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The Influence of Project Based Learning on Students Critical Thinking Ability at Muhammadiyah 1 Bangunrejo Senior High School

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Abstract

This study is based on the existence of learning activities that are still affected by the Covid-19 virus where learning only relies on material delivered by teachers through learning groups without any interaction that trains collaboration and critical thinking skills of students. This study aims to determine the effect of using the project-based learning model (PjBL) on students' critical thinking skills. The research design uses a pretest-posttest control group design, the research procedure is carried out through preparation, implementation of research, and conclusion. The instruments used are essay questions and instrument sheets with indicators of critical thinking skills. The data analysis technique for the pretest-posttest results uses the t-test (independent sample t-test). The highest critical thinking ability is found in the conclusion-drawing indicator with a value of 86.80. The hypothesis test obtained a t count value of 2.48 and a t table of 1.99, which means that the use of the PjBL learning model has a significant influence on students' critical thinking skills. Based on the results of the hypothesis test, it is known that the project-based learning model (PjBL) has an effect on the critical thinking skills of students at SMA Muhammadiyah 1 Bangurejo.

Keywords: *Project Based Learning (PjBL), Critical Thinking Ability*

A. Introduction

Development education in the 21st century demands participants not only control knowledge, but also develop the ability creativity, and problem-solving complex problems, as well as increase their ability to think critically (Saavedra & Opfer, 2012; Noviana, et.al., 2019; Komara et al., 2023). The ability to think critically involving evaluating information in a way objective,

solving problems, and making decisions based on in-depth analysis, is one aspect important in quality education. Skills thinking is critically considered one of the components important in readiness participants to face world challenges, especially in face life in in society which is increasingly complex and dynamic (Saavedra & Opfer, 2012). Quality education No let go from preparation of educators in prepare series activity learning in class, designing activity conducive learning (Liakisheva, 2024) is one of them that is with consider use/application of learning models so that achieved objective expected learning (Santoso & Khisbiyah, 2021; Sitanggang et.al., 2024), not can it denied that in School Education Level intermediate above (high school).

The selection of learning models in the class becomes the determinant of direction development activity learning in classes conducted by educators /teachers (Santoso & Khisbiyah, 2021; Sitanggang et.al., 2024). One of the learning models that can used to increase the ability to design solutions to problems, produce questions new, and grow skills think critical participants educate namely Project-Based Learning or PjBL (Sungkono & Ekaputra, 2023; Huda et.al*.,* 2024). Project-based learning or PjBL known as approach learning provides a chance for participants educate For involved in a project demanding they design, investigate, and solve problems in the real world, as well as collaborate with friends in the learning process (Hursen, 2021; Baruah, 2023; Khoiri, 2023), as well as explore concepts in a way deep through experience practical. Learning model This allows participants to not only learn theory but also develop skills to think critically in facing existing challenges and also makes participants carry out activity learning breakdown problems in a way directly (Esilvita, 2023).

The selection of learning models is also adjusted material learning that will delivered, one of material learning at school intermediate high school (high school) that demands participant his education For can think in a way critical that is Biology subjects (Anif, 2016). Biology lessons at school aim To give a understanding deep of concepts based on biology, including related topics with health, environment, and organisms. Subjects in biology including eye lessons that are not only focused on mastery of knowledge but also on development skills think critically and analytical participants are educated in reasoning a concept, solving problems as well and communicating an idea (Fitria, 2020; Urry, 2020; Ceylan, 2022).

The results of observations and interviews that have been done at the school intermediate It is known that Muhammadiyah 1 Bangunrejo Senior High School in September 2024 that the learning process carried out is still affected from activity online learning during COVID-19. Teacher-centered learning, and relying on teaching materials that are only provided by educators/teachers, lack of enthusiasm among students (Fitriyah & Ramadani, 2021) in finding learning ideas. The results of an interview with a biology subject teacher also showed that the critical thinking skills of students at SMA Muhammadiyah 1 Bangunrejo are still relatively low. Participants tend more make it easy to workmanship questions with only answer questions given to educators /teachers via the internet. So the ability participants were classified as low in ability to think critically, with Lots of misconception material. One of the materials demanding biology understanding critical and still Lots experiencing misconceptions from participants are that is virus material. High school virus material provides its challenges in the learning process. According to Mauziah et al. (2024), virus material is one of the conceptual materials that requires critical thinking from students. Virus material discusses characteristics, and classifications and is material related to everyday life so that it requires students to analyze every problem that requires students to think critically. Research This aims To know the influence of the application of learning models based on a project using a learning model *project-based learning* (PjBL) towards the ability to think critically student school intermediate above (Senior High School) Muhammadiyah 1 Bangunrejo.

