The Implementation of The Problem Based Learning Model on Vibration and Waves in Middle School

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Abstract
This study aims to find out the increase in student learning outcomes before and after PBL was applied and to see the student's response to the science learning of vibration and wave material that applied PBL to eighth-grade students. The form of research used was Classroom Action Research (CAR). The results showed that the learning outcomes of students before the implementation of PBL were 13.73% complete and 86.27% incomplete, with a very poor category. After the action was taken by applying PBL in cycle 1, the students' learning outcomes were 37.93%, and 62.07% incomplete. When viewed from the learning outcomes of students who have not met classical and individual success, cycle 2 was carried out again, with student learning outcomes completed by 82.76% and incomplete by 17.24%. Then, looking at the students' responses to the science learning of vibrations and waves by applying PBL, the response index was 72%, with a good category. The results of this study are expected to be taken into consideration in determining learning strategies and models to improve student learning outcomes.

Keywords: CAR, Learning Outcomes, Problem Based Learning, Vibration and Waves

INTRODUCTION
Education is identical to teaching and learning activities and all related aspects. The 2003 national education system law stated that:
"Education is a conscious and planned effort to create a learning atmosphere and learning process. Students actively develop their potential to have spiritual, religious, self-control, personality, tendencies, intelligence, noble character, and skills for themselves, society, nation, and state."
From the law above, it can be concluded that education in Indonesia is expected to be able to direct students to be able to develop their potential. This potential can be realized if science education is oriented to the development of thinking and language skills, preparing students to face social issues as a result of the application of science and technology, inculcating ethical and aesthetic values, problem-solving abilities, developing attitudes of independence, creativity, and responsibility (Nurdianti, 2017).
Physics is a branch of science that studies natural phenomena in terms of matter and energy. Physics learning is considered less interesting for students, so in physics learning, students should not only memorize formulas to be able to understand physics material. However, students should be able to understand concepts by connecting physics problems with everyday life so that students can understand concepts that are easy to learn and develop their thinking skills (Amalina, 2020).

Its development is a medium that the success of learning depends on the role of the teacher in providing stimuli. It depends on the selection of methods and learning models chosen by a teacher. The selection of learning models and methods that are in accordance with the objectives of the curriculum and the potential of students are basic abilities and skills that a teacher must possess. It is realized by the assumption that the teacher's accuracy in choosing learning models and methods will affect students' success and learning outcomes. Teachers must use methods that make the learning process enjoyable and provide space for students to be creative and actively involved throughout the learning process.

The monotonous learning model, which the teacher still dominates, will make students feel bored and bored, so it is not uncommon when the teacher explains students feel bored and sleepy during the teaching and learning process, which is carried out using zoom or Google Meet. Likewise, with learning science. Teachers must be as careful as possible to find the proper learning method or model because science is a lesson that is considered the most difficult and most feared for students, especially those related to arithmetic problems. At the age of cognitive development, children aged 6-13 years are in the concrete operational phase. So that they cannot understand abstract lessons. Based on the description, it shows that elementary to junior high school-age children are easier to learn real things in accordance with the facts.

Judging from the results of the pre-research, the learning outcomes of students in the 2019/2020 school year material vibrations and waves, the midterm test results show that many students do not complete these subjects because students are relatively easier to memorize imitate sample questions. So that it certainly has a negative impact on students because students find it difficult when faced with questions that have different levels of difficulty. Students tend to give up easily when working on questions and cooperate with friends to facilitate the problem-solving process on the questions given.

Based on the researcher's observations of the students in SMPN 23 Pontianak, there are several obstacles faced in the science learning process, one of which is the lack of students' understanding of the materials taught by the teacher. Various things cause this condition, including: (1) students pay less attention to the material presented because learning activities are dominated by teachers, so students become less active so that learning outcomes are below the specified KKM; and (2) The teacher's teaching method does not attract the attention of students.

