

DOI:10.58468/remics.v2i1.53

Enhancing Student Engagement and Active Participation in Dynamic Electricity Problem-Solving through Problem-Based Learning (PBL)

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Abstract

Purpose: This study aims to analyse the impact of the implementation of Problem-Based Learning method to the student's engagement and active participation in class.

Research Methodology: This study uses Classroom Action Research with descriptive statistics using the data of student's engagement and active participation.

Results: The application of problem-based learning can increase student's engagement and active participation in class.

Limitations: This study analyses the impact of Problem-Based Learning method in Science Class.

Contribution: Problem-Based Learning can be a useful method to increase student's engagement and active participation in class.

Keywords: *Problem-Based Learning, Classroom Action Research*



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1. INTRODUCTION

Education is one of the essential factors in human life. In obtaining a quality education, effective and efficient learning methods need to be applied. Effective and efficient learning methods are crucial to achieving educational goals. Each learning method has different advantages and disadvantages. Therefore, selecting the suitable learning method depends on the learning objectives, student characteristics, and the subject matter to be studied.

Students' active participation during the learning process is an indicator of students desire to learn (Maktun et al., 2018). Student's active participation is one of the critical factors in successful learning for various reasons, including a) Developing a better understanding and application of subject matter; b) Increasing the involvement and motivation to learn; c) Students who are actively involved in learning through discussion and group work, can improve social skills such as communication, cooperation, and negotiation; d) Learning activities that involve students can help improve cognitive skills such as critical thinking, analysis, synthesis, and evaluation; e) When students feel involved in the learning process, they feel more motivated to learn and improve their learning outcomes, so they can focus more on learning goals and work harder to achieve these goals; f) Learning activities that involve students can increase their understanding of subject matter and skills, which in turn can improve overall learning outcomes (Wahyuni et al., 2020).

Learning outcomes are a final assessment of the teaching and learning process and changes in behavior for the better due to cognitive, affective, and psychomotor learning from the learning process at school. The indicators used to measure learning outcomes are the post-test, according to indicators of cognitive learning outcomes, including knowledge or memory, understanding, application, analysis, synthesis, and evaluation.

Class IX A at SMPN 6 Kuningan shows unsatisfactory learning outcomes in dynamic electricity material. The unsatisfactory learning outcomes marked by inactive class activity and grades that do not reach the passing grade of 70 are likely caused by the learning model used by the teacher that has not been able to increase the activity and student learning outcomes. Teaching practices that are based on something other than evidence and the tendency to use less effective traditional teaching strategies. Evidence-backed active learning practices can help improve STEM (Science, Technology, Engineering, and Mathematics) education (Prince, 2019). Therefore, this learning process requires new methods to stimulate students' desire to participate actively in learning (Wahyuni et al., 2020).

Student active participation is an essential aspect of achieving an optimal learning experience. For this reason, teachers need to play a role in supporting student learning activities. Teachers can do various ways to activate students in learning. Efforts to increase active learning can be made by utilizing the learning approach. Active learning has effectively improved student learning outcomes, critical thinking skills, and problem-solving (Prince, 2019). The learning model oriented toward student activity is the problem-based learning (PBL) model (Nurrohim et al., 2022).

PBL aims to help students learn the concept of knowledge and problem-solving skills by connecting problem situations that exist in the real world (Fauziah, 2018; Wisudawati & Sulistyowati, 2017) and can improve student learning outcomes (Rupika & Darmawan, 2018; Sulaiman et al., 2018). PBL is a learning model designed and developed to develop problem-solving abilities (Mustaji, 2009). Applying a problem-based learning model to students is expected to increase their active participation and stimulate their participation in a lesson.

Previous research has shown that there is an effect of applying the problem-based learning model to increasing student activity in class (Maktun et al., 2018; Nurrohim et al., 2022; Wahyuni et al., 2020). Problem-Based Learning Learning Model learning model is a series of learning activities that give freedom to students to be able to identify problems as well as solve these problems independently or in groups with certain stages. The goal is that students are more active in the learning process and students can improve their critical thinking skills in students. This study will look at the effect of applying the problem-based learning model to the level of student activity in integrated science subjects in class IX A SMPN 6 Kuningan.

