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Implementation of Problem Based Learning (PBL) Models to Improve Student Physics Learning Outcomes

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Abstract

This study aims to determine the increase in student physics learning outcomes, teacher and student activities, the teacher's ability to manage learning, as well as student responses to the application of the Problem Based Learning (PBL) models in Newton's Law material during the learning process. This type of research is Classroom Action Research (CAR). The subjects in this study were class X students of one of senior high school in Pargodungan for the 2020/2021 academic year with a total of 29 students. Data collection instruments that researchers use in research are observation sheets, tests and questionnaires where the three data are analyzed with descriptive statistics. The results showed that (1) the percentage of individual completeness as a whole increased from cycle I to cycle III, namely 69%, 80%, and 94%, and the percentage of classical completeness as a whole also increased, namely 40%, 70%, and 80%; (2) there is an increase in teacher and student activity during the learning process; (3) there was an increase in the teacher's skills in managing learning from the fairly good category with an average of 2.59 to good with an average of 3.4; (4) student responses tended to be positive where 100% of students expressed pleasure in learning using this Constructivism-Problem Based Learning model. From this study it can be concluded that the application of the Problem Based Learning (PBL) Learning Model can improve the physics learning outcomes on Newton's Law topic.

Keywords: problem based learning, physics learning, student outcomes

INTRODUCTION

Education is a long-term investment that requires effort and funds, although it is recognized that education is a large long-term investment that must be arranged, prepared and provided with facilities and infrastructure in the sense of substantial material capital, until now Indonesia is still struggling with problems in this regard, namely the quality of education. The role of education is very important to create an intelligent, peaceful and democratic national life. In the 2013 curriculum there are several learning principles that are expected to support the quality of education. Among the principles in the 2013 curriculum is to encourage students to become active learners, starting with students observing certain phenomena or events so that the teacher can arouse students' curiosity about these phenomena or events. In this curriculum the teacher acts as a motivator and facilitator, but at the end of the core activities the teacher provides an explanation of the refinement of student activities. According to Jean Pieget (Sagala, 2011) "education is a link between two sides, on the one hand individuals who are growing and on the other hand social, intellectual and moral values that are the responsibility of educators to encourage these individuals".

From the observations the researchers made at high school in Pargodungan on January 2021, the researchers found that there were still many teachers who used conventional learning approaches, namely students only acquired the knowledge conveyed by the teacher. This causes student learning outcomes to be less than expected. Learning outcomes are one of the factors determined by the learning process. According to Sudjana (2005) "learning outcomes reflect goals at a certain level that are successful with numbers or letters. The learning outcomes referred to are none other than the student's ability score after the evaluation is given as a manifestation of the efforts that have been made during the teaching and learning process.

Student learning outcomes can be measured using an evaluation tool which is usually called a learning achievement test. In this case, Hodoyo (2000) suggests that learning outcomes are "the level of success or mastery of a student in the field of science study after taking the teaching and learning process as seen in the scores obtained from the learning outcomes test. According to Ngalim (2016, in Suniana) , “Students are said to be complete when they have achieved the minimum standard of completeness criteria.” The achievement of completeness of students is influenced by several supporting factors in their learning, the incompleteness of supporting factors in learning will become an obstacle for students to achieve mastery. The KKM score for physics in class X IPA2 at was 75. However, when given an evaluation, out of 29 students in class X IPA2, only 6 of them achieved the KKM score or only around 21%. The rest did not reach the KKM score or the value was below 75.

The process of acquiring knowledge will occur if the teacher can create a learning condition that is in accordance with the characteristics of learning physics. Research suggests that constructivism and problem-based learning are effective teaching approaches for physics education (Tuwoso, 2016). By engaging students in hands-on activities and challenging them to solve real-world problems, these methods can enhance students' understanding of physics concepts and principles (Chang, 2005). Constructivism encourages students to construct their own understanding of the material through active engagement (Cooperstein & Kocevar-Weidinger, 2004), while problem-based learning fosters critical thinking and problem-solving skills. Incorporating these approaches into physics education can help students develop a deeper and more meaningful understanding of the subject. These methods also promote collaboration and communication skills, preparing students for future academic and professional endeavors. Such learning is learning that prioritizes student activity. If the teacher succeeds in creating an atmosphere that can cause students to be actively motivated in learning, it will allow for an increase in learning outcomes. Teachers must use learning processes that will move students toward independence, a wider life, and lifelong learning (Dunlosky et al., 2013). The learning environment built by the teacher must encourage students' ways of thinking so that students can easily understand learning.