Based on the results of the pre-research, it was found that the science learning process at SMPN 23 was less attractive, and the interest of students in the science learning process was lacking. It happens in almost every subject, especially science. Many children have the mindset that science is a difficult and boring subject. In line with the Ministry of National Education (Kusumawati, 2011), it shows that there are still many problems in implementing the standard content of science subjects. Teachers still use a learning approach that makes students not interested in the teaching and learning process, which makes students bored so that they are not so interested in participating in the lesson, especially science learning related to abstract concepts so that understanding requires high reasoning power and Good problem-solving skills and critical thinking. Students are not yet disciplined in doing assignments. The class atmosphere is not conducive. Due to the lack of various learning media and learning methods, many students do not like to read books, causing a lack of critical thinking that impacts student problem-solving. It causes students' interest in learning, especially science learning, has not been maximized.

Based on these problems, teachers need to increase and improve students' interest in learning so that learning can be achieved in accordance with the desired goals. Therefore, teachers can use various learning models. One of these models is Problem Based Learning. During the Field Experience Practice (PPL) at SMPN 23 Pontianak, the researcher observed a teacher teaching a class
using an online-based Problem Based Learning model for Mathematics. Enthusiasm and interest of
students when learning is very high. In addition, they can solve problems with ease and fun.
Problem-based learning is one of the competencies students must master after learning science. This
ability is not only needed when learning science or other subjects but is needed by every human
being when solving a problem that ultimately making a decision. This ability requires a good mindset,
which involves critical, systematic, logical, and creative thinking. Such a mindset is developed and
fostered in learning science.

Based on the problems above, the researchers tried to improve the ability to apply concepts to
real-life issues of students using the Problem Based Learning Model. The researcher attempts to
compile a research proposal titled "The application of an online-based problem-based learning model
about vibrations and waves at SMPN 23 Pontianak".

METHOD

Research design

This research was Classroom Action Research (CAR). CAR is very suitable for this research
because the research is carried out in the classroom and is more focused on problems in the
classroom or the teaching and learning process. The CAR design used was the Kemmis & Mc.
Taggart CAR model, in his research flow, includes the steps, namely planning (Plan), implementing
the action (Act), carrying out observations (Observe), and holding reflection (reflection). Thus, this
research is a spiral cycle process, starting from planning, implementing actions, observations for
planning modifications, and reflections.

Research Subject

In determining the subject of this research, a purposive sampling technique was conducted
to determine the class for research subject. Sampling in classroom action research filters as much
information as possible from various sources. According to Sugiyono (2008), purposive sampling
is a technique of taking data samples with specific considerations. The subjects in this study were
students of eighth grade at SMPN 23 Pontianak for the academic year 2020/2021, totaling 29
people.

Data collection technique

Nawawi (2015) stated "Measurement technique is a way of collecting quantitative data to
determine the degree of certain aspects compared to certain norms and relevant units of
measurement." According to the researcher, this measurement technique is suitable for knowing
students' learning outcomes at SMPN 23 Pontianak. Data analysis in this study was carried out
during and after collecting the data collected and analyzed using qualitative data analysis of the
Miles and Huberman model (Sugiyono, 2009), which includes 3 things, namely data reduction,
data presentation, and concluding.

Research Instruments

Muchson (2017) stated that "research instruments are tools to retrieve data. In quantitative
research, research instruments can be in the form of tests, questionnaires (questionnaires), interview
guidelines, and observation guidelines. The research instrument used in this study was learning
outcomes test and a students' response questionnaire. The questionnaire used by researchers using
a Likert scale for scoring is shown in Table 1.

<table>
<thead>
<tr>
<th>Category</th>
<th>Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Strongly Agree</td>
<td>4</td>
</tr>
<tr>
<td>Agree</td>
<td>3</td>
</tr>
<tr>
<td>Disagree</td>
<td>2</td>
</tr>
</tbody>
</table>

21
<table>
<thead>
<tr>
<th>Mastery Level</th>
<th>Grade</th>
<th>Score</th>
<th>Predicate</th>
</tr>
</thead>
<tbody>
<tr>
<td>86 – 100 %</td>
<td>A</td>
<td>4</td>
<td>Very Good</td>
</tr>
<tr>
<td>76 – 85 %</td>
<td>B</td>
<td>3</td>
<td>Good</td>
</tr>
<tr>
<td>60 – 75 %</td>
<td>C</td>
<td>2</td>
<td>Fair</td>
</tr>
<tr>
<td>55 – 59 %</td>
<td>D</td>
<td>1</td>
<td>Poor</td>
</tr>
<tr>
<td>≤ 54 %</td>
<td>E</td>
<td>0</td>
<td>Very Poor</td>
</tr>
</tbody>
</table>

