The Effect of Booklets Based on Project Based Learning on Solving Environmental Problems in Junior High Schools

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Abstract: This study aims to inquire about effect of booklets based on project based learning on solving environmental problems in junior high schools. This research is experimental research using One Group Pretest-Posttest design with the subjects of this study being class VII students with a total of 17 students. The collection technique is to inquire the effect of using booklets based on Project Based Learning on solving environmental problems through a test technique where the test is carried out using pretest and post-test design. The instrument in this study was questions with valid and reliable problem-solving indicators using paired sample t-test analysis. The results of this study indicate that there are some effects of booklet on Project Based Learning on environmental problem solving through the pre-test and post-test results on the SPSS 26-assisted paired sample t-test with sig (2-tailed) 0.000 <0.05. Thus, providing booklet learning resources based on Project Based Learning has a significant effect on students' environmental problem-solving abilities.

Keywords: Booklet; Project Based Lerning; Problem Solving

Introduction

In the 21st century educational transformation, students are required to be able to master various skills in the fields of knowledge, information and technology (Maryani et al., 2022). In this transformation problem-solving skills have a very important role for students. One of them is an important learning achievement in an education in Indonesia (Siswanto et al., 2018). This is in accordance with one of the objectives of the independent learning curriculum. therefore deep in learning using the Merdeka Belajar curriculum, more emphasis is placed on how to focus on freedom and creativity in solving problems (Fauzi, 2022). In addition, the learning process places more emphasis on students who are actively involved in discovering and building their own knowledge or understanding concepts in solving a problem (Kariadi & Suprapto, 2018). With these concepts, the process of solving problems through knowledge and understanding can improve long-term memory to continue to remember an incident along with the solution (Kizilirmak et al., 2016).

Problem solving is also seen as a process of finding a combination of a number of rules that can be applied in an effort to deal with new situations in life (Luzyawati, 2018). Problem solving abilities can be useful in solving complex and multidimensional challenges in human life (Mahanal et al., 2022). This is in line with research (Permata et al., 2022) that improving problem solving skills is beneficial for life. This is also in line with research on reference (Hadi & Radiyatul, 2014). which says that problem solving is a basic activity for humans. The human ability to solve a problem is one measure of success in life (Yana et al., 2022).

Problem solving ability has a definition as a process of finding and giving the best solution to something that is not yet known which becomes an obstacle by combining the knowledge and abilities that are already owned to be applied to the problem (Juliyanto et al., 2017). This is also supported by research (Riantoni et al., 2017) which states that in modern cognitive science defines problem solving as a process of achieving a goal,

when the path to that goal is not clear. Problem solving related to the way students deal with a problem related to experience, perception, and understanding of a particular phenomenon (Yuliati et al., 2018).

The well-known model in the problem-solving process is the P*olya*, where Polya's problem-solving skills train students not only to memorize and remember but also to train students to be able to solve problems that are presented in real conditions and situations (Supiyati et al., 2019). In the process of problem-solving skills, students must have the knowledge and strategies to find solutions to these problems (Bahtiar et al., 2022). At the same time, it aims to equip students to get used to their problem-solving skills (Zengin et al., 2022). In addition, this also aims to encourage students' ability to produce a work individually or in groups in order to maximize their potential (Naqiyah et al., 2020).

There are several factors that affect students' problem-solving abilities, especially internal factors such as prior knowledge abilities and logical intelligence (Noviastiwi, 2017). Meanwhile, external factors, such as the learning model/method used, the learning environment created and the provision of motivation from the teacher (Hanifa et al., 2018). The external factor in this case is developing a learning model or method that greatly influences on how to train student problem solving, of course the teacher's role also contributes as an evaluator where as an evaluator the teacher plays a role in collecting data or information about the success of learning that has been implemented (Susanti et al., 2022). This is in line with research (Mursid et al., 2022) that teachers must act as facilitators for students, especially in utilizing various learning media. The Merdeka Belajar curriculum implemented in Indonesia currently requires students to have skills in problem solving where these skills can help students make the right decisions, careful, systematic, logical, and consider various points of view (Rosma, 2015).