Based on this, it is necessary to seek a learning approach that can improve students' understanding of physics concepts, one alternative learning approach that is considered to be able to improve students' understanding of physics concepts is constructivism-based learning. Because students are mentally active in building their knowledge based on the cognitive structure they already have.

This method is closely related to the contextual approach. Many experts call it a learning method but there are also experts who call it a learning model (Warsono and Hariyanto, 2013). Problem-based learning is used to stimulate higher-order thinking in problem-oriented situations, including how students learn. The PBL learning model is a learning model that uses real world problems as a context for students to learn about problem solving skills, as well as to acquire essential knowledge and concepts from the subject matter (Barell, 2007). This statement is in line with the opinion of Sulatri, et al (2022). The PBL model results in higher student motivation and curiosity. The Problem Based Learning model is able to become a forum for students to improve critical thinking skills.

METHOD

In this study, the authors used a descriptive approach. Which has been adjusted to the main objective of the research, namely to find out the increase in physics learning outcomes by using the Problem Based Learning (PBL) learning model on Newton's law material. The type of research used is Classroom Action Research (CAR), which is one of the efforts that teachers can make to improve the quality of the teacher's roles and responsibilities, especially in managing learning (Sanjaya, 2011). The cycle design in classroom action research conducted from start to finish can be seen in the Figure 1.

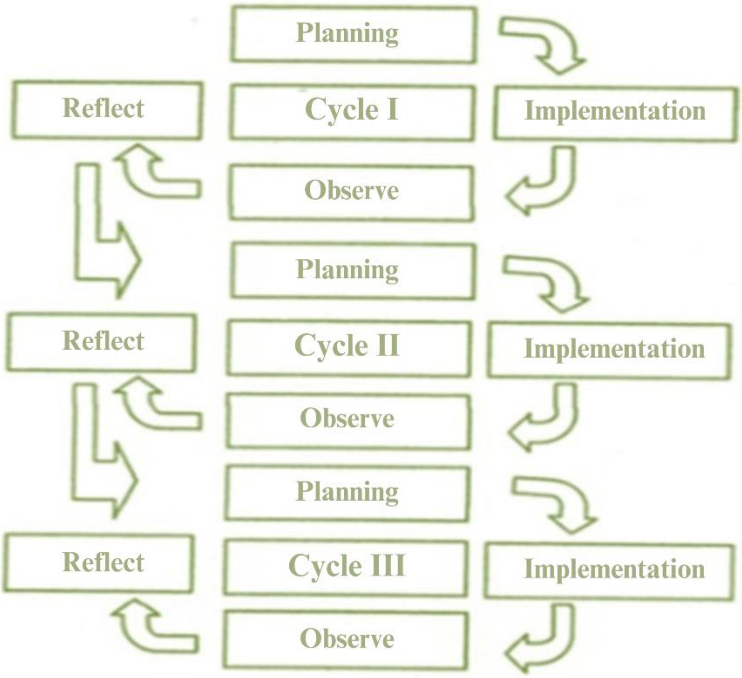

Figure 1. PTK Research Flowchart (Arikunto, 2008)

This research was conducted at one of high school in Pargodungan. The research was conducted on January 2021 to February 2021 even semester of the 2020/2021 academic year. The subjects in this study were all 29 students of class X IPA2. Meanwhile, the objects in this study were the physics learning outcomes of class X IPA2 students. The data taken were in the form of student learning outcomes, teacher and student activities, the teacher's ability to manage learning, and student responses to the problem based learning (PBL) learning model. The instruments used in this study included pretest and post -test sheets , teacher activity observation sheets, teacher ability observation sheets to manage learning and student response questionnaire sheets. The data analysis technique in this study used a percentage test with a quantitative method.

$$P = \frac{f}{N} \times 100\%$$

(Sudijono, 2005)

Where, P: Percentage of learning media needs
f : Frequency of respondents' answers
N : Total respondents

Individual mastery of the material to be determined is achieved if the acquisition of student scores reaches the KKM score, which is ≥ 75 or with a conversion value of ≥ 2.66, while classical mastery is achieved when 85% of students pass the KKM. Teacher and student activities are said to be good if they get at least 85% results. Conversely, if the results obtained are below 85%, the teacher and student activities are said to be lacking or not good. The criterion states that students are said to have understood the concept well if there are 85% of students who take the test have a minimum ability score of 75 (Trianto, 2011).

Analysis data response student to learning with use model problem learning based learning (PBL) with use questionnaire response student. Response students are said to be good if they get results of at least 85%. Conversely, if the results obtained are below 85%, the student's responses are said to be poor or not good.