**RESULTS AND DISCUSSIONS**

**Results**

This research was conducted at SMPN 23 Pontianak in the odd semester of the 2020/2021 academic year. The study was conducted by giving pretest and posttest questions and student response questionnaires in class VII with a total of 29 students. The research was conducted in 2 cycles and carried out online. Cycle 1 was carried out using Whatsapp Group, Google classroom, and Google Form. Cycle 2 was carried out using Google Classroom and Google Form and Meet.

The initial planning stage of the activities carried out by the researcher is preparing the subject matter, namely the subject of vibration and waves, preparing learning tools in the form of lesson plans, syllabus, textbooks, student worksheets, list of grades, pre-test questions, post-test questions for each cycle related to improving results. Student learning, compiling, and preparing observation sheets for researcher or teacher activities, and student learning observation sheets to be used as reference material in evaluating actions, making and preparing teaching aids needed to facilitate the learning process of picture media.

The implementation stage of the action is the implementation which is the implementation or application of the design content, namely regarding actions in class. The action plan in this learning process is to carry out teaching and learning activities according to the Problem Based Learning model in science subjects, the subject of vibration and waves of eighth grade in SMPN 23 Pontianak, giving tests on pre-action activities and final tests on each cycle in learning activities. Teaching to determine student learning outcomes by using the Problem Based Learning model.

The observation phase is carried out during the implementation of the action to find out the process of implementing the Problem Based Learning model. The observation activities include looking at the situation of the activities during the learning process, seeing the activeness of students to participate in the application of the learning model, seeing the ability of students to find solutions to problems with questions that have been given.

The reflection stage is used to measure the success of a cycle and is carried out in each cycle. This activity shows the success and weakness of a plan carried out in the cycle. Reflection is also a reference in determining improvements to the shortcomings in the implementation of the previous cycle to be applied to the next cycle. At the evaluation stage, the researcher evaluates the actions that have been taken, including analyzing the results of student work, analyzing interview results, analyzing researcher observation sheets, analyzing student observation sheets. It conducts a meeting with colleagues to discuss the results of the evaluation of the learning scenarios that have been carried out and improve the implementation according to the evaluation results to be used in the next cycle.

If in cycle 1, the results obtained are not maximized, then in cycle 2. Activities at each stage in cycle two will be adjusted to the problems of the process and learning outcomes that occur in cycle 1. What has not been achieved in cycle one will be continued and corrected in cycle 2. Meanwhile, if there is still no change in cycle two, it will be continued with cycle 3. If the learning objectives have been achieved in cycle 2, the research will be stopped. Research is considered successful if it meets classical success with KKM 78 and classical success with 805 completeness of the number of students who complete.
Before collecting test data on learning outcomes, the instrument must go through the validity and reliability test stages. It is done to ensure that the research instrument is an accurate and reliable measuring instrument. Following are the results of the validity and reliability of the questions and questionnaire responses.

Table 3. Results of Validity and Reliability Analysis

<table>
<thead>
<tr>
<th>Instrument Type</th>
<th>Validity</th>
<th>Reliability</th>
</tr>
</thead>
<tbody>
<tr>
<td>Test</td>
<td>3.74</td>
<td>0.73</td>
</tr>
<tr>
<td>Questionnaire</td>
<td>3.80</td>
<td></td>
</tr>
</tbody>
</table>

Based on Table 3, from the results of the analysis of the validity and reliability of the instrument about learning outcomes and student response questionnaires using the Cronbach's Alpha formula with the help of SPSS 26, the validity value was 3.74 with the valid category. The value of the questionnaire validation was 3.8 with a valid category. Then the reliability value was 0.73 with a very high category. After validation and reliability of the product used in further research, the researchers conducted research, the data from the pretest and post-test study before learning by applying the Problem Based Learning model. The following are students' learning outcomes before the application of the problem-based learning model.