2. LITERATURE REVIEW AND HYPOTHESIS DEVELOPMENT

Student Activity

Effective learning provides opportunities for students to study or carry out activities independently. In classroom learning, the teacher is a facilitator who helps students acquire knowledge, attitudes, and skills through learning activities. Students are expected to work alone or find problems on their own to fulfill their curiosity (Maktun et al., 2018). Student activity can be seen when students play a role in learning, such as actively asking students and lecturers, wanting to have group discussions with other students, being able to find problems and being

able to solve these problems, and being able to apply what has been obtained to solve the problems they face (Mucharom, 2022).

Efforts to increase student activity in class are based on research conducted by (Nurrohim et al., 2022).

- 1) Applying active and participatory learning methods, such as cooperative, problem-based, project-based, and flipped classrooms.
- 2) Using technology in learning, such as mobile applications, interactive games, and multimedia presentations.
- 3) Creating a pleasant and conducive classroom atmosphere for learning by paying attention to lighting, ventilation, and room layout. In addition, building positive relationships with students and respecting diversity can create a fun atmosphere and support student engagement.
- 4) Provide timely and targeted feedback to students. Feedback can help students to improve their performance and increase learning motivation.
- 5) Develop various problem-based learning strategies in which students are expected to develop critical, creative and higher-order thinking skills in solving problems.
- 6) Encourage active participation of students in class discussions and provide opportunities for them to present their ideas and thoughts in front of the class.

These efforts can increase student participation in class and ultimately improve the overall quality of learning. However, it must be remembered that each student has different learning needs and uniqueness, so a practical approach must be adapted to the needs and individual characteristics of students in the classroom.

Student learning outcomes

Learning outcomes refer to the ability of students who have experienced learning activities and include behavioral changes that include cognitive, affective, and psychomotor abilities. Changes in cognitive abilities are related to knowledge, whereas changes in psychomotor abilities are related to skills, and changes in affective abilities are related to attitudes. In the learning process, changes in student behavior increase in terms of knowledge, for example, from not knowing to know or from not understanding to understanding, as well as changes in skills (Maktun et al., 2018)

Problem-Based Learning Learning Methods

Problem-based learning (PBL) is a learning method centered on problem-solving. The PBL method emphasizes task- or problem-based learning, in which students must identify problems, collect information, analyze data, and solve problems creatively. The PBL method involves students in small group learning to solve the problems they face. The teacher's role in this method is as a facilitator who provides guidance and feedback (Hamruni, 2009).

The PBL method can help students hone critical, creative, and analytical thinking skills. In addition, this method can motivate and involve students actively in learning because they participate actively in solving problems relevant to their daily lives. However, to implement PBL effectively, careful preparation is needed, including selecting appropriate problems, clear assignments and learning objectives, and adequate teacher guidance and support (Hamruni, 2009).

This learning model prioritizes students to be active and think critically in solving a given problem with their abilities. In the Problem-Based Learning (PBL) model, students will learn current and accurate problems faced by their environment in a way oriented to authentic

problems from the student's living environment. This can stimulate students to think at a higher level. Problem-Based Learning (PBL) is a learning model that uses real-world problems as a context for students to learn about critical thinking and problem-solving skills and acquire essential knowledge and concepts from course material or subject matter (Maktun et al., 2018). The Problem-Based Learning (PBL) model is designed so that students gain essential knowledge, making them proficient in solving problems, and has their learning method and skills to participate in teams (Curriculum 2013 Middle School/Madrasah Tsanawiyah, 2014).

Problem-based learning is an innovative learning model designed and developed using real-world problems as a learning context to develop problem-solving skills so that students gain new knowledge in their way in solving problems (Mucharom, 2022).

The problem-solving plan that will be used in this study is to use a problem-based learning model. The steps for implementing the problem-based learning model include: (1) the problem orientation phase to students, (2) organizing students, (3) assisting group investigations, (4) developing and presenting results, (5) analyzing and evaluate the problem-solving process (Inayati & Kristin, 2018).

Syntax Problem-Based Learning (Jumanta, 2014)

Phase	Teacher Behavior
Phase 1: Orientation of students to problem	The teacher explains the learning objectives, everything that will be needed, and motivates students to be involved in the problem-solving activity they choose.
Phase 2: Organizing students to study	Teachers help students define and organize learning tasks related to problems
Phase 3: Guiding individual or group investigations	Teachers encourage students to collect appropriate information, and carry out experiments or observations to get explanations and problem-solving
Phase 4: Develop and present the work	Teachers assist students in planning and prepare appropriate work, carry out experiments or observations to get explanations and problem-solving
Phase 5: Analyze and evaluate the process solution to problem	Teachers help students to reflect on or evaluate their investigations and the processes they use

Previous Research

Active learning positively affects student academic achievement, especially in science and technology subjects. In addition, the effect of active learning was stronger on less skilled students and the use of more structured learning techniques. These findings provide empirical support for using active learning strategies to improve student achievement (Chen et al., 2021).

