

IMPLEMENTATION OF THE PROBLEM BASED LEARNING MODEL ON STUDENT LEARNING OUTCOMES IN THE HUMAN CIRCULATION SYSTEM IN CLASS VIII SMP NEGERI 4 STABAT

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ABSTRACT

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Low student learning outcomes are a common problem at the end of the learning process. The use of inappropriate learning models is one of the causes of low student learning outcomes. This study was conducted with the aim of determining the effect of the problem-based learning model on student learning outcomes in the human circulatory system material for class VIII of SMP Negeri 4 Stabat. This study used a quantitative approach with the Quasi Experiment method. The study population was all grade VIII students. The sampling technique was carried out using a purposive sampling method. The sample group was divided into two classes, namely the control class taught with a conventional learning model and the experimental class taught with a problem-based learning model. Each class will be given a pretest and posttest. The instrument used was a multiple-choice test instrument with 23 questions about the human circulatory system material that had been analyzed for validity, reliability, discriminating power and level of difficulty. Before testing the hypothesis, the data were tested for normality and homogeneity. From the results of the analysis, it was obtained that the sample was normally distributed and categorized as homogeneous. Furthermore, statistical hypothesis testing can be done using the t-test. The results of hypothesis testing with the t-test showed that the calculated t value of 2.88 > the t-table value of 2.01 so that H_0 was rejected. This means that there is an influence of the problem-based learning model on student learning outcomes in the human circulatory system material for class VIII of SMP Negeri 4 Stabat.

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INTRODUCTION

Education is an effort to shape, foster, and improve a person's quality of life to improve them in various aspects of life (Farid et al., 2022). Humans and education are inseparably linked. Education is a key factor in shaping humanity's future, as it allows individuals to develop their potential, knowledge, skills, and ways of thinking. Furthermore, humans are endowed with the ability to think and learn, so education plays a crucial role in helping them use these abilities wisely in their daily lives.

Natural Sciences is a subject closely related to everyday life. It studies various natural phenomena that occur in the human environment, such as living things, energy, objects, and various other natural phenomena. Science material is systematically structured based on observations, experiments, and research conducted by humans, ensuring that the knowledge gained can be scientifically validated (Siregar, M.N.N. & Aghni, 2021).

One way to ensure the learning process runs in accordance with educational goals is to actively and creatively involve students in learning activities. Active student involvement is crucial because it can help them understand the material more deeply, rather than simply passively receiving information from the teacher. Thus, students are expected to be able to formulate, discover, and construct their own understanding of the learning being conducted (Surbakti et al., 2021). To improve the quality of education, educators or teachers are expected to be able to apply and develop several learning models used during the learning process (Winoto & Prasetyo, 2020).

Based on observations and interviews with the seventh-grade science learning process at SMP Negeri 4 Stabat, it was found that student learning outcomes still show considerable variation. Some students still struggle to understand the material being taught, resulting in scores below the established Minimum Completion Criteria (KKM), which is 73. This indicates that students' understanding of science material still needs to be improved to optimally achieve learning objectives.

Furthermore, the learning model implemented by teachers still tends to utilize conventional methods. During the learning process, teachers primarily deliver material through lectures, while students simply listen and take notes. This reduces student engagement in class (Anggraini, 2023). As a result, students experience difficulties developing critical thinking skills, solving problems, and expressing their ideas or opinions during the learning process.

Students' difficulties in understanding material on the human circulatory system, particularly the processes that occur within the human body, can be overcome through learning activities that involve collaboration among students. This material is often considered quite complex because it relates to body organs, blood flow, and the function of each part of the circulatory system. Therefore, students will more easily absorb and understand the material if they are actively involved in the learning process.

One way to do this is through discussion and collaboration activities to complete teacher-assigned assignments. By exchanging opinions, discussing problems or questions together, and providing feedback to one another, students can develop a better understanding of the material being studied. In addition to improving conceptual understanding, these activities also foster students' communication and collaboration skills. This approach is designed to encourage the achievement of meaningful learning objectives, so that students can achieve satisfactory results (Dewi Astiti et al., 2021).

Based on this, the Problem-Based Learning (PBL) model was chosen for implementation in the learning process. According to Sani (2015), Problem-Based Learning (PBL) is learning delivered by presenting a problem, asking questions, facilitating investigations, and opening dialogue. The characteristics of the problem-based learning model are: (1) posing questions or problems, (2) focusing on interdisciplinary relationships, (3) authentic investigation, (4) producing and presenting products/work, and (5) collaboration (Sukaryaningsi et al., 2023).

