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Implementation of the Problem Based Learning Model to Increase the Activity and Learning Outcomes of Students in the Digestive System Material and the Human Respiratory System Class XI MAN 2 Tanah Datar

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Abstract: This study aims to determine the effect of the model *Problem based Learning* in improve results and learning activities in biology learning system material digestion and the human respiratory system. The type of research carried out is in accordance with the problem researched is study action class (*Classroom action research*). The population in this study were students of class XI MIPA MAN 2 Tanah Datar who were enrolled in the 2022/2023 academic year. The sample in this study were students in class XI MIPA 1 and XI MIPA 2 MAN 2 Tanah Datar. Data collection techniques used in this study were observation, questionnaires, documentation and field notes. The data analysis technique used to analyze activity data and student learning outcomes is the percentage technique and the t test. The results of this study indicate that the average student learning outcomes have increased from cycle I (68.55 %) to cycle II (86.20%). In line with the learning activities of students also increased from cycle I (48 %) to cycle II (77%). The conclusion of this study is that *the Problem Based Learning (PBL)* learning model can increase the activity and learning outcomes of students in biology class XI IPA MAN 2 Tanah Datar.

Keywords: Learning activity; Learning outcomes; Problem based learning

Introduction

Education is a container as a resource printer human (HR). Human resources are seen from the quality of learning. The quality of learning is one of the bases for improving the quality of education as a whole. Student activity and performance learning are two aspects of mutual money relate One The same other in activity Study teach in class (Rosidah, 2023). Activity participant educate very important in activity Study teach, so that learners as the subject of students who plan and carry out learning (Lestari, 2021; Wardhani, 2021).

The learning process in schools still uses models learning lecture, so that not enough capable develop potency students in terms of activities and learning outcomes (Andiyana et al., 2018; Mas'ud, 2018). Learners who are inclinedpassive And educator Which only give information as well as modellearning Which Still not enough appropriate in process learning will give negative impact (Wahyuni et al., 2023).

Wrong One alternative solution For handle problem in top, that is with model learning Which can increase activity and result Study participant educate (Bernadus, 2017; Nasrofah & Arsani, 2022). Model learning which applied theis PBL. This model confronts the participant educate on problems as basis in learning, namely by say other participant educate Study through problem or based on problem.(Astutik, 2021).

Stages *Problem based Learning* can support participant educate For have ability brethinktr critical And creative (Safitri et al., 2018). Educators state that when educators apply model learning PBL often

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participants learn can use many kinds of skills and procedure solvingproblem (Trianto, 2017; Odell et al., 2019). earners are trained to always be curious about the information that is presented There is For reach something problem Which received as basein process learning (Sriwati, 2021). Participant educate Also trained For have internal abilities learning activities, this is indicated by students are able to find, produce, develop ideas, with view or draft inusing information and materials, to elicit or explain viewpoint. In accordance with the opinion (Kunandar, 2008; Kusuma, 2020) which states that *Problem based Learning* is model Which stimulate ability think And use outlook with see quality opinion Which be delivered participant educate, so that can increase activity And results Study participant educate (Smith et al., 2022).

Based on the results of initial observations and the experience of teaching researchers at MAN 2 Tanah Datar, especially class XI MIPA in the learning process, students still do not understand the implementation of learning in class, and many students are not focused. The author as an educator dialogues and asks several students about learning activities so that they express difficulties in the learning process, because the use of a learning model that is still simple and results in low learning outcomes, has an average mark on material system digestion as big 56 whereas For material respiratory system of 53. The average value of class XI students No fulfil completeness criteria minimum (KKM), the material is considered difficult by students, and there is still a lack of teaching materials used in biology learning.

Problem-based learning models to increase student activity and learning outcomes on the material of the human digestive system and respiratory system. The purpose of this study was to determine the effect of the Problem Based Learning model in increasing learning activities in Biology learning on the subject of the Human Digestive System and Respiratory System.

These problems and backgrounds prompted researchers to conduct research on the application of the Problem Based Learning model to increase student activity and learning outcomes in the material of the human digestive system and respiratory system for class XI MAN 2 Tanah Datar.

Method

The type of research carried out is in accordance with the problem researched is study action class (Classroom action research) (Mardani et al., 2021). Classroom action research is research conducted by teachers in class or in school place Teacher teach with the emphasis on improvement, enhancement process and results learning. There are four stages in each cycle including: planning, action, observation, and reflection (Styowati & Utami, 2022).

