Research Article

The Role of Problem-based Learning Model in Enhancing Students' Motivation and Physics Academic Achievement

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Abstract.
The teacher's role in guiding and directing students to achieve desired academic achievement is crucial. By designing engaging learning activities, teachers optimize student involvement and presence, leading to increased motivation and improved academic achievement. At a senior high school in Banjarmasin, a research study using the problem-based learning (PBL) model was conducted to enhance motivation and academic achievement for 10th-grade students. The study focused on three areas: (1) lesson plan implementation, (2) students learning motivation, and (3) students' academic achievement. Collaborative classroom action research was conducted in two cycles involving planning, implementation, observation, and reflection. Data were collected from 34 students through tests, observation, and documentation. The study findings indicated that: (1) Lesson plan implementation was improved from an average score of 3.34 (good) in cycle I to 3.84 (very good) in cycle II. (2) Students' learning motivation increased from an average score of 2.29 (moderate) in the pre-cycle to 3.48 (very high) after the learning cycle. The N-gain score was 0.69 (moderate). (3) Students' academic achievements had significantly improved, with the average pre-cycle score of 42.60 increasing to 83.44 after the learning cycle with the N-gain score of 0.70 (high). (4) Students' responses to PBL were positive, with an average rating of 3.24, indicating a good category. In conclusion, implementation of the PBL model effectively enhanced students' motivation and improved academic achievement of the 10th-grade students at the senior high school in Banjarmasin.

Keywords: academic achievement, physics learning, Problem-Based Learning, students' motivation

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1. INTRODUCTION

Human life in the 21st century has undergone significant changes, high-quality individuals, skilled expertise, and broad insights are crucial in this era of globalization (1). Scientists and experts have concluded that the key to solving all of the emerging problems of the 21st century is knowledge, which is based on continuous education (2). Improving the quality of human resources in Indonesia can be achieved through education at all levels. Education is a vital national priority in creating competent individuals.

In the 21st century, education emphasizes creativity, critical thinking, problem-solving, communication skills, community engagement, and character development.

The enhancement of education is a key factor in advancing civilization and nation-building in the future, as stated in the Law of the Republic of Indonesia No. 20 of 2003, particularly in article (3), which addresses the education system: "National education functions to develop capabilities and shape dignified national character and civilization in the context of educating the life of the nation, aiming at developing the potential of students to become human beings who believe and fear God Almighty, have a noble character, are healthy, knowledgeable, capable, creative, independent, and become a democratic and responsible citizen".

To achieve this goal, it is essential to improve the quality of education by involving high-quality human resources, particularly teachers. Teachers play a crucial role in guiding students toward desired academic achievement. The professional skill of a teacher involves the capacity to fulfill roles that require the application of competencies, which are essential abilities (4). However, the traditional teaching methods currently used in education do not develop students' reflective thinking skills (5). According to (6), interaction between students and teacher, and interaction between students and content have positive impact on student engagement, student satisfaction and impact on the success of education and learning. Teacher–student relationships are of central importance for students' motivation (7).

Teacher support have an influence on motivational (expectancy–value beliefs and achievement goals) and student behavioral engagement, so it is important to improve students' involvement in their learning process (8). Learning motivation is the desire of students to carry out learning activities that aim to increase the achievement of learning achievement (9). Students' academic motivation is malleable in nature and can change over time. learning behaviors are driven by a combination of motivations, resulting in distinct motivational profiles (10).

Initial observations and interviews with tenth-grade students at a senior high school in Banjarmasin revealed that only two students showed high motivation, while 32 students showed moderate motivation in learning physics. Some students lacked enthusiasm, were not actively engaged, and seemed reluctant to participate. This low motivation negatively impacted their academic achievement (11). In this case, academic achievement can be broadly defined as to what extent a student has met their academic goals, including motivation and academic achievement(12). Academic achievement is

described as the demonstrated abilities and cognitive processes of students within specific subjects (13,14). Academic achievement comprises statements that outline the knowledge and understanding students can attain upon finishing the learning process.

