

The Effect of Problem Based Learning (PBL) Model on Students' Critical Thinking Ability in Class XI Digestive System Concept

Submitted 7 October 2022, Revised 27 November 2022, Accepted 28 November 2022

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Abstract

This study aimed to determine the effect of the problem-based learning model on students' critical thinking skills in the digestive system concept. The samples in this study were taken using a simple random sampling technique with 28 samples, namely 14 students for the experimental class and 14 other students for the control class. The measured variable is students' critical thinking skills, which are obtained from the pretest-posttest results using the Kolmogorov Smirnov normality test, the One Way Anova homogeneity test, and hypothesis testing for learning outcomes using the Independent Sample T-test. The results of the t-test show a significant influence of the problem-based learning model on students' critical thinking skills, with a significance value of $0.001 < 0.05$. This study concludes that the problem-based learning model has an effect on increasing students' critical thinking skills.

Keywords: Critical Thinking, Problem-based Learning, Digestive System

INTRODUCTION

Critical thinking skills are reflective thinking skills that focus on how to make decisions about what must be believed and can be accounted for (Susilawati, 2020). Implementing the 2013 Curriculum is one of the efforts to improve student's critical thinking skills. Graduate competency standards in Indonesia state that students must have critical thinking skills and act effectively and creatively (Indonesian Ministry of Education and Culture, 2013). The way to improve students' critical thinking skills is to apply a student-centered learning model. Problem-based learning (PBL) will build students' thinking and understanding to develop critical thinking skills by providing contextual problems that are easier to understand than learning concepts and theories (Simanjuntak & Sudibjo, 2019).

PBL is learning that focuses on problems that must be eliminated by finding solutions from the knowledge and higher-order thinking skills. The provided issues are closely related to everyday life related to concepts in class (Mulyanto et al., 2018; Hung et al., 2008). PBL stimulates students to formulate tentative answers to problems that require active solutions in real situations. Constructivism theory is very close to this learning model so that students can immediately understand their problems, participate actively and increase motivation (Jia, 2010; Kanselaar, 2015). In this study, we used multiple choice questions based on critical thinking skills, including four categories, namely basic level clarification, concluding further

clarification, and strategies and tactics (Afifah, 2019; Azzahra & Simatupang, 2021). The aims of this study is to know the effect of problem based learning model on students' critical thinking ability on digestive system concept.

METHOD

We used a quasi-experimental method with pretest-posttest only control group as design research (Cook, 2015; Mukhtar et al., 2021). The population used in this study were all students in class XI senior high schools' level. Subjects in this study were taken using a simple random sampling technique of 28 samples, namely 14 students for the experimental class and 14 students for the control class. In the experimental class, we used PBL model on the material concept of the digestive system and in the control class we used discussion on the material concept of the digestive system. We assessed critical thinking skills using critical thinking skills tests before (pretest) and after implementation (posttest). Figure 1 is a flowchart of this research.

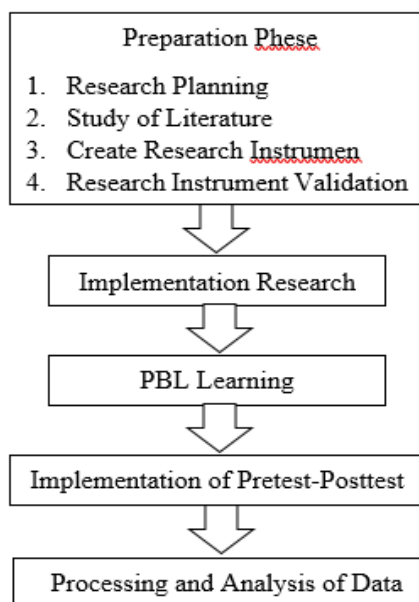


Figure 1. Research Flowchart

Table 1 is criteria for critical thinking skills after we analyzed and categorized the students score (Brunt, 2005; Fitri et al., 2017). Data analysis in this study used SPSS to see that the data was normal, homogeneous and continued to test the hypothesis using the T test.

