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Short Communication

Improving Student Learning Outcomes in the Human Digestive System through the Application of Problem-Based Learning Model

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Abstract. Learning is a process of interaction between learning resources between students and teachers in a learning environment. The application of the Problem Based Learning method can be a solution for teachers to improve student learning outcomes. This study focuses on the impact of the Problem-Based Learning (PBL) model on student learning outcomes in the topic of the digestive system in Class Mathematics and Natural Sciences (MIA) 2 at State High School (SMAN) 9 Mataram. The research involved 33 students from Class XI MIA 2 at SMAN 9 Mataram, and the learning improvement actions were implemented over three cycles. The study aimed to explore the effectiveness of the PBL method in enhancing student learning achievements, expanding teachers' professional perspectives, and contributing to innovative teaching strategies within the institution. The findings indicate a significant improvement in student learning outcomes, as reflected in the evaluation scores: 35% of students (7 students) achieved scores above the minimum completion criteria in the pre-cycle, 50% (10 students) in Cycle 1, and 85% (17 students) in Cycle 2. This study demonstrates that the application of the PBL model has a positive impact on student learning achievements in Biology, specifically in the digestive system topic.

Keywords: Digestive System, Learning Outcomes, Problem Based Learning.

1. INTRODUCTION

Learning is a process of interaction from learning resources between students and teachers in a learning environment [1]. The Biology learning process is a learning process with a scientific approach where students through a series of activities discover the concepts they are learning themselves, not just receiving information from the teacher [2]. With active and student-centered learning, students can not only understand the material being taught but can also develop critical thinking skills, creativity, problem-solving skills, collaborative and communicate results well. Thus, it is hoped that the learning process can prepare students to be able to develop their knowledge in real life so that they can face the challenges of their time [3].

Biology learning at State High School (SMAN) 9 Mataram on the digestive system was found by researchers after conducting reflection on learning, they found several problems, including learning is still dominated by the teacher so that only 5 students are active in participating in learning activities, either to ask or answer questions. There has been no interaction between students and students with teachers [4]. This is because the teacher does not convey authentic problems, the learning process has not implemented the discussion method [5]. This causes a lack of student activity in the learning process. Learning occurs individually or not in groups so that students cannot work together with other students and do not pay attention to the teacher's explanation. The problem of Biology learning is supported by data on the low value of student learning outcomes at SMAN 9 Mataram class MIA 2. The Minimum Completion Criteria (KKM) value is 78. The quiz results show that the lowest value is 25, the highest value is 100 and the class average is 67. Out of 20 students, only 7 students get a score above KKM, 13 students below KKM [6].

Based on these problems, researchers determine alternative actions to improve the quality of learning by improving teacher skills and student involvement in Biology learning through the

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Problem Based Learning (PBL) model. The PBL model was chosen because it is considered capable of inviting students to work cooperatively in groups to solve real problems. The role of a teacher in learning is to convey problems, ask questions and facilitate investigations. Research conducted by Rossi et al. [7] shows that learning with the problem based learning model can increase teacher activity, student activity and student learning outcomes. According to Rehman et al. [8], the PBL model is characterized by the use of real-life problems as something that students must learn to train and improve critical thinking and problem-solving skills and gain knowledge of important concepts, where the teacher's task must focus on helping students achieve self-direction skills. Based on the description above, the research aims to investigate the implementation of the problem-based learning model to improve student learning outcomes in studying the Human Digestive System in Class MIA 2 of SMAN 9 Mataram.

2. METHOD

2.1 Subject, Place, and Time of Research

This research activity was conducted in class MIA 2 SMAN 9 Mataram with 20 students, consisting of 13 male students and 7 female students. The study focused on Biology subjects for the odd semester of the 2023/2024 academic year, specifically on the digestive system. The schedule of activities included a pre-cycle session held on Thursday, March 7, 2024, followed by the implementation of Cycle 1 on Thursday, March 14, 2024, and Cycle 2 on Thursday, March 21, 2024.

2.2 Design of Learning Improvement Procedures

This research was conducted through a series of cycles using a cyclical assessment process that consisted of four main stages: planning, implementation, data collection, and reflection. The procedure was carried out in two cycles, each with specific activities aimed at improving the teaching and learning process. The planning stage involved developing strategies to improve student outcomes in Biology, particularly on the topic of the digestive system. Enhancements focused on integrating innovative learning models. The implementation phase took place on Thursday, March 14, 2024, with the support of colleagues from SMAN 9 Mataram.