In the pre-cycle, 28 out of 34 students in class X-F did not reach the school's passing grade of 75, with only six students achieving it. The average score in the pre-cycle was 42.60, indicating low academic achievement in physics. The low scores of physics students caused by students unable to solve problems according to the stages of problem-solving and students' motivation in learning physics that was still low (15). The use of various teaching models plays a role in improving student academic achievement. Teachers can apply innovative learning approaches to enhance achievement. Models of learning function as valuable references for shaping classroom procedures (16).

In studying physics, students are given knowledge and experience of physics concepts. In addition, students are trained to solve various problems in everyday life (17). Therefore, active student involvement is very important. So, implementing an effective learning model is very important. Based on observations, surveys and interviews, it is necessary to apply a model that actively involves students, increasing their motivation and academic achievement. One of the learning methods that can be used to increase student motivation and academic achievement, as well as to support problem-solving skills and creative thinking skills is PBL (18). Since PBL is a teaching technique that encourages students to practice and solve problems on their own, student skills in logical thinking and critical thinking, analytical thinking, synthetic thinking, and creative thinking are enhanced (19).

The research results of (20) and research by (21) state that the PBL model can increase students' learning motivation. Then the research results of (22) also research by (23), and research by (24) , state that the PBL model can improve student academic achievement. Then the results of (25) research and the research results of (26) state that the PBL model can increase student motivation and academic achievement in class. So based on relevant previous research, the PBL model is appropriate for use in class X-F at SMA Negeri 11 Banjarmasin to increase learning motivation and student academic achievement. Based on the description above, the researcher is interested in conducting research with the title: "The Role of Problem-Based Learning Model in Enhancing Students' Motivation and Physics Academic Achievement".

2. METHOD

This study is a Classroom Action Research (CAR), it is an approach used to determine the most effective strategies within the classroom, aiming to enhance student learning through teacher-driven improvements (27). This CAR consists of two cycles. The number of cycles used is chosen based on the issues faced by the researcher in the field or based on the problems that need to be solved. The issues were resolved after the second cycle, so this CAR was conducted in two cycles, with each cycle following the stages of the Kemmis & McTaggart model, involving stages such as planning, implementation, observation, and reflection. These steps are iterated until the research goals are attained (28). The research was conducted with 34 students. The study was carried out in two cycles over a period of three months, from March to May 2023.

In this research, the data collection techniques used include several methods: (a) Firstly, the observation method is used to directly observe the interaction between teachers and students during the learning process. (b) Secondly, the test method is used to measure the level of understanding and development of students in specific aspects. The test instrument is administered both before (pre-test) and after (post-test) the implementation of the learning model. Students' academic achievement can be determined through the analysis of their test scores. This test provides information about the students' understanding of physics concepts after going through the learning process. It also helps identify changes in the student's motivation level before and after the learning cycle. (c) The documentation method is also used to obtain data on the implementation of the PBL model. Documentation can take the form of notes, teaching materials, or learning products generated during the learning process. Documentation data is analyzed using the triangulation method (29). This documentation data provides an overview of how the learning model is applied and how students are involved in learning activities. By utilizing these diverse data collection techniques, this research can generate comprehensive information about students' learning motivation measured using a self-assessment questionnaire, their academic achievement, as well as the implementation and effectiveness of the PBL model in improving motivation and academic achievement in physics for tenth-grade students in Banjarmasin.

After collecting data from this research, the data will be analyzed using a mix method that integrates qualitative and quantitative approaches, with the aim of leveraging the strengths of both types of research to provide a more comprehensive understanding of the studied phenomenon (30). Quantitative data will be analyzed using a percentage

approach to understand the proportion and distribution of the research findings. Meanwhile, qualitative data in the form of words or sentences will be analyzed by identifying patterns, themes, and meanings that emerge based on predetermined criteria. Qualitative analysis helps to understand deeper and more complex aspects of the phenomena being studied, such as students' perceptions, opinions, and experiences. Thus, the combination of quantitative and qualitative analysis provides a more comprehensive understanding of the research findings.

