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The Implementation of Problem Based Learning Model: An Effort in Upgrading Students' Problem-Solving Skills

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Abstract *– Problem-based learning (PBL) is one of the various effective learning models used by a teacher in teaching physics. In the PBL model, students are encouraged to ask and answer questions to improve their problem-solving skills. This study aims to analyze whether the PBL model with the hybrid method can improve students' problem-solving abilities in learning physics. This research is pre-experimental research. The research sample is class X MIPA 1 at SMAN 17 Surabaya, taken by using the purposive sampling technique. The research was conducted in a hybrid learning (offline and online) using a one-group pretest-posttest design. Data were collected through observation and tests in the form of pre-test and post-test. The data were then analyzed using quantitative descriptive methods. The results showed that the n-gain value obtained was 0.31 (medium category). The paired t-test results obtained have a sig value. (2-tails) of 0.000, which is smaller than sig. 0.05. Based on these results, it can be concluded that learning physics with the PBL model is quite effective in improving students' problem-solving abilities.*

Keywords: *hybrid learning; problem-based learning; problem-solving skill*

I. INTRODUCTION

Education is a process related to teaching and learning methods in schools or environments such as schools (Coletta & Steinert, 2020; Rajagukguk, 2019). The education system in Indonesia is regulated by a law that contains a curriculum. The curriculum functions as a public policy outlined in a document realized in an educational process and produced in student learning outcomes (Hasan, 2019). The curriculum in Indonesia has undergone various changes from time to time to achieve academic goals. Currently, education in Indonesia applies the revised 2013 curriculum; this curriculum improves the previous curriculum. The revised 2013 curriculum emphasizes three areas that need to be assessed: attitudes, knowledge, and skills. In the revised 2013 curriculum, the term scientific approach is also known. In

learning with a scientific method, students become more active (Bancong et al., 2021).

Physics is the science of matter and energy (such as heat, light, and sound) and is one of the subjects which is quite tricky and challenging for students (Azizah et al., 2015). Through the Ministry of Education and Culture's website (Kementrian Pendidikan dan Kebudayaan, 2018), it turns out that one of the students of SMA Negeri 1 Tualang, Riau named Shiela Farah stated that studying physics is fun. When interviewed on Tuesday, July 3, 2018, after completing the experimental test in the 2018 OSN in Physics at SMA Negeri 10 Padang, West Sumatra, Shiela stated, "Actually, physics is fun if we understand it because we do not need to memorize much. We need to understand the formula. Then if you already understand the procedure, it will be good to work on (the questions), want to develop more no matter what the problem is ". Of course, this cannot be separated from the role of the teacher as an educator. The learning model used must also be appropriate to understand learning easily.

Learning models that have been known to be very diverse are the Problem Based Learning (PBL) learning model. PBL is characterized by real problems as a context for students to learn critical thinking and problem-solving skills and gain knowledge (Shoimin, 2017). Problem-solving skills are an essential part of physics lessons in schools and are also helpful in adapting to the environment (Abdulfattah & Supahar, 2019; Suhendri & Mardalena, 2015). This learning model allows students to respond to difficulties given by educators actively. There are five steps of problem-solving learning, namely: (1) understanding the problem, (2) presenting the problem physically, (3) planning a solution strategy, (4) executing the plan, and (5) evaluating and expanding (Gunada & Roswiani, 2019).

Parasamya et al. (2017) found out that teachers (both subject teachers physics and other subjects) are still often using a conventional learning approach, where students only acquire imparted knowledge from the teacher. It leads to the situation that the student's learning results are not as expected. It is hoped that through learning using the Problem Based Learning model, students can solve problems in the learning process and later when they are involved in the real community. Asdar et al. (2020) affirm that using the PBL model requires students' active involvement in learning activities.

Based on the background presented, this research aims to describe the improvement of students' problem-solving skills through the PBL model. This research was conducted to answer the question: how does the PBL model improve students' problem-solving skills?

II. METHODS

The researchers used pre-experimental research to describe the improvement of problem-solving skills using the PBL model. The pre-experimental design includes only one group or class given pre and post-test (Sugiyono, 2017).

This design has one group that received a pre-test (O), treatment (X), and post-test. The treatment's effect was measured by comparing pre-test and post-test results. Figure 1 shows the design of this research.

O1 X O2

Figure 1. Research design

This research was conducted at SMA Negeri 17 Surabaya in the odd semester of the 2021/2022 academic year. The population in this study were students of class X science at SMA Negeri 17 Surabaya. The sampling technique used in this study was purposive. Class X MIPA 1 was selected as a sample and then involved in one group pretest-posttest design. The research activity was carried out in a hybrid method (Nasution & Lubis, 2021).

Data collection was conducted by observation and tests in the form of pre-test and post-test, which were carried out in a hybrid way (online and offline learning). Data analysis uses quantitative descriptive analysis. This technique serves to analyze data by describing the data collected based on the variable data obtained (Sugiyono, 2017). Figure 2 shows a flowchart of the research procedure.