The demands of the curriculum at this time have conditions that are the opposite of classroom learning, where problem-solving abilities have not received more attention in the learning process, especially in science learning (Artinta & Fauziah, 2021). To be able to practice problem solving in science learning, students need to increase their curiosity first. Where students' high curiosity will have an impact on student learning outcomes (Priyo, E, 2018). In these characteristics, it can help students comprehend and understand the learning material conveyed by the teacher (Fatkul Jannah et al., 2021). Students think that the science learning process is a rote lesson that tends to take notes and pay attention to the teacher's explanations (Pisaba, 2018). So that in class, students feel bored and monotonous. This is also according to research (Wildani & Budiyono, 2022) that the low problem-solving ability of these students can be caused by several things, one of which is the lack of

learning innovations carried out by educators. Research (Rahayu et al., 2021) states that students' problem-solving abilities in science are still low, this can be seen from their ability to experience difficulties when studying environmental pollution material. Where this material should be easy to work on considering it is very closely related to everyday environmental problems. This happens because teachers still use conventional learning methods, and students are less faced with concrete problems, because the problems given by students are not complex, monotonous, and less varied (Setyobudi & Marsudi, 2018).

The first results of the researchers' observations on 42 students of SMP Nurul Huda Tulangan, who were disrupted into 3 classes, namely grades VII, VIII, and IX which were taken randomly. Then the students filled out a questionnaire totalling 20 questions on environmental pollution material which were distributed through the *Google form* platform and the result was that 15 students of class VII people got an average score of 15.27, 15 students of class VIII got an average score of 13.47, and 12 students of class IX got an average score of 12.59. From the observation results, it can be seen that the 42 students have not reached the Minimum Completeness Criteria for science subjects that have been determined, which is 65. This shows that the level of students' problem-solving abilities is still very low.

This issue of problem-solving ability needs to be carried out by various learning innovations to be repaired, where a teacher is obliged to train his students to think at a higher level, of course with interesting learning innovations (Fatmawati et al., 2022). With this innovation, it is able to trigger students' problem-solving abilities, one of which is by using Project Based Learning. Project Based Learning is a learning model that uses projects as media. Students can explore, assess, interpret, synthesize, and collect information to produce various forms of learning outcomes (Santoso & Wulandari, 2020). Project Based Learning is carried out so that students are able to relate the various components of problem solving, link between materials, direct questions, hands-on, group work, and interactive group activities (Makrufi et al., 2018).

Project-based learning can also improve students' skills in solving problems (Kurniawati et al., 2017). Therefore, the teacher no longer acts as a learning resource but rather as a facilitator, meaning that the teacher helps students more to learn, the teacher also monitors students while studying (Muamar et al., 2017). However, the PJBL method also has its weaknesses. Such as the need for teaching media or interesting new learning resources that can be used as understanding in learning activities (Tyas, 2017). Thus, in order to optimize project-based learning, it is necessary to support learning resources. Learning resources that are considered to be appropriate in supporting project-

based learning are learning resources in the form of booklets. Booklet is one of the print media to convey messages in the form of interesting summaries and pictures. This is in line with research on reference (Uswatun, 2020) which shows that the use of booklets is very effective in improving student learning outcomes. This is evidenced from the research which obtained from student learning outcomes achieving learning completeness ≥80% with a score of ≥80 and is suitable for use, with an average assessment result of material and media validators of 91.5%.

Based on the description above, this study aims to inquire about the effect of booklets based on Project based Learning on solving environmental problems in Junior High Schools. This research is very important to hone students' ability to solve a problem. Besides that, is very important to hone students' ability to solve a problem This research is expected to be able to provide appropriate results, where in the problem-solving method students are faced with general problems, so they are expected to be able to construct their own knowledge and seek various kinds of solutions to solve it. In this case, students are also expected to be more active and creative in the science learning process that they will learn later.