The population in this study were students of class XI MIPA MAN 2 Tanah Datar who were enrolled in the 2022/2023 academic year. The sample in this study consisted of two classes, namely the experimental class and the control class. Sampling was carried out using the *Simple Random Sampling technique*. After carrying out the normality test, homogeneity test and analysis test for the similarity of the population average. Class XI MIPA 1 as an experimental class with a total of 29 students consisting of 8 boys and 21 girls.

The instruments in this study consisted of lesson plans, questions, and activity questionnaires. Data analysis techniques consist of data normality tests, data homogeneity tests and hypothesis testing. The results of learning activities are seen from the percentage of questionnaires while learning outcomes are seen from the questions that have been prepared beforehand.

The procedure of this research can be seen in Figure 1. The following.

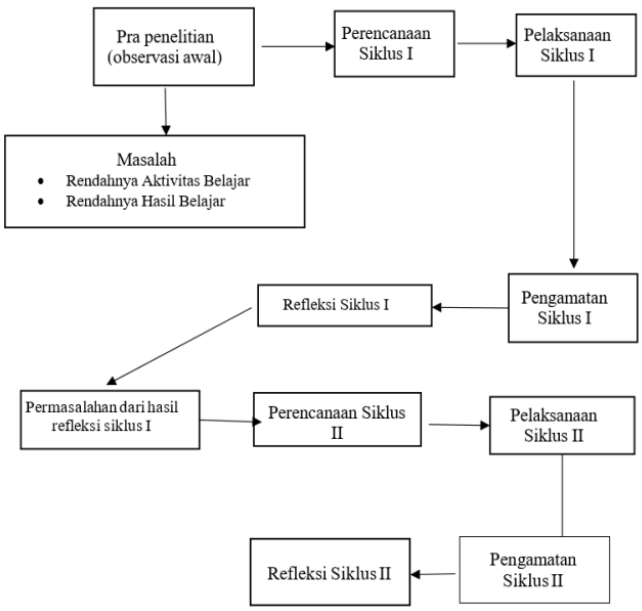

Figure 1. Flow of classroom action research (CAR)

Results and Discussion

Analysis of student learning outcomes data that has been carried out aims to be able to draw conclusions from the data that has been obtained from the results of the final evaluation of student learning. Based on research that has been done on student competitions in the realm of material knowledge of the digestive system and respiratory system. To achieve this goal, it is first analyzed by carrying out several tests such as the

normality test, homogeneity test, and hypothesis testing in cycle I and cycle II.

Cycle Testing I

Normality test

Shows that the sample belongs to a normally distributed category. The normality test results can be seen in table 1.

Table 1. Sample Class Normality Test Results

Research Class	Signification	Conclusion
Experiment Class	0.19	Normal
Control Class	0.68	Normal

Based on the normality test using the One Sample Kolmogorov Smirnov Test, it can be seen that the significant value of the experimental class is 0.19 (0.19 > 0.05), while for the control class the result is 0.68 (0.68 > 0.05) with normally distributed sample categories. So it can be concluded that both samples are normally distributed.

Homogeneity test

The homogeneity test is used to analyze whether the two samples used have homogeneous or heterogeneous variance. This test was carried out using the SPSS 25 application. The results obtained from this homogeneity test can be seen in table 2.

Table 2. Sample Class Homogeneity Test Results

Research Class	Signification	Conclusion
Experiment Control	0.562	Homogeneous

Based on the homogeneity test table above, it can be concluded that the cognitive learning outcomes data of students in the experimental class and control class are homogeneous by obtaining a homogeneity test value of 0.562, where 0.562 > 0.05. So it can be concluded that the data on the learning outcomes of students in the two sample classes are homogeneous.

Hypothesis testing

Based on the normality and homogeneity tests that have been carried out, it turns out that both classes are normally distributed and have homogeneous variances. The hypothesis test was carried out using the t-test. Based on calculations using the SPSS 25 application, the results are obtained based on table 3.

Table 3. Sample Class Hypothesis Test Results

Research Class	Significance	Conclusion
Experiment Control	0.001	H_0 reject

Based on the hypothesis test using the independent simple t test method, the calculated t value is 2,597 while the value of t_{table} is 1.669 so $t_{count} > t_{table}$, then H0 is rejected. Another provision is that the t -test calculation results have a Sig-(2-tailed) value of 0.012 <0.05 with a significant level of $\alpha = 0.05$, so H_0 is rejected and H_1 is accepted. So it can be concluded that the learning outcomes of experimental class students by applying the problem-based learning model are better than the learning outcomes of control class students by applying conventional learning models.