RESULTS AND DISCUSSION

Research data obtained for three cycles and in each cycle were observed by two observers. Research analysis was carried out by describing descriptions of students' pre-test and post-tests, descriptions of teacher and student activities, descriptions of teacher classroom management, and descriptions of student responses to learning using the PBL model on Newton's laws.

Cycle I

Based on the results of the post-test in cycle I, it can be seen that out of 29 students there were 20 students who completed individually or in other words the overall individual completeness in cycle I was 69%, while the classical completeness as a whole was 40% where out of 10 questions there are 6 questions that have not been completed classically. Teacher activity during the learning process using the PBL model in cycle I was 65% and was categorized as quite good. Meanwhile, student activity during the learning process in cycle I was 60% and was categorized as quite good.

Problem Based Learning (PBL) learning model consists of four phases, namely introduction (initial activity), core activity, closing (final activity), and observation of class atmosphere. Where as a whole the teacher's ability to manage learning using the Problem Based Learning (PBL) learning model in cycle I can be categorized as quite good with an average score of 2.59. Weaknesses and obstacles in the implementation of the learning process in cycle I are as follows following:

- Based on the results of the posttest , there were 6 students whose learning outcomes had not been completed individually and there were 6 questions which had not been completed classically. This is because there is still a lack of teacher skills in providing reinforcement of the material and not optimally giving examples of questions that are relevant to the material learning.
- Based on the results of the assessment of teacher and student activities, there are several teacher and student activities that are still lacking and necessary repair .
- Based on the results of the teacher's skills in managing learning, there are several teacher skills that are still lacking, including: when giving information about the material to be studied, when dividing students into groups, demonstrating material according to worksheet, giving students the opportunity to think, solve problems and discuss, when guiding students in discussions, when giving material reinforcement and guiding students to make conclusions, the lack of teacher skills in inviting students to be active and enthusiastic in learning and when conditioning learning is centered on student.

Cycle II

Based on the results of the post-test in cycle II, it can be seen that of the 29 students, there were 23 students who completed individually or in other words, the overall individual completeness in cycle II was 80%. While the overall classical completeness is 70% where out of 10 questions there are 3 questions that have not been completed classically.

the Problem Based Learning (PBL) learning model in cycle II is 75%. Meanwhile, student activity during the learning process in cycle II was 73%. The results of the assessment of the teacher's ability to manage learning using the Problem Based Learning (PBL) learning model are already better than cycle I. Where as a whole the teacher's ability to manage learning using the PBL model in cycle II can be categorized as good with the acquisition of a score an average of 3.1. In addition, teachers are still not skilled in inviting students to be active and enthusiastic in learning so that students are still not directly involved in the learning process.

Cycle III

The teacher has succeeded in guiding students in carrying out learning by using the Problem Based Learning (PBL) learning model until they can improve students' understanding of the material being studied. This can be seen from the increasing mastery of student learning both individually and classically, where in cycle III there were only 2 students out of 29 students who had not completed and 23 other students were declared complete, meaning that overall individual completeness increased to 93% and classical completeness as a whole increased again to 80%, in other words, out of 10 questions there were only 2 questions that had not been completed classically.

Teachers and students are also more successful at adapting activities during the learning process. The teacher's skills in managing learning are getting better compared to the previous cycle. Teacher activity during the learning process using the PBL model in cycle III was 94% while student activity during the learning process in cycle III was 89%, where there was an increase in teacher skill scores and student activity from cycle I to cycle III. This means that the teacher has succeeded in presenting learning according to the expected criteria. The teacher has been able to monitor student work, starting from discussions in groups, to *the posttest* and has succeeded in making students enthusiastic Study.

Based on the results in cycle III, the actions in the cycle were dismissed because learning outcomes were maximized and most students had succeeded in completing their studies both individually and classically, and the teacher had been able to apply learning using the PBL model very well . Based on the results of the research, it can be seen that there was an increase in student learning outcomes from the initial test which was carried out before the application of the PBL model to the final test which was carried out after learning using the problem based learning model. (PBL).

The results showed that the average individual completeness score increased from cycle I to cycle III. Improved learning outcomes are presented in Figure 2.