Table 4. Student Learning Outcomes Before the Implementation of PBL

<table>
<thead>
<tr>
<th>No</th>
<th>Score Range</th>
<th>The Number of Students</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Score</td>
<td>Information</td>
<td></td>
</tr>
<tr>
<td>1.</td>
<td>≥78</td>
<td>Complete</td>
<td>4</td>
</tr>
<tr>
<td>2.</td>
<td>&lt;77</td>
<td>Not Complete</td>
<td>25</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td></td>
<td>29</td>
</tr>
</tbody>
</table>

Based on Table 4, after processing the data on student learning outcomes, the data obtained as above, namely the number of students as many as 29 people; an average score of 51.06; with many students who passed as many as four people with a percentage value of 13.73%; and the number of students who did not complete as many as 25 people with a percentage value of 86.27%. Then the researchers conducted cycle one by giving treatment to the teaching and learning process using the Problem Based Learning model on vibration and wave material. Here are the learning outcomes of students in cycle 1.

Table 5. Student Learning Outcomes in Cycle 1

<table>
<thead>
<tr>
<th>No</th>
<th>Score Range</th>
<th>The Number of Students</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Score</td>
<td>Information</td>
<td></td>
</tr>
<tr>
<td>1.</td>
<td>≥78</td>
<td>Complete</td>
<td>11</td>
</tr>
<tr>
<td>2.</td>
<td>&lt;77</td>
<td>Not Complete</td>
<td>18</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td></td>
<td>29</td>
</tr>
</tbody>
</table>

Based on Table 5, it can be seen that the learning outcomes of students in cycle 1 were 37.93% complete and 62.07% incomplete. After seeing student learning outcomes in cycle 1, student learning outcomes did not meet classical success and individual success, then cycle II was carried out again. The following are the learning outcomes of students in cycle II.

Table 6. Student learning outcomes in cycle II

<table>
<thead>
<tr>
<th>No</th>
<th>Score Range</th>
<th>The Number of Students</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Score</td>
<td>The Number of Students</td>
<td></td>
</tr>
<tr>
<td>1.</td>
<td>≥78</td>
<td>Complete</td>
<td>24</td>
</tr>
<tr>
<td>2.</td>
<td>&lt;77</td>
<td>Not Complete</td>
<td>5</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td></td>
<td>29</td>
</tr>
</tbody>
</table>
Table 6 shows students' learning outcomes in cycle II with the number of students who completed 82.76% and those who did not complete 17.24%. From students' learning outcomes, it can be seen that students have met the classical success in cycle II. From the recapitulation of the average value between cycles, it can be stated that the implementation of the online-based PBL learning model to improve student learning outcomes for vibration and wave topic in eighth grade students of SMPN 23 Pontianak in the 2021/2022 academic year has been enhanced from cycle I 71.84% became 85.58% in cycle II. It is in accordance with the classical indicators if the class average reaches 80% of the number of students in eighth grade, then the students in the class can be said to have come to the KKM.

After calculating the learning outcomes of students, then the researchers calculated the questionnaire responses of students to learning the application of the online-based Problem Based Learning model. Vibration and wave materials were analyzed using descriptive analysis to understand respondents' answers. The following is the result of analyzing the student response index to science learning that applies the Problem Based Learning model.