Problem-based learning is a learning model that uses real-world problems to solve problems and think critically to gain knowledge and learn to make decisions to improve learning outcomes (Sitinjak et al., 2022). The application of the problem-based learning model in the learning process is expected to improve student learning outcomes. Furthermore, the application of this learning model is expected to provide students with learning experiences aligned with learning objectives.

METHODS

This research was conducted at SMP Negeri 4 Stabat. The research method used was a quasi-experimental approach, which aims to determine the effect of a treatment on the research subjects, in this case, students. The population in this study was all eighth-grade students at SMP Negeri 4 Stabat. The sampling technique used purposive sampling, which involves selecting samples based on specific considerations or criteria that align with the research objectives. This technique enabled the researchers to identify classes deemed to possess relevant characteristics for use as research samples. The research sample was then divided into two classes: an experimental class and a control class. The experimental class was taught using the Problem-Based Learning (PBL) model, while the control class was taught using a conventional learning model.

The experimental class was taught using the syntax or stages of the Problem-Based Learning (PBL) model. According to Ramlawati et al. (2017), the steps in the Problem-Based Learning model include orienting students to the problem, organizing students for learning, guiding individual and group investigations, developing and presenting work, and analyzing and evaluating the problem-solving process. Meanwhile, the control class was taught using conventional learning methods, consistent with the teaching methods typically employed by the school's teachers. In conventional learning, the learning process tends to be teacher-centered, with the teacher primarily explaining the material

while students listen, take notes, and follow directions.

The data collection technique in this study used a learning outcome test as a research instrument. Before administering the instrument to students, the researcher first conducted a content validity analysis and an item analysis of the questions used. The content validity analysis was conducted to ensure that the instrument was appropriate for the material, learning objectives, and the indicators to be measured. The item analysis, meanwhile, aimed to determine the quality of each item, such as difficulty level, discriminating power, and effectiveness, ensuring that the instrument was truly suitable for the study. The data obtained were then analyzed using several prerequisite tests, namely normality and homogeneity tests. After the analysis requirements were met, a final test using an independent sample t-test was conducted to determine whether there were significant differences in learning outcomes between the experimental and control classes.

RESULTS AND DISCUSSION

In this study, the assessment instrument used was a learning outcomes test. The test consisted of 30 multiple-choice questions structured around the human circulatory system and the competency indicators to be achieved. This test aimed to measure the level of student learning achievement after participating in the learning process, allowing researchers to determine the extent of students' understanding of the material taught. Before being used in the study, the test instrument was first analyzed through content validity testing and test item analysis. Content validity was conducted by submitting the prepared test to an expert validator, a lecturer with expertise in the relevant field. The validator then assessed the suitability of the content, language, and accuracy of the questions to the learning competencies students were expected to achieve. According to Utomo (2022), content validity is used to determine the extent to which the prepared test content aligns with the competencies students are expected to achieve in the learning process.

Before conducting the study, the research instrument was piloted on ninth-grade students who had already studied the relevant material. Next, the students' answers were analyzed to determine validity, reliability, discriminatory power, and question difficulty. Instrument analysis is crucial to ensure that the test items used in the research are of high quality and suitable for accurately measuring student learning outcomes (Ida & Musyarofah, 2021). With a good instrument, the research data obtained will be more reliable and can support the research results more optimally.

The results of the instrument data analysis were then processed using a computing application, namely Microsoft Excel, allowing for more systematic and efficient calculations. Based on the validity test results, 23 questions were declared valid and 7 questions were declared invalid. These validity results are presented in Table 1.

Table 1. Validity Test Results

Question Number	Number of Question	Validity
1, 2, 3, 4, 5, 6, 7, 8, 10, 12, 14, 15, 16, 17, 18, 19, 20, 22, 23, 24, 25, 27, 28	23 question	Valid
9, 11, 13, 21, 26, 29, 30	7 question	Not Valid

Next, an instrument reliability analysis was conducted by comparing the obtained Cronbach's Alpha values. Reliability testing aims to determine the level of consistency of test items in measuring student learning outcomes, ensuring that the instrument can provide stable and reliable results (Alhakim et al., 2021). Test item reliability is determined by comparing the calculated *r* value with the table *r* value. A test item is considered reliable if the calculated *r* value is greater than the table *r* value. Based on the analysis, all test items demonstrated reliable results, making them suitable for use in research to measure student ability.

The item difficulty analysis aimed to determine the level of difficulty of each item to ensure that the questions used were neither too easy nor too difficult for students. The analysis

revealed that 22 questions fell into the easy category, 1 question fell into the medium category, and no questions fell into the difficult category. The complete results of the difficulty analysis are presented in Table 2.