Table 1. Criteria for critical thinking skills	
Value	Criteria
0 - 43,75	Very Low
43,76 - 62,5	Low
62,6 - 71,5	Medium
71,6 - 81,25	High
81,26 – 100	Very High

(Ali & Wajdi, 2022)

RESULTS AND DISCUSSION

This study used Problem Based Learning (PBL) learning model when studying the digestive system concept for experimental class and used interactive discussion, presentation, and question-and-answer methods for control class. Before carrying out their learning, students are first given a pretest. The pretest measures students' initial abilities and self-confidence before receiving treatment (Tusaroh & Juhji 2020). After the two groups (control and experimental classes) were given a pretest, they were given treatment and in the last we gave a posttest.

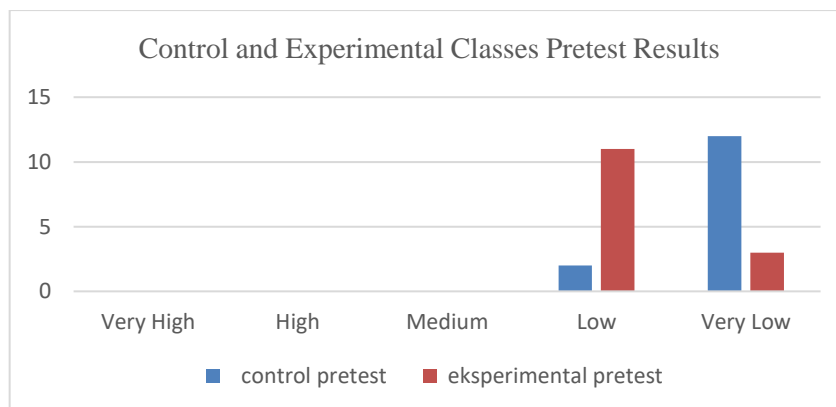


Figure 2. Bar chart of the frequency of students' pretest results on experimental and control class

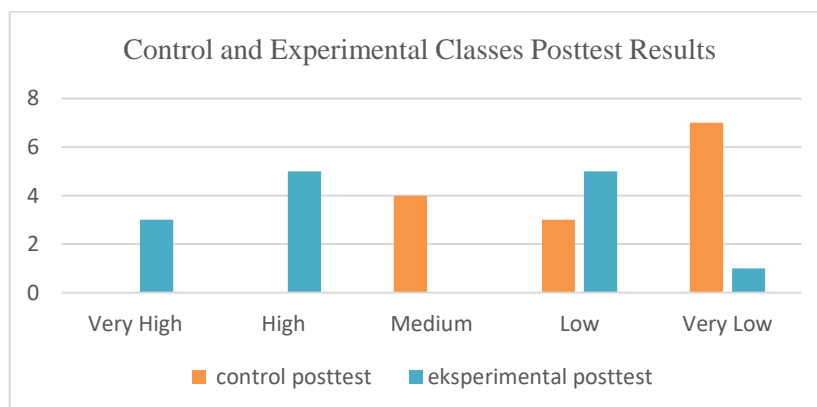


Figure 3. Bar chart of the frequency of students' posttest results on experimental and control class

Based on the diagram in Figure 2, we can see that the class that received the model treatment (experimental class) had significant changes. The pretest results for the control and experimental classes are in the low and very low categories with little difference. Whereas in Figure 3, the posttest results in the control class have medium, low, and very low categories. That is, the control class did not experience a significant increase result. Meanwhile, in the other class, the posttest results were all in categories, and most students got the high category.

1. Normality Test

The normality test was carried out on two kinds of data: the pretest and posttest value data from the experimental and control classes. The method for carrying out the normality test is using the Kolmogorov-Smirnov test. The SPSS program analysis result show that the data has a sig level of $\alpha = 0.05$, namely $> \alpha$, so the data is normally distributed. Meanwhile, if the data analysis value is $< \alpha$, the data is not normally distributed (Ali & Wajdi, 2022). Table 2 shows the normality test results.

Table 2. Normality Test Results using Kolmogorov-Smirnov

Class	Statistic	Sig.
Control	.173	.200*
Exsperiment	.162	.200*

*. This is a lower bound of the true significance.

2. Homogeneity Test

To find out the homogeneity of the data, the researchers used the One Way Anova test. The SPSS program analysis has a sig level of $\alpha = 0.05$, namely $> \alpha$, the data is homogeneous, while, $< \alpha$, the data is not homogeneous (Ejin, 2016). Table 3 shows the homogeneity test results based on the Mean is 0.734. So, the experimental class and the control are homogenous.