Table 7. Analysis of the index of student responses to online-based PBL learning

<table>
<thead>
<tr>
<th>No</th>
<th>Response Type</th>
<th>%F4</th>
<th>%F3</th>
<th>%F2</th>
<th>%F1</th>
<th>Index % of Statement</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Positive</td>
<td>24.1%</td>
<td>68.96%</td>
<td>6.89%</td>
<td>0%</td>
<td>79.28%</td>
</tr>
<tr>
<td>2</td>
<td>Positive</td>
<td>13.79%</td>
<td>68.96%</td>
<td>17.24%</td>
<td>0%</td>
<td>74.13%</td>
</tr>
<tr>
<td>3</td>
<td>Positive</td>
<td>20.68%</td>
<td>44.82%</td>
<td>27.58%</td>
<td>6.8%</td>
<td>70%</td>
</tr>
<tr>
<td>4</td>
<td>Positive</td>
<td>3.44%</td>
<td>72.41%</td>
<td>24.13%</td>
<td>0%</td>
<td>70.5%</td>
</tr>
<tr>
<td>5</td>
<td>Positive</td>
<td>13.79%</td>
<td>68.98%</td>
<td>7.24%</td>
<td>0%</td>
<td>69.13%</td>
</tr>
<tr>
<td>6</td>
<td>Positive</td>
<td>13.79%</td>
<td>72.41%</td>
<td>7.24%</td>
<td>0%</td>
<td>71.71%</td>
</tr>
<tr>
<td>7</td>
<td>Positive</td>
<td>13.79%</td>
<td>55.17%</td>
<td>31.03%</td>
<td>0%</td>
<td>70.68%</td>
</tr>
<tr>
<td>8</td>
<td>Positive</td>
<td>10.3%</td>
<td>44.82%</td>
<td>44.82%</td>
<td>3.44%</td>
<td>67.02%</td>
</tr>
<tr>
<td>9</td>
<td>Positive</td>
<td>17.24%</td>
<td>58.62%</td>
<td>31.03%</td>
<td>0%</td>
<td>76.72%</td>
</tr>
<tr>
<td>10</td>
<td>Positive</td>
<td>6.89%</td>
<td>68.96%</td>
<td>20.68%</td>
<td>3.44%</td>
<td>70%</td>
</tr>
</tbody>
</table>

Student response index value 72%

Based on table 7 above, after processing the questionnaire data on students' learning responses to online PBL learning based on vibration and wave material, the data obtained as above. The number of students was 29 students who answered ten statements given by researchers in the questionnaire. The average score of student response index was 72% considered as good category.

**Discussion**

During the COVID-19 pandemic, students are required to be able to learn more independently in the learning process but still under the guidance and direction of the teacher. In this study, the researcher intends to see how the learning outcomes and student responses in online learning use the Problem Based Learning model on vibration and wave materials.

Before the research was carried out, the sample was determined using the Purposive Sampling Technique. It was decided that the eighth-grade students of SMPN 23 Pontianak, amounting to 29 students, were to be research subjects.

*Student learning outcomes before the application of the Problem Based Learning model*

The research begins by giving pre-tests to students to find out student learning outcomes before applying the online-based Problem Based Learning model given through the Goggle classroom and a reference for researchers to answer problem formulation 1. After the pre-test was complete, the researcher calculates the score recapitulation and students' pretest scores. Before applying the online-based Problem Based Learning model, the students' learning outcomes were 1,481 out of 29 students,
with an average of 51.06. The number of students who completed was 13.73%, and those who did not finish were 86.27%. After looking at the student learning outcomes in Table 4.1, it is known that the student learning outcomes before the online-based Problem Based Learning model was applied was low.

When viewed from the number of students, learning by applying the Problem Based Learning learning model is focused on learning that presents various problem situations that occur in the real world to students, which serve as the initial basis for starting the learning process. Problems are given to students before studying the concept or concept. Material related to the problem to be solved. Thus, to solve these problems, students will know that they need new knowledge that must be learned to solve the problems given.

After seeing students' learning outcomes before applying the Problem Based Learning model, it was seen that student learning outcomes were very low. The low learning outcomes of students before the application of the Problem Based Learning model could be due to several factors, including the lack of understanding of students on vibration and wave material, even though they have been given a summary of the material and learning videos before implementation, but students do not yet have further initial knowledge about the topic. Therefore, when learning that applies the Problem Based Learning model, researchers can provide problems that make students understand the concept of vibrations and waves.

Student learning outcomes after the implementation of the problem-based learning model

The study began with cycle 1 with the planning stage. On August 11, 2021, the researcher sent learning tools to be used in cycle 1, such as a summary of material and videos, to students via Google Classroom. Then continued, the implementation stage was carried out on August 12, 2021. The implementation stage of learning was carried out through Whatsapp Group, and learning began by giving a pretest. In working on the pretest, students did it personally and collected it back to the researcher by sending their answers online via Google Form. Then the researchers sent learning tools such as videos and material summaries to students via Google Classroom. After learning is complete, the researcher conducts an evaluation stage by giving a post-test. Students do it online and collect their answers via Google Forms.

After the post-test was completed, the researcher did the calculations and recapitulated the students' post-test scores and scores. The average value of eighth grade students was 71.84, with the average number of students who completed was 37.93%, and students who did not pass were 62.07%.