During the initial meeting, the teacher began with greetings, ensuring students were ready to learn, and introduced the learning objectives. In the core activities, students were oriented toward the problem by watching a video related to the digestive system, available at You Tube link (https://www.youtube.com/watch?v=g9LvjUavRMg). Students were encouraged to ask questions such as how the food we consume is absorbed by the body and what processes occur in the digestive organs. The teacher organized students into heterogeneous groups and guided them in exploring learning materials through a Sway link containing visuals of digestive organs. Groups were tasked with discussing key questions, including identifying the roles of various parts of the mouth in mechanical and chemical digestion and the implications of enzyme production failures in digestion. Students conducted experiments by modeling absorption in the small intestine and responded to questions in the provided worksheets (LKPD).

Students then presented their findings and experimental results, while other groups provided feedback in the form of questions, comments, and objections. The teacher facilitated analysis and evaluation of the problem-solving process and provided additional material on digestive organs. The session concluded with reflection, assignments on digestive system disorders, and practice questions accessible via an online link (https://forms.office.com/r/0eEZLtxh7J).

Observations from Cycle I revealed that learning improvements were necessary as the average student score of 71.2 did not meet the minimum completeness criteria (KKM) of 78, and student participation remained low. Therefore, planning for Cycle II focused on increasing student engagement and improving learning outcomes related to disorders of the digestive system organs. Cycle II was implemented on Thursday, March 21, 2024, and began with the teacher greeting students, ensuring readiness, and explaining the learning objectives. In the core activities, students observed a new video on digestive system disorders, available at You Tube link (https://youtu.be/7UK-vxpU-nA), and were encouraged to ask questions. The teacher posed critical thinking questions, such as the dangers of obesity and the conditions defining obesity. Students were then divided into heterogeneous groups to discuss case studies and solve problems outlined in the LKPD.

Students collaborated in groups, answered questions, and formulated conclusions. They presented their findings while other groups provided constructive feedback. The teacher guided the evaluation of the problem-solving process and addressed any remaining student inquiries. The session concluded with reflection and a final assignment on practice questions accessible through an online link (https://tinyurl.com/PH-SPM-Kelas-MIA2). The teacher closed the lesson with a prayer, emphasizing the importance of understanding and applying the knowledge gained throughout the learning cycles.

2.3 Research Instruments

The research instruments can be seen in Table 1.

Table 1. Learning Improvement Activities in Cycle I

No	Observed Teacher Behavior	Score			
		1	2	3	4
1	Opening learning activities by greeting, praying and taking attendance of students				
2	Giving apperception				
3	Conveying the core and objectives of learning				
4	Dividing students heterogeneously				
5	Distribute student worksheets and explain how they work				
6	Ask students to discuss in groups and guide students in groups				
7	Give students the opportunity to present the results of group discussions				
8	Responding to student discussion results				
9	Summarizing learning outcomes				
10	Pray and say hello				
Score Acquisition					
Percentage					

Description: 4 for Very good; 3 for good; 2 for Enough; 1 for not enough

Table 2. Student Observation Sheets

No	Name	Observed Aspects				Score
		1	2	3	4	
1	Student 1					
2	Student 2					
3	Student 3					
4	Student 4					
5	Student 5					
6	Student 6					
7	Student 7					
8	Student 8					
9	Student 9					
10	Student 10					
11	Student 11					
12	Student 12					
13	Student 13					
14	Student 14					
15	Student 15					

No	Name	Observed Aspects				Score
		1	2	3	4	
16	Student 16					
17	Student 17					
18	Student 18					
19	Student 19					
20	Student 20					
Total						
Percentage						

Table 3. Observed aspects

No	Aspects observed	Score	Criteria
1	Student Activity	4	Students actively ask questions, answer questions, and put forward ideas.
		3	Only 2 aspects are visible
		2	Only 1 aspect is visible
		1	No aspects visible
2	Student discipline	4	Arrive on time, complete assignments on time, follow directions
		3	Only 2 aspects are visible
		2	Only 1 aspect is visible
		1	No aspects visible
3	Student Attention	4	Camera on, no zoom in and out, enthusiastic, responsive
		3	Only 3 aspects are visible
		2	Only 2 aspects are visible
		1	Only 1 aspect is visible
4	Conducting Discussion	4	Conducting discussions with friends, presenting discussion results, responding to discussion results, concluding discussion results
		3	Only 3 aspects are visible
		2	Only 2 aspects are visible
		1	Only 1 aspect is visible