Research conducted by (Dincer, 2018) shows that students who take part in active learning have a higher motivation than students who take conventional learning. This can be seen from student involvement in class, interest in learning, desire to achieve academic goals and confidence in solving problems.

Active learning can increase student motivation and increase student involvement in learning. This can improve student learning outcomes and provide a more positive learning experience. These findings provide empirical support for using active learning strategies to increase student motivation (Dincer, 2018; Nurrohim et al., 2022; Wahyuni et al., 2020).

Using active learning and student-based pedagogy can help improve student learning outcomes and develop the skills needed in the world of work. This study's results indicate the need to adopt innovative and student-oriented teaching strategies in tertiary institutions to improve the quality of education and student career preparation (Freeman et al., 2018).

3. RESEARCH METHODOLOGY

This research uses the type of Classroom Action Research. (Arikunto & Suharsumi, 2010) Mentions that PTK is an examination of learning activities in the form of an action, which is deliberately raised and occurs in a class together. The subjects in this study were class IX A students of SMPN 6 Kuningan, totaling 27 people in the Integrated Science subject, the Dynamic Electricity Chapter. In this study, the Problem-Based Learning learning model was applied to integrated science subjects to see the effect on student activity later.

Data Collection Techniques

Problem-Based Learning is a series of learning activities that allow students to identify and solve problems independently or in groups with certain stages. The goal is for students to be more active in the learning process and for students to be able to improve students critical thinking skills (Wahyuni et al., 2020).

The data collection method is based on research conducted by (Wahyuni et al., 2020):

1. Observation sheet

Observation sheets are used to observe student learning and active participation. Active student learning can be observed through the activities carried out by students. Student activity was seen from

- a) Participate in the implementation of the study task
- b) Engage in problem-solving
- c) Ask other students or the teacher if they do not understand the problem they are facing.
- d) Trying to find the various information needed to solve the problem
- e) Carry out group discussions according to the teacher's instructions
- f) Assess his abilities and the results obtained
- g) Train themselves in solving similar questions or problems
- h) Opportunity to use or apply what has been obtained in solving the tasks or problems it faces.

The characteristics included in PBL include: (1) problems are used as the beginning of learning; (2) usually the problems used are real-world problems presented in an ill-structured manner; (3) problems usually require multiple perspectives; (4) the problem makes the learner challenged to get learning in a new learning area; (5) highly prioritizes independent learning; (6) utilizing various sources of knowledge, not from just one source, and (7) learning is collaborative, communicative, and cooperative. This characteristic requires students to be able to use higher order thinking skills, especially problem solving skills (Wahyuni et al., 2020).

2. Evaluation Test

Written evaluation tests are arranged according to the essential competencies to be achieved by students.

3. Action Completeness Criteria

The indicator of success in the aspect of active participation in this study is when student activity increases by more than 70% of the number of students in one class who are active in learning activities. While the indicator of success in learning outcomes is when student learning outcomes experience an increase in average scores and at least 75% of students have achieved mastery learning above the passing grade, namely 75.

4. Data analysis

The data analysis used in this study refers to research conducted by (Wahyuni et al., 2020). Observational data counted the number of scores obtained from each student. Then the percentage of student activity is calculated by the formula:

$$\text{Percentage of Student Active Participation} = \frac{\text{The total score of all students}}{\text{number of students} \times \text{maximum score}} \times 100\%$$

Students are said to have achieved learning mastery if students have achieved a score above the passing grade. To calculate the achievement of learning outcomes, the following formula is used:

$$\text{Percentage of learning outcomes} = \frac{\text{number of students passing the passing grade}}{\text{The number of students}} \times 100\%$$

In addition to the increasing number of students who complete the passing grade, learning outcomes are said to increase if there is an increase in the average learning outcomes in each cycle. The following formula calculates the average value of learning outcomes:

$$\text{Average value} = \frac{\text{The total score of all students}}{\text{the number of students}}$$

The procedure for this study uses the Kemmis & MC design. Taggart was carried out in 2 cycles, each consisting of four stages: planning, action, observation, and reflection—data analysis techniques using descriptive qualitative and quantitative descriptive analysis. Data collection uses observation and evaluation tests (Wahyuni et al., 2020). Figure 1 shows the cycle in classroom action research.

