concluded that H_0 is rejected while H_1 is accepted. The conclusion shows that there is an increase in student learning outcomes using PBL-based sound wave LKS. Many students succeeded in exceeding the KKM given by the school in biology lessons. This is in line with research conducted by Mukaromah et al., (2022) which states that learning using PBL can improve student learning outcomes but still has to go through good control and supervision from the teacher as a facilitator. Zakia et al., (2018) also added that the success of learning activities is the responsibility of the teacher, because the teacher is a direct party in planning and implementing the learning process. Therefore, the right learning model is implemented, namely PBL as an alternative to improve student learning outcomes.

In the PBL-based LKPD, there is a provision of environmental problems of sound noise which is made in the form of a video. When students scan the preset

barcode, the video will automatically play on their Android device. Students were asked to give their opinion on the noise problem in the video. Students are able to give opinions on existing problems. This is in line with research developed by Yuwono et al., (2020) which says that learning using the PBL model is suitable for improving students' analytical thinking skills. Students become aware that the sound threshold is 55 dB. If it exceeds that number, it means there is noise pollution.

Furthermore, in LKPD a group investigation phase was carried out and all students enthusiastically carried out a joint investigation to see how noise pollution was in the classroom, canteen and school gate. Students actively participate in all investigative activities. This is in accordance with research conducted by Santosa, (2022) which by using the PBL model student activity increased from 33.3% to 66.7%. Students carry out investigations with their group mates carefully and compactly. This is in accordance with research conducted by Yustianingsih et al., (2017) can provide learning experiences to solve learning problems and can potentially have a good impact on student collaboration in the learning process.

Furthermore, students are asked to develop and present the results in discussion together. At this stage students answer the questions given to the LKPD by discussing with their group friends. Questions in the LKPD such as what factors make the place they investigated earlier have high noise? came to the question whether students feel comfortable with their school environment against existing noise pollution. Students by conducting experiments are also increasingly aware that the school environment, especially in class, is very noisy. With the hope that this learning can reduce noisy

problems in class. This is in accordance with research conducted by Priyanti et al., (2022) requires students to be able to find, identify and know the problems that exist around their environment in order to develop a positive attitude.

Furthermore, students also analyze and evaluate existing problem-solving processes, especially sound noise. They come up with various solutions to the problem. This is in accordance with research conducted by Ma'wa et al., (2021) which using PBL-based LKPD can improve students' ability to solve problems. Finally, students can also provide conclusions on the experimental activities that have been carried out that day. This is in accordance with research conducted by Ayuni et al., (2020) that PBL-based LKPD invites students to think representationally to solve problems. [20] said the combination of teaching materials (LKPD) and the PBL model brought new changes in learning. This combination makes learning more interesting, fun, and helps students understand concepts more easily.

4. Conclusion

Considering the outcomes of the experiments and development, it is clear that PBL-based sound wave worksheets are appropriate for improving student learning outcomes. Based on tests in schools can also improve student learning outcomes by using data analysis using SPSS 25 One Grub Posttest-Only Design with Sig. (2-tailed) 0.006. With PBL-based sound wave worksheets, students' analytic thinking skills are increased. With this LKPD also increases the ability to work together between students and find solutions to problems around students.

5. Conflicts of Interest

The authors declare no conflicts of interest.

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