By looking at the learning outcomes of students in cycle one and comparing with the classical and individual success rates where students are said to be complete in learning if their learning outcomes reach 78, and classical success can be said to be successful if the class average results reach at least 80% of the total number of participants completed in eighth grade. After comparing the learning outcomes of cycle 1 with classical and individual success, it can be said that science learning by applying the Problem Based Learning model for vibration and wave material in eighth grade at SMPN 23 Pontianak in cycle 1 was not successful, because the learning outcomes of students in cycle 1 were still below the level of classical and individual success, because the researchers continued the research in cycle II.

Before carrying out Cycle II, the researchers conducted feedback discussions with the science teacher at SMPN 23 Pontianak about learning in cycle 1, and the discussion with the science teacher at SMPN 23 Pontianak discussed the obstacles that occurred in the learning process in cycle 1 and will be improved in cycle II.

Cycle II learning began with the planning stage on August 18. The researcher sent learning tools such as videos, PPT, material summaries, and meet learning links that will be used for learning cycle II through Google Classroom, followed by the implementation stage of cycle II learning starting on August 19, 2021, and learning takes place using Google Meet. The learning process was in accordance with PBL steps, such as in the learning lesson plans. During the learning process, students actively ask questions. After completing the cycle II learning process, the researcher continued with the evaluation stage, namely by giving post-tests to students online through Google Classroom. Students worked individually and collected answers via Google Forms.
After the post-test cycle II was completed, the researchers did the calculations and recapitulated the scores and the post-test scores of the students. The average value of eighth grade students in cycle II was 85.58, with the number of students who completed were 24 students or 28.76% and students who did not complete were five students or 17.24%.

Based on the data on student learning outcomes in cycle II, it can be said that the science learning of vibrations and waves in eighth grade at SMPN 23 Pontianak using the online-based PBL learning model can be said to have been successful because student learning outcomes were already above the standard of success. Thus, this study was stopped in cycle II.

The factor of giving questions can cause researchers' success in the second cycle, and the materials provided in cycle I and cycle II were same. Also, due to the selection of learning media for cycle II using meet so that the delivery of material is clearer, students are more active in asking questions.

The effect of student responses to science learning by applying the Problem Based Learning model by calculating the student response index to learning that involves the online-based PBL model, it is found that the student response index calculation after learning by applying the online-based PBL model is 72%, with a questionnaire response interval of 72 % belongs to the good category. In this study, the researcher intends to offer a method that can facilitate student's self-study at home during the COVID-19 pandemic.

Learning by applying the online-based PBL model makes students more open-minded by applying problems in everyday life that have been interpreted into the learning process that will take place. This research is expected to be implemented as an alternative online learning method by subject teachers in schools. So that teachers are more varied in presenting material to students.

CONCLUSIONS AND SUGGESTIONS

Conclusions

From the results of the data and discussion of the study, it can be concluded that applying the online-based Problem Based Learning model can improve students’ learning outcomes in the vibration and wave material of eighth grade at SMPN 23 Pontianak. There are significant differences in student learning outcomes. It can be shown by the increase in the average percentage and completeness of students with average pre-action scores (51.06) and complete students (23.73%), cycle 1 average value (71.84), students completed (27.93%), and in the second cycle the average (85.58) and students completed (82.76%) This study can be said to be successful because the individual and classical success indices have been met. With the student's response to the science learning of vibration and wave material that applies the online-based PBL model, it is 72% or is interval into the response index that the student's response was good.

Suggestions

Based on the study results, several suggestions were put forward as follows: 1) It is recommended to teachers that the PBL model can be used as an alternative online learning method by science subject teachers in schools to improve student learning outcomes. 2). It is recommended that there be a monitoring system for students in the implementation of online learning using the PBL model, such as holding online meetings with the help of google meet or zoom, so that the development of students can be observed more clearly. Not just from Google classroom or Whatsapp group. 3). It is suggested that teachers optimize various media and learning tools to make science learning fun. 5). It is suggested to researchers who want to do this research to pay more attention to and understand the problems in everyday life, which will be the basis for the learning process that applies the PBL model.

REFERENCES