2.4 Data Analysis Techniques

Data analysis in CAR is an activity of observing or reviewing, describing and linking each piece of information related to initial conditions, learning processes and learning outcomes to obtain conclusions about the success of learning improvement actions. The data obtained can be grouped into two, namely qualitative data and quantitative data. The data analysis used is quantitative data analysis [9]. Quantitative data analysis can be done simply by using descriptive analysis. According to Lilhore et al. [10] Descriptive analysis can be done by utilizing simple statistics such as calculating the average (mean) and calculating the percentage. Calculating the average score can be done easily by adding all the data and then dividing it by the number of data.

$$Average\ Student\ Score = \frac{Total\ Score\ of\ All\ Students}{Number\ of\ Students} \quad (2)$$

To analyze overall student learning outcome data, classical learning completion is calculated using the formula:

$$KB = \frac{NS}{N} \times 100\% \quad (1)$$

Classical learning completeness (KB) refers to the percentage of students who achieve a score equal to or greater than 78 in a particular subject. This is calculated by dividing the number of students who score ≥78 (NS) by the total number of students (N) and multiplying by 100 to express the result as a percentage.

3. RESULT AND DISCUSSION

3.1 Cycle 1 Results Description

Implementation of learning using the Problem Based Learning model on the material of the food digestive system, the author as a teacher opened with an opening greeting and prayed to start the learning then checked the attendance and condition of the students and ensured that the students were ready to follow the learning activities. After that, reminding the previous material about food nutrition and explaining the learning objectives that will be carried out. At the beginning of this activity, the teacher showed a video about the journey of a food from the beginning entering the mouth until it can be digested by the body.

From the video, the teacher explores questions about the video so that students think critically. At the stage of organizing data for students to learn, the author as a teacher divides students into 4 groups where each group contains 4-5 students [11]. In the group, students are asked to study the material on the course regarding the Structure and Organs of Digestion and discuss the processes that occur in each digestive organ. At the stage of guiding individual and group investigations, the teacher asks students to carry out activities to create an absorption model in the small intestine. After conducting student experiments and working on LKPD, students take turns to present and respond to the results of the discussion. At the phase of analyzing the problem-solving process, the teacher responds to the results of the discussion and presentation. The teacher invites students to conclude learning activities and gives quizzes to find out the achievement of today's learning.

After the learning improvements in cycle 1 are completed, it can be seen that there is an increase in student participation and learning outcomes from the previous scores (pre-cycle). From the results of the evaluation scores in the Pre-Cycle, there are still many students whose scores have not reached the Minimum Completion Criteria (KKM), the targeted KKM is 78. Of the 20 students, there are 13 students whose scores have not reached the KKM, if presented, the number of students whose scores have reached the KKM is 7 students or 35%. After the learning improvement was carried out in cycle 1, it turned out that there was an increase, namely 10 students whose scores had not reached the KKM. This proves that there was an increase in student scores between the Pre-Cycle and Cycle 1.

The results of the evaluation results for the Pre-Cycle and Cycle 1 learning are as follows:

Table 4. Pre-Cycle and Cycle 1 Evaluation Value Acquisition

No	Student Name	Value	
		Pre-Cycle	Cycle 1
1	Student 1	22	25
2	Student 2	70	80
3	Student 3	67	80
4	Student 4	90	90
5	Student 5	50	60
6	Student 6	30	40
7	Student 7	60	80
8	Student 8	60	70
9	Student 9	85	90
10	Student 10	80	90
11	Student 11	65	70
12	Student 12	80	80
13	Student 13	70	75
14	Student 14	80	70
15	Student 15	100	100
16	Student 16	70	75
17	Student 17	61	30
18	Student 18	40	45

19	Student 19	80	90
20	Student 20	80	80
Average		**67**	**71**
Complete		**7 (35%)**	**10 (50%)**
Not Complete (Min. 78)		**13 65 %)**	**10 50%)**

3.2 Description of Cycle 2 Results

Learning improvements in cycle 2, teachers corrected weaknesses and deficiencies in cycle 1, namely teachers involved students more in learning, encouraged students to think critically, and motivated students who were not yet active in learning activities.