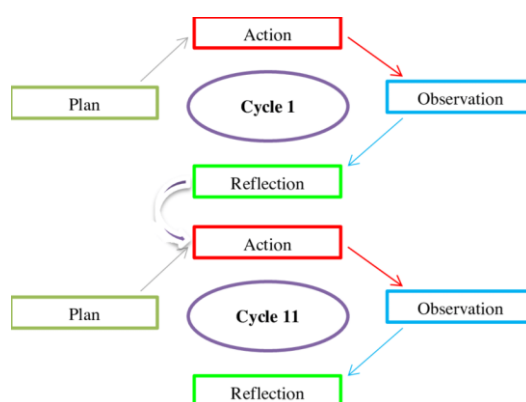


Figure 1 Kemmis & McTaggart Classroom Action Research

4. RESULTS AND DISCUSSIONS

This research was conducted in class IX A of SMPN 6 Kuningan with a total of 27 people in the Integrated Natural Sciences Chapter of Dynamic Electricity subject. The research was carried

out using two cycles, where each cycle consisted of two meetings and ended with an evaluation test.

In the early stages, first observations were made to students to determine student activity and learning outcomes data. The following are the results of the pre-action (see table 1)

Table 1 Observation of Pre-Cycle Student Activity

No	Observation Aspect	The number of students	Percentage
1	Students pay attention to the teacher's explanation	14	52%
2	Students are not easily influenced by other situations when learning	11	41%
3	Students are active in answering the teacher's questions	5	19%
4	Students have the initiative to ask questions	7	26%
5	Students can express opinions during learning	4	15%
6	Students can present their work	2	7%
7	Students participate in concluding learning outcomes	1	4%
8	Students turn in assignments on time	8	30%
	Rate-rate	6.5	24%

From the table above, it can be concluded that the level of student activity prior to the holding of this research action was 24%. Next, a test of two cycles will be carried out in line with the PBL learning model. All activity results will be observed using the existing observation sheet during the learning process. The observation sheet will consist of eight items that already existed during the previous pre-action.

Table 2 Schedule for the implementation of Cycle I and II actions

Cycle	Date and time	Time
I	Thursday, October 6, 2022	08.00 - done
	Wednesday, October 19 2022	08.00 - done
II	Wednesday, December 14, 2022	08.00 - done
	Wednesday, December 21, 2022	08.00 - done

Table 3 Results of increasing the percentage of student activity

No	Observation Aspect	Percentage of Cycle I		Percentage of Cycle II	
		Meeting. 1	Meeting 2	Meeting 1	Meeting 2
1	Students pay attention to the teacher's explanation	68%	74%	92%	100%
2	Students are not easily influenced by other situations when learning	56%	60%	74%	82%
3	Students are active in answering the teacher's questions	34%	48%	64%	72%
4	Students have the initiative to ask questions	42%	58%	62%	76%

No	Observation Aspect	Percentage of Cycle I		Percentage of Cycle II	
		Meeting. 1	Meeting 2	Meeting 1	Meeting 2
5	Students can express opinions during learning	32%	40%	48%	64%
6	Students can present their work	20%	34%	45%	54%
7	Students participate in concluding learning outcomes	24%	38%	46%	64%
8	Students turn in assignments on time	60%	78%	85%	92%
	Rate-rate	42%	54%	65%	76%

The results are constantly increasing based on the observations made after evaluating each test carried out in each cycle. In the first cycle at a meeting, one found that the average value of student activity was 42%. Then, the second meeting found an average increase in student activity of 54%. Furthermore, in the second cycle at the first meeting, an average increase in student activity was found from the previous results, which was 65%. Finally, at the second meeting in the second cycle, a remarkable average increase was found at an average rate of 76%.

5. CONCLUSION

Based on the results of the research that has been done, the application of problem-based learning can increase student activity. This is supported by the findings where every cycle and student activity meeting always gets an average percentage value that always increases. The average final score of 76% of student activity meets the expected success indicators for increasing the percentage of completeness with a minimum score of 75% of students completing the lesson.

LIMITATION AND STUDY FORWARD

Based on the results of classroom action research research using the Problem-Based Learning model, the researchers provide suggestions for teachers to be able to apply this Problem-Based Learning method to other subjects. Furthermore, teachers can increase their proactive attitude and always create harmonious relationships with students. This will help students grow self-confidence and actively participate in learning.

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