

The Influence of Problem-Based Learning (PBL) Model on Student Learning Outcomes on the Concept of Measurement

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Received: June 12, 2024

Revised: July 21, 2024

Accepted: August 25, 2024

Published: August 31, 2024

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DOI: [10.29303/jppipa.v10i8.8059](https://doi.org/10.29303/jppipa.v10i8.8059)

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Abstract: Problem-based learning (PBL) is a learning model that focuses on problems and solving. This research aims to describe the influence of the PBL model on student learning outcomes on the concepts of measurement. This method is experimental and replication class. The research is carried out in class VII on Madrasah Tsanawiyah school at MTs Ma'arif Tolangohula for the 2023/2024 academic year. The research design used is one group pretest-posttest. Test the research hypothesis using the t-test where, before carrying out the t-test, the data is tested first using the requirements test, namely the normality test and the N-gain test. Based on the research results, it is known that learning using the PBL model in the experimental class obtained a post-test score of 85.18, replication 1 of 80.71, and replication 2 of 80.24, for the t-test in the post-test the experimental class obtained T_{count} of 5.174 and T_{table} of 2.131, for the replication 1 obtained T_{count} of 3.133 and T_{table} of 2.131, and replication 2 obtained T_{count} of 4.287 and T_{table} of 2.131. This shows that the PBL model has the influence of improving student learning outcomes on the concept of measurement.

Keywords: Measurement; PBL model; Student learning outcomes

Introduction

Education has an important role in preparing the young generation who have fulfilled their qualifications according to the challenges that exist in 21st century (Redeker et al., 2012; Utaminingsih et al., 2023). These challenges include skills of critical thinking and problem-solving. The teacher not only plays a role as someone who provides knowledge in the learning process but also plays a role in providing skills that can help students in learning. As one of several skills mentioned above, collaboration skills are important skills for students to have (Orakci, 2023; Xu et al., 2023; Anggraeni et al., 2023; Octaviana et al., 2022).

Learning is an empowerment process that is important in education to achieve optimal learning outcomes (Arambuluzabala et al., 2024; Pertiwi, 2023; Abidin, 2022). The use of effective and efficient learning models greatly influences students' learning abilities. One model that can influence student learning outcomes

is Problem-Based Learning (PBL) (Nurmahasih & Jumadi, 2023; Darajat & Sapriati, 2023; Anggraini et al., 2023; Haetami et al., 2023). By presenting problems that are relevant to real life, students are expected to engage in higher-level thinking, apply the knowledge, and find solutions from the problems (Zulyusri et al., 2023; Ichda et al., 2023). PBL offers students the chance to use the knowledge and skills they have learned in a relevant and in-depth context. Directly, this learning model can improve students' literacy skills. Apart from that, through PBL, students are also taught to think critically and collaborate (Silva et al., 2018; Yu et al., 2015; Ramadhani & Nana, 2020).

PBL is student-based learning where students are designed to have the ability to carry out experiments or practicums and the capacity to address problems so that the learning model provides positive value to these students, increasing their creatively, critically, ability to solve problems (Yulhendri et al., 2023; Hou et al., 2023; Agustina et al., 2023; Arifin, 2021).

How to Cite:

Oktaviani, I., Abdjul, T., & Mursalin. (2024). The Influence of Problem-Based Learning (PBL) Model on Student Learning Outcomes on the Concept of Measurement. *Jurnal Penelitian Pendidikan IPA*, 10(8), 4498–4503. <https://doi.org/10.29303/jppipa.v10i8.8059>

PBL is a learning approach centered around problems and solving these problems (Adjilahu et al., 2021). The PBL model presents learning material by using an issue as the foundation for discussion, which students analyze and synthesize in their efforts to find solutions or answers (Suradika et al., 2023; Rizki & Suprpto, 2024; Syahlan et al., 2023). Meanwhile, Kurniasih (2014) stated that PBL is an educational approach that introduces multiple real problems in students' daily lives (contextual), thereby stimulating students to learn. Based on the opinions of the experts above, the researcher concluded that PBL is an approach to a PBL process, where students collaborate in teams to address a problem related to contextual issues in everyday life, which requires students to think critically and faced with being able to improve students' thinking abilities on an ongoing basis.