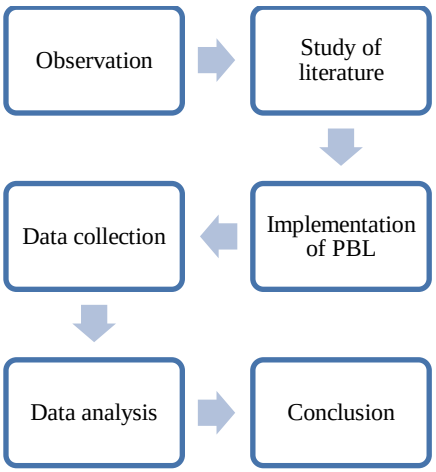

Figure 2. Flowchart of the research procedure

N-gain is the average class score change divided by the maximum possible gain (Coletta & Steinert, 2020). The N-gain score was examined using Microsoft Excel to determine the effectiveness of the PBL model in learning physics. Learning is effective if the N-gain is in the high and medium categories. Information about a category of N-gain score is explained in Table 1.

Table 1. Category of N-gain

No	N-gain Score	Category
1	$g > 0.7$	High
2	$0.3 \leq g \leq 0.7$	Medium
3	$g < 0.3$	Low

III. RESULTS AND DISCUSSION

The results of this study are in the form of students' score data before and after learning with the PBL model. The research data was obtained from the pre-test and post-test results using the PBL model. The highest

and lowest scores obtained by students from the pre-test and post-test are presented in Table 2. As we can see, there is an increase in the value of the pre-test and post-test. So, it can be claimed that the effect given by learning physics using the PBL model is a positive influence (increasing students' problem-solving skills).

Table 2. Pre-test and post-test scores

Problem-solving		Descript.
Pre-test	Highest	17.0
	Lowest	0.0
Post-test	Highest	68.0
	Lowest	5.0
N-gain score		0.31

Data analysis of students' scores was carried out using a paired t-test. The paired *t*-test (for matched samples) was probably the most widely used method in statistics to compare differences between two samples (Xu et al., 2017). However, previously a prerequisite test was carried out, namely by testing the normality of the data. The software used to analyze the data is SPSS 26. The normality test data analysis is presented in Table 3.

Table 3. Data normality test results

Score	Sig.
Pretest	0.096
Posttest	0.399

Data analysis used the Shapiro Wilk normality test because the small data obtained were less than 50 (King & Eckersley, 2019). Decision-making is based on the significant value in Table 3. The research data is normally distributed if the significance value is > 0.05. However, if the significance value is < 0.05, the research data is not a normal distribution. Based on the results obtained in the pre-test and post-test, the data were normal because the significance was > 0.05.

The follow-up test carried out was the paired t-test. This paired t-test aims to determine the improvement of students' problem-solving skills before and after learning is carried out. Data analysis of paired t-test results is shown in Table 4.

Table 4. The result of paired t-test

Score	Sig. (2-tailed)
Pre-test and Post-test	0,00

The basis for decision making on the paired t-test is if the 2-tailed significant value < 0.05, then H_1 is accepted, and H_0 is rejected. However, if the 2-tailed significant value < 0.05, then H_0 is accepted and H_1 is denied, where H_0 means that there is no effect of using the PBL model in physics learning and H_1 means that there is an effect of using the PBL model in physics learning.

Based on the results of the study, it can be said that the PBL model can improve students' problem-solving skills. The analysis shows that the n-gain score obtained is moderate, with a value of 0.31. The analysis also showed that the score of paired t-test analysis obtained a sig. (2-tailed) of 0.000. This value is < 0.05, so H_1 is accepted, and H_0 is rejected. Thus, there are differences in

students' average pre-test and post-test scores, which indicate that the PBL model affects students' problem-solving skills in learning physics.

The results of this study are in line with several studies that the PBL model can improve problem-based skills (Sahyar et al., 2017; Mundilarto & Ismoyo, 2017; Solikha et al., 2020; Dewi & Riandi, 2016; Peranginangin & Sahyar, 2015; Rajagukguk , 2019). The research was conducted by Dewi and Riandi (2016) showed that: 1) the complex thinking ability of students has increased after the implementation of mind mapping-assisted problem-based learning, with a normalized gain of 50.60% (medium); 2) complex thinking skills that showed the best improvement were problem-solving and decision-making abilities. Another study by Peranginangin and Sahyar (2015) indicated that higher-order thinking skills in physics using a problem-based learning model using flash media are better than conventional learning. Higher-order thinking skills of students with above-average scientific attitudes are better than students with below-average scientific perspectives. There is an interaction between PBL models using flash media and scientific attitudes in influencing students' higher-order thinking skills. A study by Argaw et al. (2016) shows a mean difference between comparison and experimental groups. The difference was statistically significant with a large effect size. Students in the experimental group show good motivation toward the strategy.

The results obtained by the researcher follow those obtained by Hastuti et al. (2016), which state that the PBL model affects students' mastery of physics concepts. In addition, other research says that students who use the PBL model are better at solving problems (Sahyar et al., 2017). Learning with the PBL model can improve students' skills compared to conventional learning models (Andriani, 2016). Other studies have shown that PBL is challenging, motivating, and fun that allows students to develop study skills, effective problem solving, independence, and life (Nasar & Kurniati, 2020). It proves that the PBL model will improve students' skills when used for learning.

IV. CONCLUSION AND SUGGESTION

This study concludes that the PBL model with the hybrid method is quite effective in improving students' problem-solving abilities in learning physics. This can be seen by the students' post-test scores which are higher than the pre-test scores. In the PBL model, students are encouraged to ask and answer questions so that they are active during learning, and it has an effect on their problem-solving skills.

Suggestions for further research on the same topic are that if learning is carried out in a hybrid way, it is better to ensure a stable connection so that students who carry out

online learning can gain the same knowledge as offline. However, if possible, it is better to give learning videos according to the material taught in class (for offline). In addition, utilizing software for learning can also be applied to continue a more varied learning process.

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