3. RESULTS AND DISCUSSIONS

After conducting the research, here is a description of the implementation of PBL in physics learning:

3.1. Implementation of Lesson Plans

In the realm of physics education in school settings, it is essential for teachers to instill problem-solving abilities in students, create an environment conducive to discussions, incorporate hands-on experiments, and support students in getting ready for exams to enable profound learning. Similarly vital is the students' development of an affinity for the subject, nurturing positive attitudes toward the course, and demonstrating self-discipline (31). However, students often perceive physics as intimidating despite its relevance to everyday life. Thus, diverse methods and learning models are needed to change their perception and make physics interesting.

The implementation of PBL is assessed based on the implementation of the learning stages according to the lesson plans recorded using an observation sheet for plan implementation. It is categorized as not good, less good, fairly good, good, and very good, with improvements observed from Cycle I to the next cycle. The implementation of the lesson plans in Cycle I and II can be seen in the Figure 1.

In cycle I, the average score of the research results was 3.34, while in cycle II it increased to 3.84. This shows an increase in the teacher's ability to manage classes in the learning process from cycle I to cycle II. In cycle I, as a whole, the implementation of lesson plans is still in the good category. The obstacles encountered were mainly related to the preliminary stage, where many students were not ready to take part in learning. The guidance provided by teachers is still lacking, and many students are not familiar with the PBL model. Important for teachers to establish a classroom environment

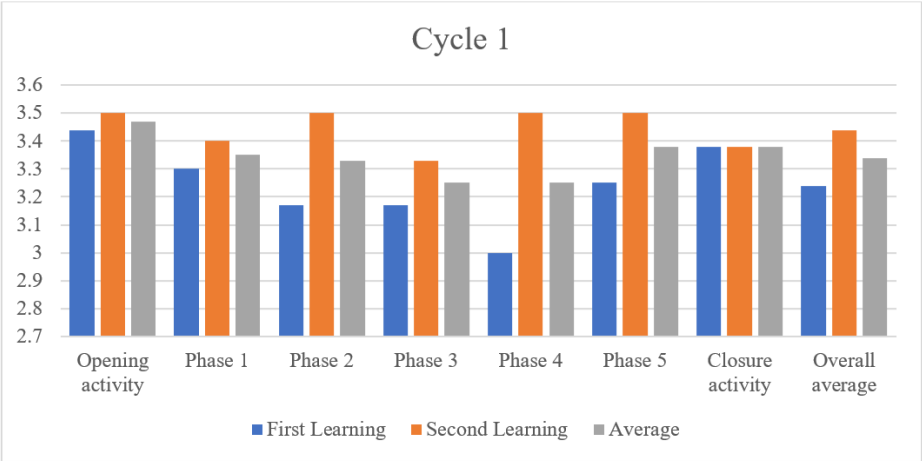

Figure 1: Implementation of Learning Scenarios in Cycle 1.

that is positive and engaging, in order to necessitate the utilization of various teaching strategies, techniques, and approaches (32). Because situational engagement plays a critical role in promoting students' academic performance (10).

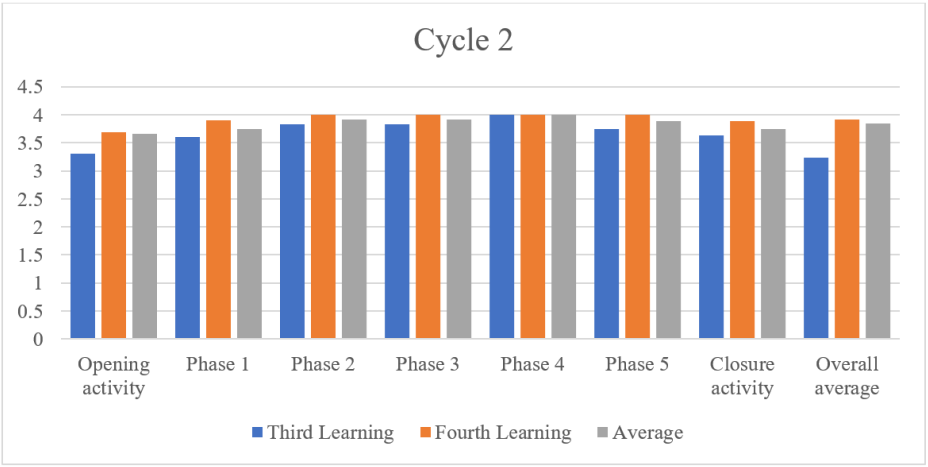

Figure 2: Implementation of Learning Scenarios in Cycle 2.