Table 2. Difficulty Level Test Results

Question Number	Number of Question	Level of Difficulty
1, 2, 4, 5, 6, 7, 8, 10, 12, 14, 15, 16, 17, 18, 19, 20, 22, 23, 24, 25, 27, 28	22 question	Easy
3	1 question	Medium
-	-	Difficult

The results of the discriminant power analysis are presented in Table 3. The discriminant power analysis was conducted to determine the ability of each test item to differentiate between high-ability students and low-ability students (Magdalena et al., 2021). In other words, this analysis aims to determine the extent to which a question can identify differences in the level of material mastery between students. Based on the analysis, 5 questions were categorized as poor, 11 questions as adequate, and 7 questions as good. The results of the discriminant power test can be seen in Table 3.

Table 3. Differentiating Power Test Results

Question Number	Number of Question	Differentiating Power
3, 19, 24, 25, 27	5 question	Bad
1, 2, 4, 5, 8, 15, 18, 20, 22, 23, 28	11 question	Enough
6, 7, 10, 12, 14, 16, 17	7 question	Good

After the assessment instrument was declared to meet the criteria for good question quality, it was then used to collect research data in the control and experimental classes. Data collection was carried out by administering a pretest to both classes before the learning process was implemented. The pretest aimed to determine students' initial abilities related to the

material to be learned, allowing researchers to observe the initial conditions of students' abilities in the control and experimental classes before being given different treatments. The results of the pretest in the control and experimental classes are then presented in Table 4.

Table 4. Pretest results in the control class and experimental class

Data	Pretest	
	Control	Eksperiment
Max	57	56
Min	21	21
Mean	36,89	35,84
SD	14,48	9,78

After the pretest, the control and experimental classes were given treatment according to the predetermined research design. Each class received a different learning model. The control class was taught using a conventional learning model. Meanwhile, the experimental class was taught using a problem-based learning model that emphasizes active student involvement in discovering and understanding learning concepts independently. After the entire learning process was completed, students in both classes were given a posttest. The posttest was conducted to determine student learning outcomes after receiving the treatment and to assess improvements in student understanding of the material. The posttest results for the control and experimental classes are presented in Table 5.

Table 5. Posttest results in the control class and experimental class

Data	Posttest	
	Control	Eksperiment
Max	86	86
Min	48	73
Mean	65,97	73,44
SD	15,28	12,40

A prerequisite analysis was conducted before conducting the hypothesis test. The prerequisite tests used in this study included the normality test and the homogeneity test. The normality test is an analytical technique used to determine whether research data is normally distributed or not (Usmadi, 2020). The normality

test criteria were performed by comparing the calculated L and the table L values. If the calculated L value is < the table L, then the data are considered normally distributed. Based on the normality test results, the calculated L value was 0.030 and the table L value was 0.161. These results indicate that the calculated L value is < the table L, thus the sample data in this study are considered normally distributed and meet the requirements for further analysis.

The next step in data analysis was the homogeneity test of variance. This test aims to determine whether the data from the two research groups have the same variance or are homogeneous. The homogeneity test criteria were performed by comparing the calculated F value and the table F value. Data are considered homogeneous if the calculated F value is less than the table F value. Based on the calculation results, the calculated F value was 1.257, while the F table value was 1.990. Because the calculated F value < F table, the data from both research groups were declared to have homogeneous variance. Therefore, the data met the requirements to proceed to the hypothesis testing stage. After both prerequisite tests, namely normality and homogeneity, were met, the hypothesis was tested using a t-test at a significance level of 0.05. This test aimed to determine whether or not the implementation of the learning model had an effect on student learning outcomes. The testing criteria used were: if the calculated t value > t table, then H_0 is rejected and H_a is accepted.

Based on the calculation results, the calculated t value was 2.88, while the t table value was 2.01. These results indicate that the calculated t value > t table, so H_0 is rejected and H_a is accepted. Thus, it can be concluded that the problem-based learning model has an effect on the learning outcomes of eighth-grade students at SMP Negeri 4 Stabat. This indicates that the application of the problem-based learning model is proven to be more effective than conventional learning models in improving student learning outcomes. These results also align with research by Riniwati & Dian (2023), which found that student learning outcomes in the pretest and posttest improved after receiving treatment with the problem-based learning model.

CONCLUSION

Based on the results of the research that has been conducted, it can be concluded that there is a significant influence of the problem-based learning model on the learning outcomes of class VIII students of SMP Negeri 4 Stabat. This is proven through the results of the t-test analysis on the post-test data, where the calculated t value is $2.88 > t$ -table of 2.01. Thus, the null hypothesis (H_0) is rejected and the alternative hypothesis (H_a) is accepted.

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