Method

This research is a quantitative study that uses an experimental design type of research with the *One Group Pretest-Posttest* (Wahab et al., 2021). This research was conducted at SMP Nurul Huda Tulangan with a population of 67 students. Sampling used purposive sampling technique, namely the technique of determining a sample with certain considerations (Wulandari, 2016) . Based on this technique, the sample selected was 17 students of class VII SMP Nurul Huda Tulangan. The dependent variable in this study is the ability to solve environmental problems and the independent variable in this study is the booklet. In general, the research design is presented in figure 1 and research steps in Figure 2.
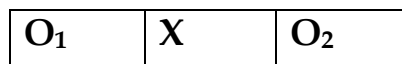
O$_1$	X	O$_2$

Figure 1. One Group Pre-test Post-test (Iii et al., 2016)

Description:
O$_1$ = Pre-test Score
O$_2$ = Post-test score
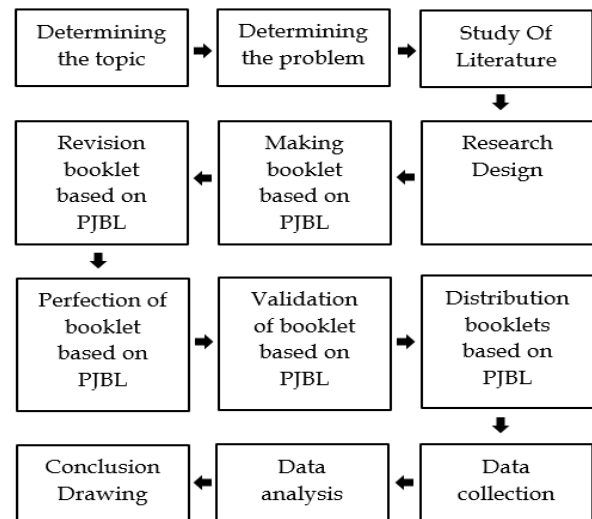X = Treatment using booklet learning resources based on Project Based Learning

Figure 2. Research Steps

Data collection techniques in this study used pre-test and post-test problem solving which were designed to measure problem solving indicators, namely understanding the problem, problem-solving planning, completing problem solving planning, and rechecking answers. In this study the instrument used was an environmental problem-solving test in the form of a description of twelve questions that had been tested for validity and reliability. Then students were grouped based on the level of problem-solving ability which was divided into five groups, namely: very good, good, good enough, not good enough and not good. The percentage interval for solving environmental problems is presented in table 1.

Table 1. Criteria for the percentage of ability to solve environmental problems (Rohmah et al., 2022)

Percentage Interval (%)	Criteria
81–100	Very good
61–80	Good
41–60	Good enough
21–40	Not good enough
0–20	Not good

In this case, the next step is that the data obtained will be tested using a paired sample t-test assisted by SPSS 26 to find the sig score in the pre-test and post-test data.

Result and Discussion

Providing booklet learning resources based on *Project Based Learning* in the learning process intends to familiarize students in solving problems in the surrounding environment. In order to review or see how much influence booklets based on Project Based Learning have on solving environmental problems,

must be carried out by analysing and processing the data obtained from the results of the pre-test and post-test.

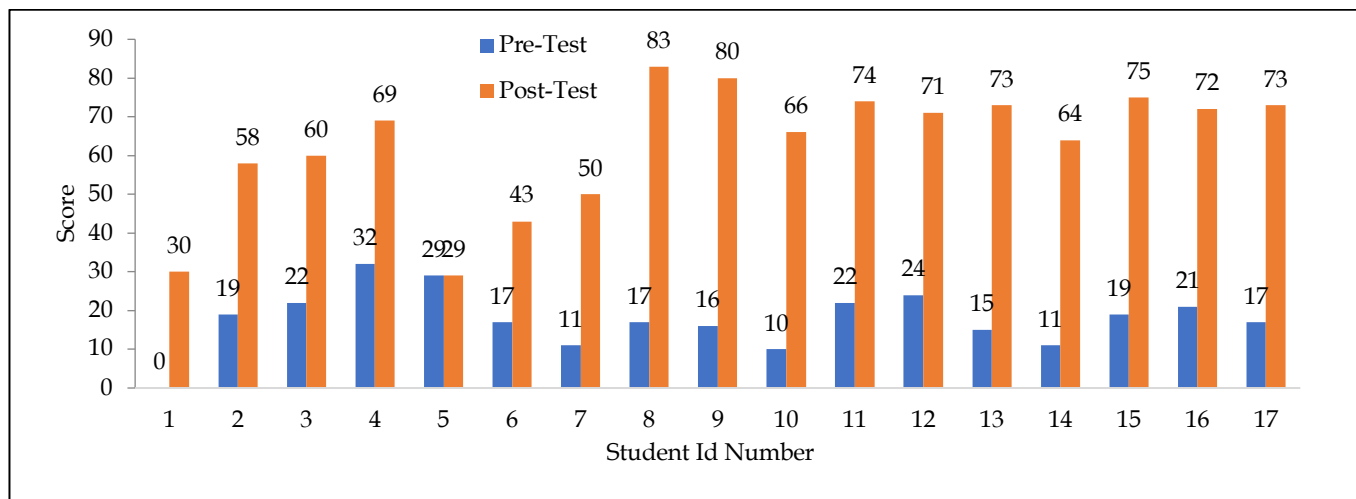The results of the pre-test and post-test can be seen in Figure 3.