In cycle II, the overall implementation of lesson plans increased to a very good category. The teacher has succeeded in carrying out what is planned in the lesson plan well, as well as guiding the form of questions and multi-directional discussions well, to be able to guide students in the learning process. Students are ready to take part in learning and seriously pay attention to what is conveyed by the teacher. They are also getting used to the PBL learning model. PBL places significant emphasis on the notion that the learning process commences with the introduction of a problem. Thus, this approach to learning initiates by tackling a problem, and the problem assigned to

students should offer novel information or concepts, allowing students to acquire fresh knowledge before they can successfully address the given problem (33).

PBL is related to everyday life, so skills and strategies for solving a problem become the essential capability that must be owned by students in learning, so that students' critical thinking can be seen from the ability of students to respond to every problem about everyday life (34). PBL uses appropriate problems to increase knowledge and understanding, also provide students with an immersive experience (35).

The PBL model was chosen as it encourages active student involvement in knowledge acquisition. It increases enthusiasm and understanding of physics concepts, ultimately enhancing motivation and academic achievement. Through PBL, teachers can continuously motivate students and promote their independence in completing assignments. This learner-centered model fosters creativity, collaboration, metacognitive thinking, higher-order thinking skills, problem-solving, and teamwork. It aligns with the Independent Curriculum, emphasizing teacher flexibility in creating learning experiences based on student's abilities. Problem-Solving Skills are important skills for students to have in order to the challenges and demands of the 21st century (36). PBL may improve students' 21st century skills as it reflects modern insights to learning (37).

Thus, the results of increasing the implementation of lesson plans from cycle I to cycle II showed that the teacher was successful in overcoming the obstacles that arose in the preliminary stage. Teachers are also able to improve their ability to manage classes and facilitate learning better.

3.2. Student Learning Motivation

The measurement of students' learning motivation before and after the learning cycle is conducted using a self-assessment questionnaire based on the indicators from Sardiman (38), the results are as shown in the following figure:

Students learning motivation includes feelings of pleasure when following lessons, willingness to do assignments, encouragement to achieve good grades, awareness of the importance of learning, and independence in learning. In the pre-cycle measurement, the student's learning motivation score was 2.29 in the moderate category. However, after the cycle was carried out, measurements were taken N-gain and a score of 3.48 was obtained in the very high category. This shows an increase in students' learning motivation after implementing the learning cycle. Motivation is an important

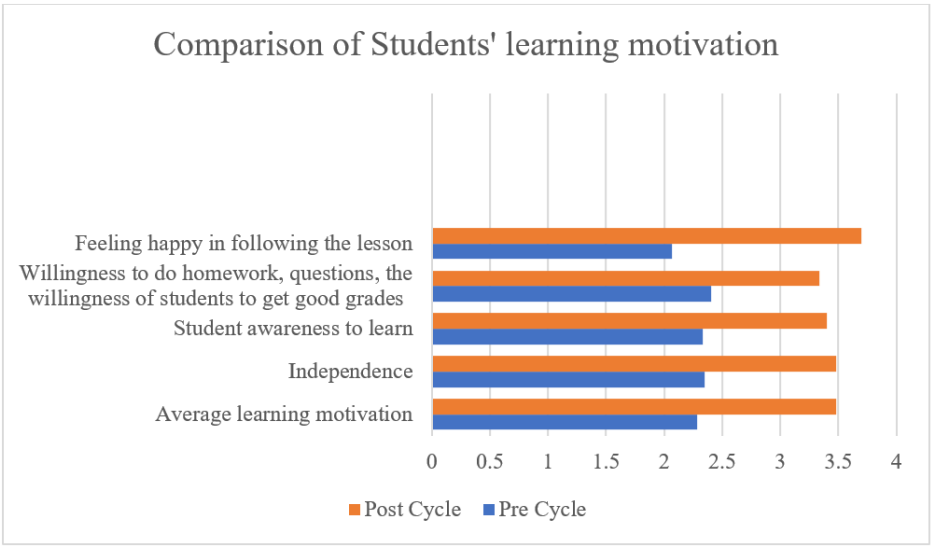

Figure 3: Comparison of Students' learning motivation.

factor in the learning process; motivated students tend to engage in class activities and perform better over time (39). Student who are not motivated does not want to be involved in learning or does not know why he or she should participate in learning (40).