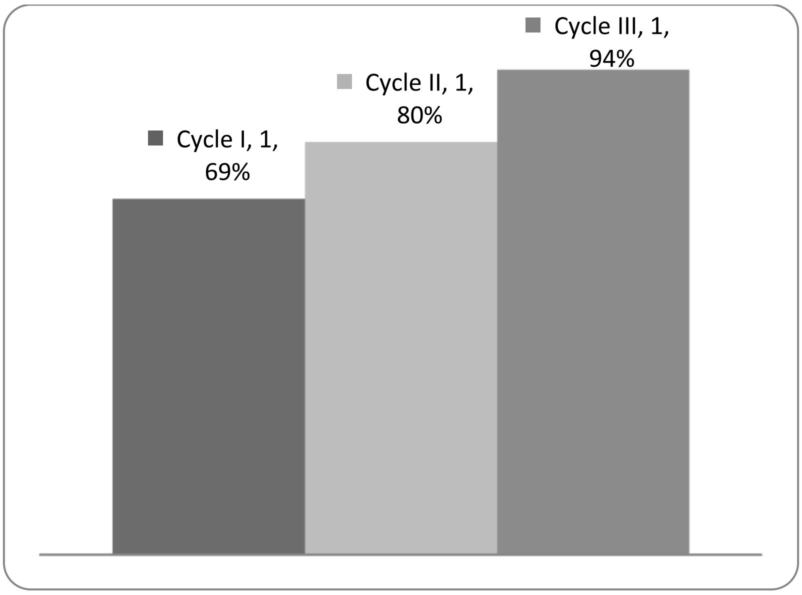

Figure 2 Percentage of Individual Completeness

Based on Figure 2 it can be explained that there was an increase in the percentage of individual completeness as a whole between cycles I, II and III. In cycle I the percentage of individual completeness as a whole was 69%, meaning that out of 29 students there were 20 students who had completed individually. In cycle II the overall individual completeness increased to 80%, meaning that out of 29 students there were 23 students who had completed individually. In cycle III overall individual completeness increased again to 93%, meaning that out of 29 students there were 27 students who had completed individually. In addition to individual mastery, this study also showed an increase in overall classical mastery results from cycle I to cycle III using the problem based learning (PBL) learning model.

The results of research on increasing mastery classically are presented in Figure 3.

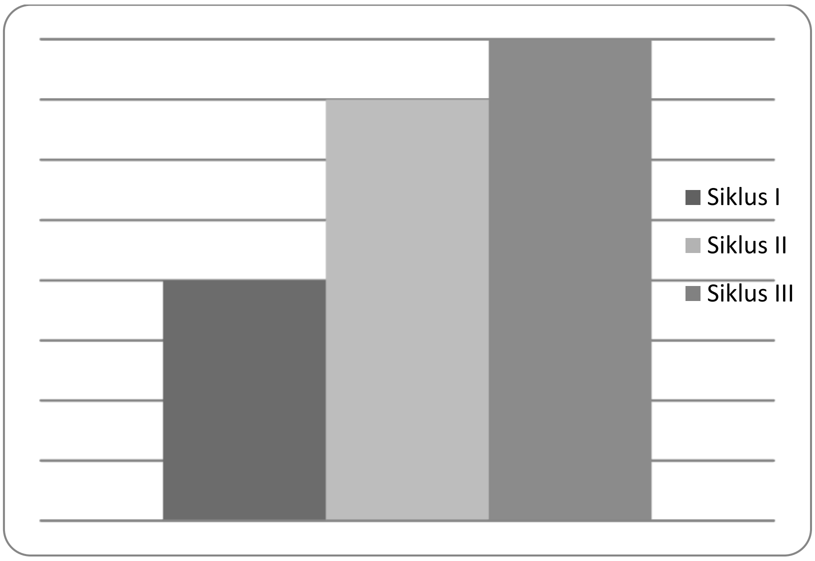

Figure 3 Percentage of Classical Completeness

Based on Figure 3 above, it can be seen that there was an increase in overall classical completeness from cycle I to cycle III. In cycle I the overall percentage of classical completeness only reached 40%, where out of 10 questions there were 6 questions which had not been completed classically. In cycle II the overall percentage of classical completeness increased to 70% where out of 10 questions there were 3 questions that had not been completed classically. In cycle III the overall percentage of classical completeness increased again to 80%, in other words, out of 10 questions there were only 2 questions that had not been completed classically.

Based on the increase in individual and classical mastery obtained after learning for 3 cycles, it can be concluded that the application of the problem based learning (PBL) learning model has succeeded in helping students understand Newton's law material. Teacher and student activities during the learning process using the problem based learning (PBL) learning model have increased in each cycle. This can be seen in Figure 4.