Table 3. Homogeneity Test Results

		Levene Statistic	df1	df2	Sig.
Digestive system study results	Based on Mean	,118	1	26	,734
	Based on Median	,194	1	26	,663
	Based on Median and with adjusted df	,194	1	25,916	,663
	Based on trimmed mean	,129	1	26	,723

3. Hypothesis Test

Therefore, a hypothesis test can be carried out to answer the existing hypothesis. The way to find out the research hypothesis test is to use the Independent Sample T-test. The T-test was conducted to determine whether the PBL model affected students' critical thinking skills on the concept of human digestive system material with a significance level of 0.05 (5%).

Table 4. Hypothesis Test Results

		t-test for Equality of Means						
		t	df	Sig. (2- tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
							Lower	Upper
Digestive system study results	Equal variances assumed	-3,839	26	,001	-24,071	6,270	-36,959	-11,184
	Equal variances not assumed	-3,839	25,718	,001	-24,071	6,270	-36,966	-11,177

Based on the independent sample t-test analysis results, the probability value (Sig (2-tailed)) = 0.001 < 0.05 is obtained (Kurniahtunnisa, et al., 2016). This shows that H₀ is rejected and H₁ is accepted, so it can be concluded that the use of the PBL model affects students' critical thinking skills in the digestive system concept. The problem-based learning model causes cognitive outcomes (critical thinking skills) in the experimental class to be higher than in the control class, which uses discussion, presentation, and question and answer methods. In the PBL model, students are required to think when solving problems.

Based on Amin et al (2020) critical thinking indicators include providing simple explanations regarding the questions faced, determining appropriate actions to solve problems, defining various terms used in solving problems and concluding activities that have been carried out with logical assumptions. The influence PBL on critical thinking can be caused that the PBL model support students in developing thinking skills.

At the student orientation stage of the problem, students are given problems related to several disorders in the digestive system and the technology used to overcome these disorders. At this stage, students can develop higher-order thinking skills in determining appropriate actions to solve problems that occur in everyday life. Contextual learning can involve students in the process of direct experience, encourage students, meaningful learning, and can apply it in everyday life (Zubaidah, 2017). Students are directed to work with group mates according to the problem topic given at the stage of organizing students for learning. According to Mareti and Hadiyanti (2021), in the problem-based learning model, students' abilities can be optimized with group work to develop critical thinking skills to solve problems. Also, encourage students to be more active and open opportunities to foster students' curiosity naturally.

When guiding students in individual and group investigations, students are directed to discuss the problems given according to worksheets in various ways, such as by reviewing references. The worksheets provided are PBL-based, so each activity develops thinking skills. PBL-based student worksheets development can stimulate students' critical thinking skills (Munawaroh & Solikhah, 2022). At the stage of developing and presenting student work, the results of discussions and investigations that have been carried out are written down on worksheets and presented to friends in class. Students can develop higher-order thinking skills at this stage by defining various terms used in solving problems and providing simple explanations regarding the questions they face. Students conduct questions and answers and express opinions to friends presenting. The teacher provides reinforcement and evaluation to obtain meaningful conclusions from discussions and presentations. Students are trained at this stage to develop logical assumptions.

The PBL model makes problem-solving easier for students because it presents problems contextually as they occur in the surrounding environment. Students are active in constructing their knowledge through discussions and questions based on real-world problems. This is directly proportional to the results of the response questionnaire showing that 100% of students like learning using the PBL model because students find it easier to understand digestive system material. Using the PBL model, students are more actively involved and participatory in learning activities such as discussing, looking for solutions to problems, making presentations, and asking and answering questions. Learning activities with the PBL model have the courage to communicate by discussing, expressing opinions, presenting, and improving students' critical thinking skills.

CONCLUSION

The problem-based learning model for the digestive system material influences students' critical thinking skills with a significance value of 0.001 less than 0.05. This is because, in the stages of the PBL model, it supports students' roles and active discussions during the learning process and can solve problems in the surrounding environment and provide solutions to these problems. Based on the findings, we recommend that senior high school teachers use the problem-based learning (PBL) model to assess 21st-century skills, including 6C skills.

ACKNOWLEDGEMENT

The authors express their thanks to Program Kompetisi Kampus Merdeka (PKKM) Universitas Sultan Ageng Tirtayasa 2022 for their support and grants for this study.

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