Table 5. Cycle 1 and Cycle 2 Evaluation Value Acquisition

No	Student Name	Value	
		Cycle 1	Cycle 2
1	Student 1	25	77
2	Student 2	80	82
3	Student 3	80	100
4	Student 4	90	92
5	Student 5	60	95
6	Student 6	40	60
7	Student 7	80	80
8	Student 8	70	100
9	Student 9	90	95
10	Student 10	90	87
11	Student 11	70	90
12	Student 12	80	100
13	Student 13	75	80
14	Student 14	70	80
15	Student 15	100	90
16	Student 16	75	60
17	Student 17	30	95
18	Student 18	45	85
19	Student 19	90	81
20	Student 20	80	80
Average		**71.25**	**85.45**
Completed		**10 (50%)**	**17 (85 %)**
Not Complete (Min. 78)		**10 (50%)**	**3 (15 %)**

From the results of cycle 1, there were 10 students who had not reached the KKM out of 20 students, or 50%. While students who had reached the KKM were 10 students, or 50%. After the learning improvement actions were carried out in cycle 2, it turned out that there was an increase in student evaluation scores, only 3 students had not reached the criteria or (15%) of the total 20 students. While students who had reached the criteria were 17 students or (85%). So the percentage increase from the evaluation score of cycle 1 to cycle 2 was 35%.

3.3 Discussion of Learning Improvement Research Results

The implementation of learning improvement is divided into 2, namely cycle 1 and cycle 2. The purpose of carrying out learning improvement is to improve the learning outcomes of MIA 2 class SMAN 9 Mataram students in the Biology subject on "Food Digestion System" using the problem based learning model. The author as a researcher conducted a learning improvement research in MIA 2 class SMAN 9 Mataram by applying the rules and principles of Classroom Action Research. according to Dolapcioglu and Doganay [12] stated that Classroom Action Research is a systematic and planned research process through learning improvements carried out by teachers in their own classes.

Based on the results of discussions with supervisor 2 and colleagues, the learning improvements implemented have shown an increase in student evaluation scores starting from pre-cycle, cycle 1, and cycle 2. It is proven that the evaluation scores in the pre-cycle were 7 out of 20 students who took the KKM. After improvements were made in cycle 1, the number of students who achieved the KKM became 10. Then, in the implementation of cycle 2 improvements, the student evaluation results increased to 17 students who achieved the KKM. This shows that there are learning outcomes which are the culmination of a process carried out in learning [13].

The use of the Problem Based Learning model in the Biology learning process about the Digestive System can improve student learning outcomes in class MIA 2 SMAN 9 Mataram. Problem-based learning makes students think critically to solve problems contextually. The role of teachers in student-centered Biology learning is as a conveyor of information, facilitator and evaluator. Teachers must master the material in order to be able to determine cases according to the level of difficulty with the level of student thinking related to the knowledge and experience possessed by students. Changing student habits from simply listening to lectures and passively receiving information to learning by thinking a lot is a challenge for teachers to be able to choose to use this learning model [14], [15]. This can be seen in cycle one, the increase in learning outcomes did not show encouraging figures, only 15% from the first cycle. By sharpening the orientation on the problem, directing students to learn, providing motivation to students, conveying the expected behavior, the process in the cycle is better so that there is an increase in student learning outcomes.

4. CONCLUSION

The implementation of the Problem-Based Learning (PBL) model has proven to be effective in improving students' learning outcomes in Biology, specifically in the Human Digestive System topic, in class MIA 2 at SMAN 9 Mataram. This is evident from the significant increase in student evaluation scores across the cycles: 35% (7 students) achieved scores above the KKM in the pre-cycle, 50% (10 students) in Cycle 1, and 85% (17 students) in Cycle 2. The results indicate a positive development in student performance from Pre-Cycle to Cycle 2. Based on these findings, it is recommended that teachers continue to implement the Problem-Based Learning model in Biology to enhance students' learning outcomes and foster their critical thinking skills. Additionally, it is suggested that teachers further refine their implementation strategies by incorporating more real-life case studies, enhancing group collaboration, and providing timely feedback to better address individual student needs. By doing so, teachers can create a more engaging and effective learning environment that encourages deeper understanding and application of the material.

5. AUTHOR DECLARATION

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