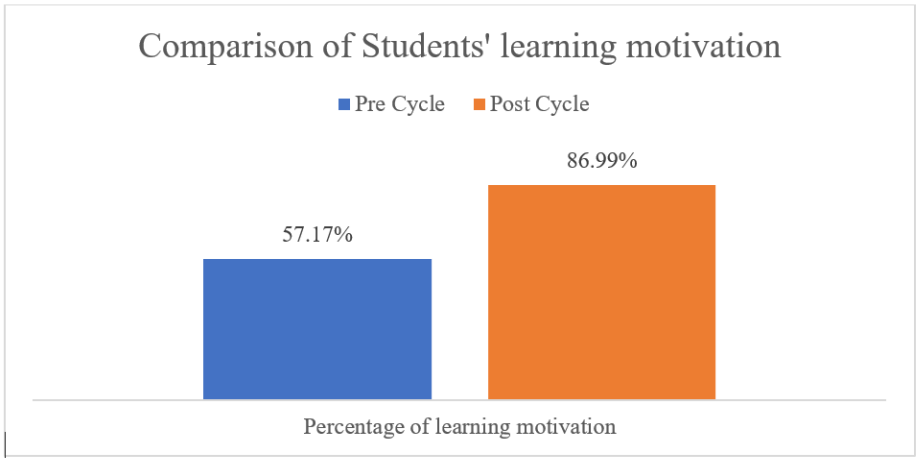

Figure 4: Percentage of Students' learning motivation.

Motivation is vital in learning as it stimulates student engagement. In the context of learning activities, motivation can be defined as an internal force that drives students' learning activities and provides direction. Therefore, if students lose their motivation to learn, no learning activities will occur on their part. In the pre-cycle, students' learning motivation is in the moderate category. Several contributing factors include some students feeling incapable of completing assignments or even not doing them, preferring to joke with friends during Physics lessons, being reluctant to ask the teacher if there

are difficulties in understanding the material, feeling uninterested and unmotivated to do physics assignments and feel not assisted by the teacher when facing learning difficulties.

However, at the post-cycle stage, students' learning motivation experienced an increase in every aspect. This is due to the enthusiasm for learning that increases after participating in learning. In addition, students also feel happy when material containing problems is presented in learning, they reduce the habit of joking with friends while studying, actively ask the teacher if there are things that are not understood, feel happy and challenged to do the assignments given and feel helped by the teacher when facing learning difficulties. N-gain learning motivation is 0.69 or on medium category. If the effectiveness criterion is greater than 0.700, it is classified as high (41). This finding is consistent with the results of research by (20) which state that the application of the PBL model can increase students' learning motivation. And research by (21) that the PBL model has advantages in arousing and maintaining student motivation in their learning activities. Therefore, by using the PBL model, the learning motivation of students at SMA Negeri 11 Banjarmasin has increased.

3.3. Students' academic achievement

At the end of the lesson, the teacher gives assessment questions to students to measure the extent to which students' academic achievement are related to the material being taught. The problems given during the learning process are in the form of issues found in the lives or environment of the students related to the physics lesson on the topic of energy sources. The ability to solve problems demonstrates students' critical thinking abilities. When students showed a positive response to the problem is proof that students are able to demonstrate critical thinking skills (3). The academic achievement of students in cycles I and II obtained results as in the Table 1.

Based on the research, it was found that at the pre-cycle stage, only 17.64% of students achieved complete academic achievement. Out of a total of 34 students who took the test, only five people managed to achieve completeness individually. This decrease was caused by students' lack of understanding of physics concepts and their low ability to formulate physics equations and analyze problems.