Testing Cycle II

Normality testing

Based on the test results obtained by using the SPSS 25 application, the sample when compared with $\alpha = 0.05$ shows that the sample belongs to a normally distributed category. The normality test results can be seen in Table 4.

Table 4. Sample Class Normality Test Results

Research Class	Signification	Conclusion
Experiment Class	0.95	Normal
Control Class	0.68	Normal

Based on the normality test using the One Sample Kolmogorov Smirnov Test, it can be seen that the significant value of the experimental class is 0.95 (0.95 > 0.05), while for the control class the result is 0.68 (0.68 > 0.05) with normally distributed sample categories. So it can be concluded that both samples are normally distributed.

Homogeneity Test

Homogeneity test is used to analyze whether the two samples used have homogeneous or heterogeneous variance. This test was carried out using the SPSS 25 application. The results obtained from this homogeneity test can be seen in table 5.

Table 5. Sample Class Homogeneity Test Results

Research Class	Signification	Conclusion
Experiment Control	0.43	Homogeneous

Based on the homogeneity test table above, it can be concluded that the cognitive learning outcomes data of students in the experimental class and control class are homogeneous by obtaining a homogeneity test value of 0.43 , where 0.43 > 0.05. So it can be concluded that the data on the learning outcomes of students in the two sample classes are homogeneous.

Hypothesis Test

Based on the normality and homogeneity tests that have been carried out, it turns out that both classes are normally distributed and have homogeneous variances. The hypothesis test was carried out using the *t-test*. Based on calculations using the SPSS 25 application, the results are obtained based on Table 6.

Table 6. Sample Class Hypothesis Test Results

Research Class	Significance	Conclusion
Experiment Control	0.012	H_0 is rejected

Based on the hypothesis test using the independent simple t test method, the calculated t value is 2,597 while the value of t_{table} is 1.669 so $t_{count} > t_{table}$, then H_0 is rejected. Another provision is that the t -test calculation results have a Sig-(2-tailed) value of 0.012 <0.05 with a significant level of $\alpha = 0.05$, so H_0 is rejected and H1 is accepted. So it can be concluded that the learning outcomes of experimental class students by applying the problem-based learning model are better than the learning outcomes of control class students by applying conventional learning models.

Based on the results of this study, the implementation of learning using the PBL (problem Based Learning) learning model can increase the activity and learning outcomes of biology students in class XI MAN 2 Tanah Datar. This can be seen from the results of the post-test and test results which increased from cycle I to cycle II. The PBL model focuses students on solving problems or understanding material concepts. The PBL learning model is also an alternative model that can be used to increase activity and learning outcomes.

Student Learning Activities

Low activity is one of the problems found in the research class (Halawa & Mulyanti, 2023). Prior to implementing classroom action research, when learning was taking place students tended to work individually in completing assignments given by the teacher and had not been able to understand the problems in the material (Febriana et al., 2020; Saputri, 2020). Researchers have applied learning methods with group discussions, but the discussions applied have not been structured so that the results are not as expected.

In learning using the Problem Based Learning model , students play an active role in learning with the same syntax clear, namely starting from orienting students towards problem to analyze the existing problem (Aldila & Mukhaiyar, 2020; Prasetyo & Kristin, 2020). Every syntax in the learning is there activities start from observing to communicating. Syntax first and second on the Problem Based Learning model observing activities. observing activity opens up wide opportunities for students to do observations related to the important things of an object or object (Burgess et al., 2020). This is very beneficial for fulfilling taste curious students (Abidin et al., 2014). On the third syntax the Problem Based Learning model contains activities ask. Asking is an activity ask questions about information that is not understood (Kastur, 2020). This activity opens up opportunities wide for students to ask about what has been done observed in the previous observation activity. Activity this is very useful for developing creativity, curiosity and the ability to formulate questions (Aminah et al., 2013).

The fourth syntax in the Problem Based Learning model g there are activities to collect data and associate. In this activity, students try collect data from various sources and try to find correlations between existing information obtained. Activities to collect data and associate this is very beneficial to develop inductive thinking skills and deductive students to make conclusions (Ibrahim et al., 2014). In the fifth syntax of the Problem Based Learning model there are communication activities. In this activity students are conveying the results of observations and conclusions based on the results of the analysis orally, in writing or with other media. Communicating activities it is very useful to develop students' communication skills (Arofiq, 2019).