When implementing the PBL model, the stage that must be considered is orienting students toward the problem because this stage determines the success of implementing the PBL model. The problems faced are problems that are in accordance with students' real lives. Teachers should be able to create a pleasant learning atmosphere and direct learning in accordance with the principles of PBL (Mahmudah & Nugraha, 2024; Rubiyanto, 2021; Amaludin, 2023; Mualimah, 2024).

Learning outcomes are the results obtained from a follow-up study and teaching. Learning outcomes are all related to knowledge, skills, and changed attitudes. To get learning results in accordance with what is desired, teachers must have the ability to use or choose a method, model, or media in learning so that students stay energized while learning and remain enthusiastic (Arukha et al., 2020; Aeni et al., 2023).

In science learning, students must actively discover and build their knowledge, not just learn understanding

as a result of scientific activities. Science learning must also facilitate students to think and speak through minds-on and carry out activities (scientific processes) hands-on (Soysal, 2022; Oliveira & Bonito, 2023).

Based on interviews with science teachers at Mts Ma'arif Tolangohula, the media currently used by teachers during learning is PowerPoint. Microsoft Office PowerPoint is a slide show type office application program (a worksheet that is an alternating slide) that conveys concepts and arguments you wish to share with others. PowerPoint is widely used because it is easy to operate, and everyone can create a PowerPoint presentation. PowerPoint offers a variety of engaging features, including text processing, the ability to insert images, audio, animations, and customizable effects, which appeal to students and enhance their interest in the presentation. Apart from that, textbook-based learning media is also always used in classroom learning. Seeing this problem, the author wants to examine further the influence of the PBL Model on student learning outcomes in measurement concept.

Method

This research uses an experimental method and a group pretest-posttest Design. The research is carried out in class VII on Madrasah Tsanawiyah school at MTs Ma'arif Tolangohula for the 2023/2024 academic year. The subjects of this research consisted of 51 students divided into 3 classes, namely experimental class, replication 1, and replication 2, which were chosen randomly. A test (essay) consisting of a pre-test and a post-test is are the instrument used in this research. The flowchart of research in Figure 1. Data analysis techniques are the normalized gain (n-gain) test, data normality test, and hypothesis test.

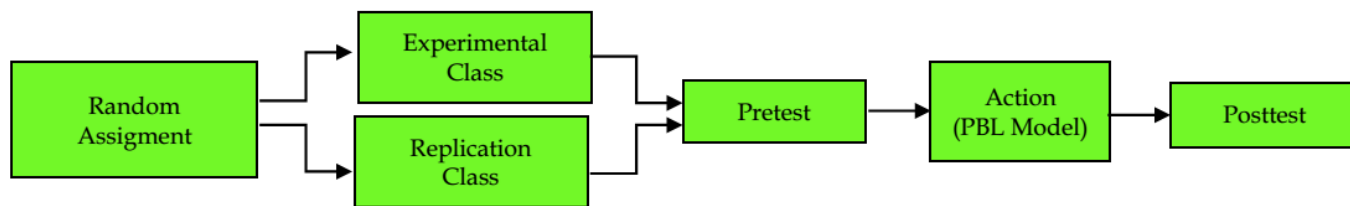


Figure 1. The research flowchart

Result and Discussion

Student learning outcomes are obtained through tests in the form of essays that validators have validated. To determine the improvement in student learning outcomes, first, they are given a pre-test. After being given a pre-test, the three classes, both experimental class, replication 1 and replication 2, are provided with instruction using the PBL model at measurement

concept, where this treatment takes place over three meetings for each class in accordance with the teaching module contained in Table 1. Based on the Table 1 is the results of calculating the average student learning outcomes in each class.

Table 1 demonstrates an increase in the average scores across each class. The experimental class was 85.18, the replication 1 was 80.71, and the replication 2

was 80.24. The results of student learning outcomes described in Figure 2.

Table 1. Results of Student Learning Outcomes

Class	Average	
	Pretest	Posttest
Experimental	40.59	85.18
Replication 1	41.18	80.71
Replication 2	39.41	80.24

Based on Figure 2 shows achievements of students experience an increase in their average scores in each class. The results of the learning process aim to ensure that students achieve cognitive competence. The results of cognitive learning are obtained, and the results of tests or working on questions given to students have been prepared based on question indicators, which are adjusted to the learning indicators of 10 essay questions. The process of obtaining this knowledge can be obtained through several things in accordance with the aspects contained in the cognitive domain measurement. The level of tests given consists of 5 levels, namely levels C2 is Understanding, C3 is Applying, C4 is Analyzing, C5 is Evaluating, and C6 is Creating.