However, after the learning cycle was carried out, the percentage of students who achieved completeness increased to 91.17%. Of the 34 students who took the test, 31 people managed to achieve completeness individually. This increase occurred because

TABLE 1: Comparison of Student academic achievement.

No.	Description	Pre Cycle	Post Cycle
		Results	Results
1	Average test score	42.60	83.44
2	The number of students who reached completion	5	31
3	The total number of students	34	34
Percentage of students who reached completion		17,64%	91,17%
N-gain		0.70	
N-Gain category		High	

students studied physics concepts more deeply through the learning model used. They also follow the learning process in each phase of the learning model well, and the teacher provides more opportunities for them to ask questions if there are things they don't understand. Students are familiar with the PBL model, so they can find and understand the lesson concepts well.

The knowledge assimilated by students has the potential to remain in their memory for an extended period, leading to an improvement in their academic accomplishments. This concept aligns with Piaget's theory, which posits that individuals construct knowledge through their own cognitive processes (42). The Gestalt theory posits that human experience is organized and shaped holistically. This implies that individuals in the process of learning will perceive stimuli as unified wholes rather than isolated components.

Increasing the learning completeness of students by applying the PBL model, following theoretical studies according to (43), the PBL model is highlighted for its benefit in enabling students to attain a comprehensive understanding of the learning material. Using PBL as a method of instruction makes students active and enables them to develop cognitive skills (44). These results are based on the results of research by (22), also research by (23), and research by (24) that the PBL model can improve student academic achievement. Thus, the results of the study showed a significant increase in the completeness of student academic achievement after the implementation of the learning cycle. This shows that students have experienced increased understanding and ability in studying physics.

3.4. Student responses

At the end of the lesson, the teacher gave a questionnaire to assess students' responses to the learning carried out using the PBL model. Based on the responses given by students to the learning that has been carried out, then the results are obtained in the Table 2.

TABLE 2: Student responses after cycles I and II.

No.	Description	Results
1	The material contains conflict	3.17
2	Critical thinking	3.14
3	Develop new knowledge	3.34
4	Increased academic achievement	3.30
Average		3.24
Percentage		**80.94%**
Category		Good

Students give a positive response to learning using the PBL model. They respond well to material that contains conflict, demonstrate critical thinking skills, develop new knowledge, and experience increased academic achievement. Based on the measurement, the student's response score to learning reached 3.24 in the good category. This shows that students feel and provide a positive response to the learning that has been implemented with the PBL model.

Students' positive response to learning is caused by several factors. First, they feel more able to understand the subject matter through the use of PBL models. This has an impact on increasing their value in learning. Second, they feel more able to understand and be challenged in learning when given assignments to be completed in groups. In addition, they can provide ideas and input in the group discussion. Third, students feel helped when teachers or colleagues provide explanations for things they do not understand in the learning process.

The increased learning motivation of students in this study was also accompanied by an increase in student academic achievement, this is in line with the results of research conducted by (25) and the research results of (26), states that the PBL model can increase student motivation and academic achievement. Thus, the use of the PBL model in learning gets a positive response from students. They feel actively involved in

the learning process, can develop critical thinking skills, and experience improvements in their academic achievement.

4. CONCLUSION

From the analysis data, result and discussion it's drawn findings that: (1) the PBL model lesson plans in cycle I and cycle II was generally well implemented, namely in cycle I an average of 3.34 was obtained in the good category, and in cycle II, the average implementation score was 3.84 in the very good category, (2) students' motivation in physics learning has increased from the pre-cycle with an average score of 2.29 (moderate) to 3.48 (very high) after the PBL implemented, and the score of N-gain as high as 0.69 in the medium category, (3) students' academic achievement have increased from the pre-cycle with an average score of 42.60 to 83.44 after the learning cycle was implemented, and also the percentage of students who achieved individual completeness from the pre-cycle is 17.64% to 91.17 % after the learning cycle. So that an N-gain score of 0.70 is obtained in the high category, (4) students' responses to learning carried out with PBL is 3.24 in the good category. It can be concluded that the implementation of the PBL model effectively enhanced students' motivation and improved academic achievement of the tenth-grade students at the senior high school.

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