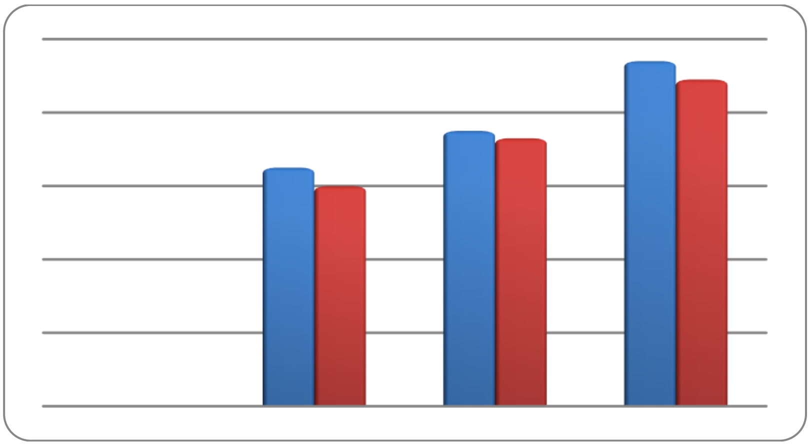

Figure 4. Percentage of Teacher (blue one) and Student (red one) Activities.

Figure 4 explains that in cycle I, teacher activity only got a percentage of 65%, while student activity only got 60%. In Cycle I the teacher was still not able to manage the class properly so that the learning process using the PBL model did not run optimally. In cycle II there was an increase, so that the percentage of teacher activity was obtained 75%, while the percentage of student activity was obtained 73%. This proves that teachers are getting better at managing learning using the problem based learning (PBL) learning model and students are starting to take it seriously learning.

Even so, there are still deficiencies, one of which is in demonstrating material that is in accordance with the worksheet. In cycle III the teacher's activity in the implementation of learning using the PBL model increased so that the percentage became 94% and student activity became 89%. This shows that teachers are increasingly skilled in managing the class so that it has a positive impact on the learning process.

Based on the results of research and data analysis, it appears that there is an increase in teacher skills in managing learning by applying the PBL model. In detail shown in Figure 5.

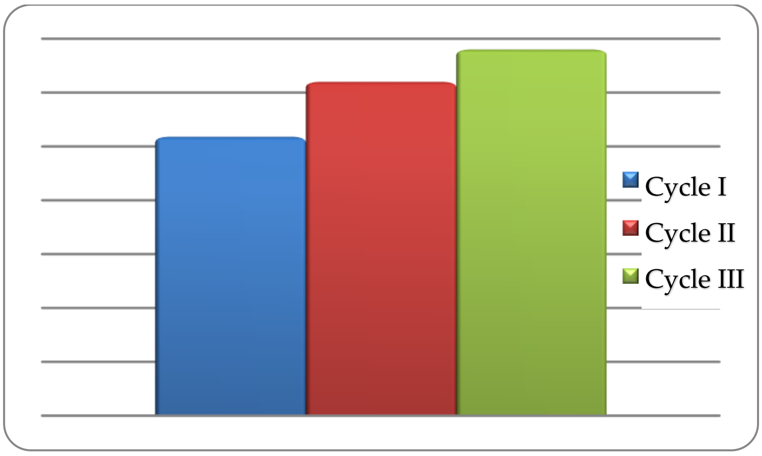

Figure 5. Teacher's Ability to Manage Learning

Figure 5 shows an increase in teacher skills in managing learning by applying the constructivism-based problem-based learning model from cycle I to cycle III. In cycle I the average score achieved by the teacher was 2.59 with a fairly good category, in cycle II the average score achieved by the teacher was 3.1 in the good category and in cycle III the average score achieved by the teacher was 3.4 by category Good.

From the figure it can be seen that teachers are increasingly skilled in managing learning by using the PBL model. From the explanation above, it can be seen that there was an increase from cycle I to cycle III, both increasing individual and classical mastery, increasing teacher and student activity, and increasing teacher abilities in managing learning.

So it can be concluded that the application of the PBL learning model succeeded in making students interested and enthusiastic about participating in learning. In addition, students' responses to the application of the PBL model also tended to be positive. This positive response shows that students are enthusiastic about the learning presented. This can motivate students to increase attention and make them actively involved in fun and meaningful learning experiences. This motivation encourages students to carry out learning activities as observed by observers. The high student response can indirectly help students gain a complete understanding of the concept.

CONCLUSION

Based on the results of research and data analysis on classroom action research (CAR) which has been carried out for 3 cycles, it is seen that there is an increase in learning outcomes, teacher and student activities, the ability of teachers to manage learning, and good student responses to the application of the PBL model.

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