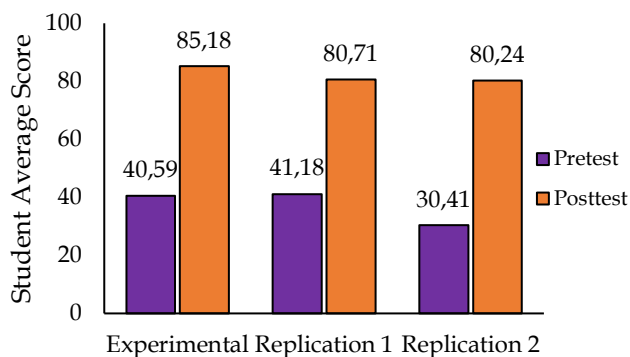


Figure 2. Achievements of student average score

Data Normality Test

In this research, the Smirnov colmogrof normality test formula contained in Chapter III was used using Microsoft Excel. To test the normality of data in the three classes, namely experiment, replication 1, and replication 2. The results, data normality test in Table 2.

Table 2. Results of Data Normality Test

Class	F_i	K	Status
Experimental	0.465	0.318	Normally distributed
Replication 1	0.465	0.318	Normally distributed
Replication 2	0.465	0.318	Normally distributed

The Table 2 shows data normality test results, it is known that $F_i \geq K$ for the real level $\alpha = 0.05$. So, it can be concluded that the research data for the three classes, are normally distributed.

Hypothesis testing

Hypothesis testing aims to determine whether the PBL model influences the measurement concept in the experimental and replication classes given on student learning outcomes. For hypothesis testing for the three classes in Table 3.

Table 3. Results of Hypothesis Testing

Class	T_{count}	T_{table}	Status
Experimental	5.174	2.131	H_a Received
Replication 1	3.133	2.131	H_a Received
Replication 2	4.287	2.131	H_a Received

Table 3 shows T_{count} for experimental was 5.174, replication 1 was 3.133, and the replication 2 was 4.287. Meanwhile, T_{table} for the three classes were 2.131. The three classes obtained the T_{count} value higher than the T_{table} value with H_a received status.

Test N-gain

N-gain test analysis results using the course average normalized gain per class in Table 4.

Table 4. Results of N-Gain Test

Class	N-gain	Criteria
Experimental	0.64	Medium
Replication 1	0.64	Medium
Replication 2	0.63	Medium

Table 4 shows n-gain value of 0.64. for experimental class, replication 1 of 0.64, and in replication 2 of 0.63. Both the experimental and replication classes are in the medium category.

The results of calculating the normality of data in the three classes, the F_i result was 0.465, which means that the results obtained were normally distributed. From several data analyses carried out in this research has an influence of the PBL model are greater than the Criteria for Achieving Learning Goals on student learning outcomes in measurement concept in class VII MTs Ma'arif Tolangohula for the 2023/2024 academic year. There is further improvement in developing, presenting, analyzing, and evaluating on the problem-solving process as the researcher provides evaluations in clear and comprehensible language (Khaerudin et al., 2023; Suharyat et al., 2023). This approach aligns with previous research conducted (Adjilahu et al., 2021) that using the PBL model can influence of improving on student learning outcomes the concept of measurement.

Conclusion

The PBL model on the concept of measurement has a significant effect on the learning outcomes of class VII students. Based on the hypothesis test, the learning

outcomes of class VII students on the concept of measurement using the PBL model are greater than the Criteria for Achieving Learning Goals for all sample classes, both experimental and replication classes. In the experimental class, it was 85.18. In replication class 1, it was 80.71, and in replication class 2, it was 80.24. Meanwhile, based on the average normalized gain for all classes, both experimental and replication are in the medium category. This shows that the PBL model has the influence of improving student learning outcomes on the concept of measurement.

Acknowledgments

The researcher would like to express his gratitude to the principal and teachers in MTs Ma'Arif Tolangohula.

Author Contributions

Indah Oktaviani: Conceptualization, methodology, writing – original draft preparation; Tirtawaty Abdjul: Validation, methodology, curation; Mursalin: Writing – review and editing, formal analysis.

Funding

This research received no external funding.

Conflicts of Interest

The authors declare no conflict of interest.

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