Figure 3. Students' Pre-test and Post-test Results

Figure 3 shows the pre-test and post-test scores which have increased. In the pre-test, the highest score was 32 and the lowest score was 0. Where at the time of the pre-test, no treatment was given at all, so that the score was classified as not good enough criteria. Meanwhile, in the post-test, the highest score was 83 and the lowest score was 30. This score has increased significantly and is classified as very good criteria. This can happen due to the existence of treatment in the form of providing learning resources in the form of booklets based on Project Based Learning. The average score of the pre-test and post-test can be presented with a bar chart in Figure 4:
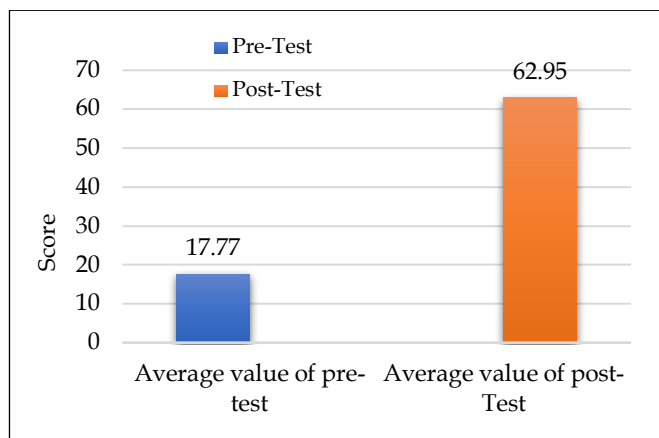

Figure 4. Average pre-test and post-test scores.

Based on Figure 4, the average score in the post-test has increased significantly. Where initially the pre-test average score was 17.77 in the post-test rose to 62.95. The above data is strengthened by the results of the SPSS-assisted paired sample t-test as shown in Tables 2, 3, and 4.

Table 2. Paired Samples Statistics

		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	PRE TEST	17.7647	17	7.48774	1.81604
	POST TEST	62.9412	17	16.18823	3.92622

Table 3. Paired Samples Correlations

		N	Correlation	Sig.
Pair 1	PRE TEST & POST TEST	17	0.208	0.423

Tables 2, 3, and 4 above show the results of the paired sample t-test assisted by SPPS 26 with three outputs. The first output is in table 3 paired samples statistics. This output shows the results of the summary descriptive statistics of both samples or pre-test and post-test data. It can be seen that the pre-test which has not been given treatment in the form of a PJBL-based booklet gives an average score of 17.7647, whereas in the post-test that had been given treatment in the form of a PJBL-based booklet, it gave an average score of 62.9412. The second output is in table 4 paired samples correlations. This output shows the results of the correlation or data relationship between the two pre-test and post-test which shows a result of sig 0.423 as the basis for taking the correlation test where the significance results are > 0.05 which indicates there is no relationship between pre-test and post-test. The third output is in Table 5 paired sample test.

Table 4. Paired Samples Test

		Mean	Std. Deviation	Std. Error Mean	Paired Differences 95% Confidence Interval of the Difference		t	df	Sig. (2-tailed)
					Lower	Upper			
Pair 1	PRE TEST POST TEST	-45.17647	16.36015	3.96792	-53.58808	-36.76486	-11.385	16	,000

This output is the most important thing in the paired sample t-test. Because in the third output there is data to find out how much influence the booklet based on project based learning has on solving environmental problems where the data produces a decision whether the data experiences a significant difference or does not experience a significant difference, if the sig score (2-tailed) < 0.05 then there is a significant difference between the test results on the pre-test and post-test data, whereas if the sig score (2-tailed) > 0.05 then there

is no significant difference between the test results on the pre-test and post-test data. It is known from these data that the sig (2-tailed) score is 0.000 <0.05, so it can be concluded that there is a significant difference between the test results on the pre-test and post-test data. So that the provision of learning resources in the form of booklets have effects on students' environmental problem-solving abilities. The data above is strengthened by the results of the analysis of problem-solving indicators as shown in Table 5.