B. Literature Review

1. Project Based Learning (PjBL)

21st-century learning is a time when learning activities must be able to shape the character, academics, and skills of students (Sitanggang & Haryanto, 2023). One of the efforts to build these student abilities is to use a project-based learning model. Project-based learning / PjBL is a learning model that involves students in each learning activity to carry out problem-solving processes that are also related to everyday life (Kardoyo, 2020). Learning using project-based learning is an innovative and creative learning model, so that students are happier doing learning activities Nawangsari, 2023; Tarling, 2023; Suradika, 2023). The use of problem-based learning models in this case PjBL is also able to provide opportunities for students to collaborate with their peers, and also make students improve their critical thinking skills (Latifaj, 2023). This is by the syntax of learning using PjBL which can improve critical thinking skills with its stages,

namely being able to analyze the causes of a problem, creating/producing products, and being able to answer essential questions (Manikutty, 2022; Khoiri, 2023).

2. Critical Thinking Skills

Critical thinking skills are one of the skills that students must have in the 21st century. Critical thinking skills are one of the processes that train students to be able to produce work that is accompanied by a reflective thinking process (Putriyanti, et al., 2021). Priyadi (2018) explains that critical thinking skills are one of the domains of cognitive ability, which can support students' ability to process information and determine its truth. The benefits of critical thinking skills possessed by students are to help them understand every reality faced and be able to solve every problem faced (Luzyawati, 2017; Rosdiana et al., 2019).

C. Methodology

1. Research Design

This research was conducted at Senior High School (SMA) Muhammadiyah 1 Bangunrejo, Central Lampung. The research was conducted in October of the 2024/2025 academic year. The population of this study was all students of class X of SMA Muhammadiyah 1 Bangunrejo. The sample used was 34 students for each experimental class and control class. The sampling technique used probability sampling (simple random sampling). The method used in this study was a quasi-experiment, using two groups/classes, namely the control class and the experimental class or the class that received treatment using the project-based learning model, namely project-based learning. The research design can be seen in Table 1.

Table 1. Research Design

Class	***Pretest***	***Treatment***	***Posttest***
Experiment	O_1	X_2	O_2
Control	O_1	X_1	O_2

Information:
O_1 : Pretest of both groups
O_2 : Posttest of both groups
X_2 : Experimental class using project-based learning (PjBL) model
X_1 : The control class uses a conventional learning model

2. Instruments

The research instrument used to identify participants' critical thinking skills is by using multiple-choice questions and essay questions as well as project assignments that contain critical thinking assessment indicators. The instrument used refers to the test instrument indicators/guidelines used by researchers Umayroh & Siregar (2024) based on the Ennis (1993) research instrument. The results of the validation of the test instrument used contain indicators of critical thinking skills, after the trial was carried out it was found that the questions had high reliability so the questions were suitable for use in the research process.

3. Technique of Data Analysis

The data analysis technique of the pretest-posttest results used the t-test where the previous data had been tested for normality and homogeneity. The normality test used the Lilliefors test which was then tested for homogeneity using the Fisher test, to determine the increase in critical thinking scores before and after using the Project-based learning model (PjBL) was calculated using the N-Gain test. In addition, the data analysis also used descriptive analysis of each indicator of critical thinking skills.

D. Findings and Discussion

1. Findings

Implementation class experiment using a learning model *project-based learning* is divided become a number of groups. Each group to obtain material or discussion about different viral materials. Each group requested To determine related projects with life daily about viral material that has been given. Class control in a matter This uses a learning model, such as the regular teacher/ educator becoming the center main with lecture in delivery material. Following results data collection has been done in the class control and class experiment.

Table 2. Normality Test of Pretest and Posttest Scores

Group	Results L_{value}		L_{table}
	Pretest	*Posttest*	
Experiment	0.1438	0.1498	0.1519
Control	1,1156	0.075	

Based on the table above known mark $L_{count} < L_{table}$ which means that the data obtained normally distributed.