Student Learning Outcomes

After administering the action in cycle I, a completeness percentage of 45% was obtained. From the results of the analysis of the first cycle, the learning process with the application of PBL has not reached the 75% completeness criterion, so it can be said that the cognitive learning outcomes of students in the first cycle have not been successful. This is because students are still confused and have difficulty in working on the LKPD given. As said by Majid (2013) learning difficulties are one of the obstacles to students' efforts to achieve learning goals (Novianti et al., 2020). Therefore, by referring to the results of the first cycle of reflection, the teacher made efforts to improve in carrying out the learning process in cycle II.

In cycle II, the classical percentage is 8 6 %. The increase in cognitive learning outcomes from cycle I (45%) to cycle II (8.6%) amounted to 41 %. This happens because students follow the learning well and understand the material they have received. The same thing was conveyed by Devi et al. (2015) that this PBL has the advantage of remembering and increasing understanding of teaching material, increasing focus on relevant knowledge, encouraging thinking, building teamwork, leadership, and social skills, build study skills, motivate learners, be realistic with students' lives

(Erlangga et al., 2021; Ramadhan, 2021) Classically the learning process in cycle II was declared complete because it met the learning completeness criteria of 75%.

Based on the data on student learning outcomes, it shows that the application of the PBL learning model can improve student learning outcomes in the material of work and energy (Buanawaty, 2021). This is consistent with research conducted by Directorate General of Higher Education Academic (2008) which states that the application of the PBL learning model can improve students' biology learning outcomes at MAN 2 Tanah Datar and research conducted by Azhari et al. (2013) which states that the application of the PBL learning model can improve student learning outcomes of class XI IPA 2 MAN Gerung in the 2012/2013 academic year.

The description and analysis of students' final grade data shows that the learning outcomes of students in biology learning in the experimental class using these activities can be seen that students have high learning activity because students play an active role in learning activities. Students who play an active role in learning will greatly influence the high student learning outcomes (Astuti, 2020; Apri, 2018; Hanesti, 2023). The high learning outcomes can be seen from the results of formative tests with predetermined minimum completeness criteria (KKM). Based on the percentage of students who met the KKM, the experimental class had a higher percentage of completeness than the control class. Therefore, the results of hypothesis testing of student learning outcomes show that there are significant differences in learning outcomes between the experimental class and the control class (Dirckinck-Holmfeld, 2009).

The above is achieved because students are taught by applying the Problem Based Learning (PBL) model, some of the things that cause the use of this learning model to be successful include this learning model which leads to critical thinking skills and encourages students to solve problems according to real life (Fihartini & Muryaningsih, 2023).

Problem Based Learning can stimulate students to be active in learning and produce a product or work (Berki & Valtanen, 2007; Tan et al., 2020). The Problem Based Learning model can improve student learning outcomes on biology concepts, because students construct their own knowledge that students get (Bridges, 2019; Byun, 2020). In the learning process students are involved in activities such as observing, collecting data, and analyzing problems and being able to think critically (Suwastini et al., 2021). By using this model students can develop thinking abilities in problem solving and intellectual skills.

Conclusion

Based on the results of classroom action research conducted with the application of Problem Based Learning (PBL) learning to increase activity and learning outcomes in biology class XI IPA MAN 2 Tanah Datar students, it can be concluded as follows: "With the learning process Problem Based Learning (PBL) can improve activity and learning outcomes in learning biology students of class XI IPA MAN 2 Tanah Datar.

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Author Contributions

This research involves contributions from various parties who have assisted in various aspects of research. Aspects of Conceptualization, methodology, formal analysis, investigation, resources, data curation, writing original drafts, writing reviews, and visualizations were carried out by Sri Wahyuni and Dr. Syamsurizal, M. Biomed. Aspects of review, editing, monitoring, and validation were carried out by Dr. Irdawati, M.Sc., Mrs. Dr. Violita, M.Sc., and Mrs. Dr. Suci Fajrina, M.Pd.

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Conflict of interest

The authors declare no conflict of interest. Writer identify and state that no circumstances or personal interests whatsoever could be considered to influence the representation or interpretation of the reported research results.

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