Table 5. Achievement results of problem-solving indicators.

Indicators		Pre-test		Post-test
	Percentage %	Criteria	Percentage %	Criteria
Understanding the problem	25 %	Not good	78 %	Good
Problem-solving planning	26 %	Not good	78 %	Good
Completion of problem-solving planning	17 %	Not good	69 %	Good
Rechecking answers	16 %	Not good	49 %	Good enough

Based on table 6 the results of the problem-solving achievements can be summarized and presented in the form of a bar chart in Figure 4:
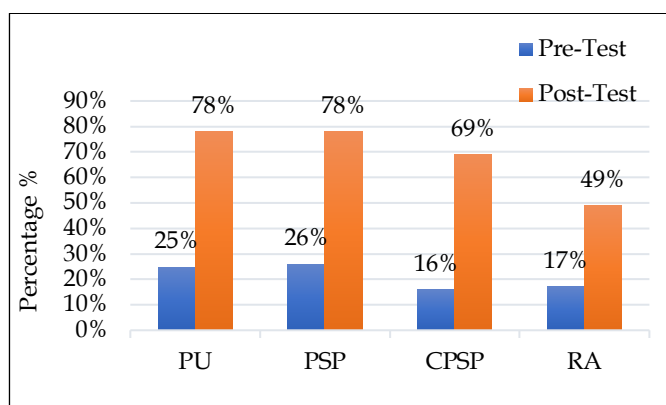

Figure 4. Sketch of achievement indicators for solving environmental problems in the form of a bar chart.

Description:
PU   = Problem understanding
PSP   = Problem solving planning
CPSP = Completing problem solving planning
RA   = Rechecking answer

In figure 4 above, it shows the results of the pre-test in which initially the problem-solving abilities of students were classified as not good criteria. In contrast to the results of the post-test which shows problem-

solving abilities have increased significantly and are classified as good criteria. Thus, the provision of learning resources in the form of booklets based on Project Based Learning have effects on solving environmental problems in Junior High Schools. In line with research (Aryanti, 2017) which examined the effect of the problem-solving learning model through booklet-assisted on Buffer Solution material with the results having effects in students' problem-solving abilities with an *effect size* of 5.2. This was also proven by research (Sunu et al., 2021) that booklet teaching materials can increase student enthusiasm for learning, because the booklet teaching materials developed were in accordance with the curriculum used and had been adjusted to the characteristics of students and also interesting designs and the materials can increase students' enthusiasm for learning and capable of solving problems. In research (Pralisaputri K R et al., 2016) it was also stated that with booklet media the process of solving problems was easier to solve as evidenced by the results of the research post-test which increased significantly.

From the four problem solving indicators, namely: problem understanding, problem-solving planning, completion of problem-solving planning, and rechecking answers also experienced a significant increase during the post-test. The indicators for the problem understanding and problem-solving planning, get the same and the highest score among the other

indicators. Whereas the indicator of rechecking answers, gets low scores both in the pre-test and post-test. This can occur due to lack of thoroughness of students in answering, where the average student's wrong answers are for not rechecking the answers that have been written and feeling very confident about the answers (Fitriyana & Sutirna, 2022). This is also in line with research (Rini Husna Azzahra & Heni Pujiastuti, 2020) which states that on this indicator students have not been able to provide evidence that the solutions given are correct. Students only give solutions without providing evidence of the correctness of the solution. This is also according to research (Zakiyah et al., 2018) that the rechecking answers indicator is also included in the low category as evidenced by a percentage of 29.17%.

Conclusion

Based on research data and data analysis that have been carried out by researchers, it can be concluded that providing booklet learning resources based on Project Based Learning has significant effects on students' environmental problem-solving abilities. Students who initially had difficulty understanding problems, planning problem solving, completing problem-solving plans and rechecking answers, were eventually able to improve these abilities, even though they were still in good or good enough criteria.

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