Table 3. Homogeneity Test of Pretest and Posttest Scores

Group	Result F_{value}		F_{table}
	Pretest	*Posttest*	
Experiment	1,5627	0.7828	1.78782
Control			

Based on the homogeneity test that has been carried out, the results obtained are that the pretest and posttest F count values < F table, which means that the data is homogeneous so that based on the two prerequisite tests, the data can be continued to hypothesis testing using the independent sample t-test and the following results are obtained:

Table 4. Results of the Independent Sample t Test

Data	Mean	t_{count}	t_{table}	Conclusion
Class Experiment	61.06	2.48	1.99	H0 is rejected
Control Class	54.00			

Based on Table 2, the test results show that the posttest value obtained by the two groups is 2.48 while the t-table value is 1.99 so the t-count value is greater than the t-table, so the H0 hypothesis is rejected, which means that the use of project-based learning models has an effect on students' critical thinking skills.

The ability to think critically participant students of Muhammadiyah 1 Bangunrejo High School who were given treatment with learning using the PjBL model and conventional can seen in Figure 1 below:

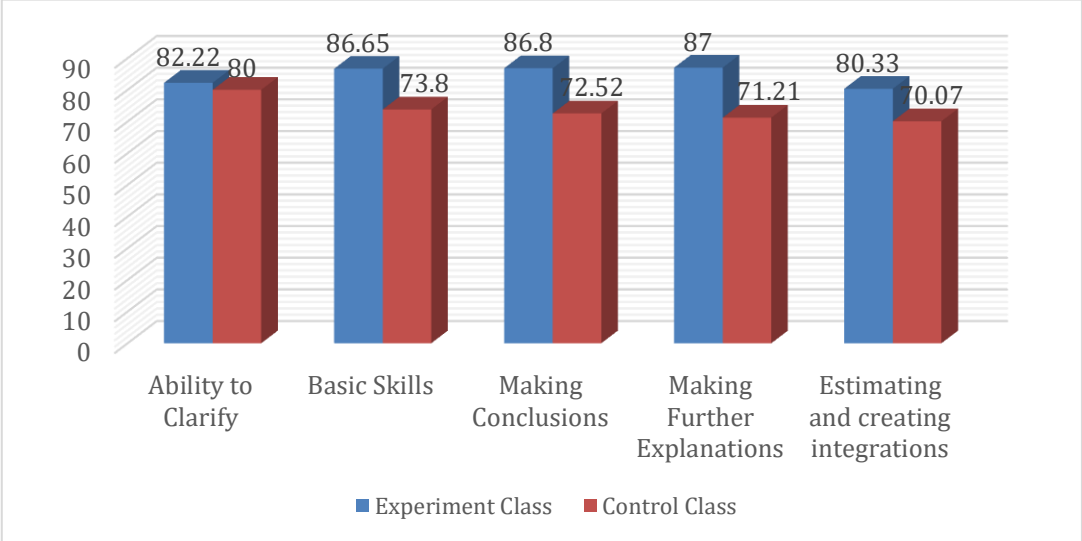

Figure 1. Graph Percentage of Ability Value Think Critical Based on The indicators
(Source : Primary Research Data)

2. Discussion

Based on the data that has been presented, it is known that the results of the final test using the Independent Sample t-test are that the t count value is greater than the t table, which means that the experimental class that learns using the project-based learning model has an effect on the critical thinking skills of students at SMA Muhammadiyah 1 Bangunrejo. The learning that has been carried out is the application of the project-based learning (PjBL) learning model applied to the experimental class, and the control class uses conventional teacher-centered learning. The results of the research that has been carried out are by providing pretest and

posttest questions in collecting research data. During the learning activities to determine the effect of using the project-based learning model, three meetings were held. Each meeting consists of 1) the activity of delivering questions, 2) the activity of making projects in groups, and 3) the activity of presenting project results with teaching materials that have been prepared by the teacher, then a discussion is carried out, and continued with evaluation activities. The final activity is a posttest to determine the final results of the critical thinking skills of students who have been given treatment in learning using the project-based learning (PjBL) learning model.

Based on the data that has been obtained, the application of the project-based learning model to the PjBL material affects the critical thinking skills of students in the teaching material. This is shown from the results of the final evaluation of the experimental class which obtained greater results compared to the control class. It is known that the use of the PjBL learning model can increase the activity of student's enthusiasm for learning with activities that are not monotonous. Students are very enthusiastic about participating in learning on the virus material, students are not only enthusiastic and excited but are also able to think and reason compared to learning only using conventional models (Nabilah & Syamsurizal, 2024). In addition, the use of the PjBL model also makes students understand learning materials better in a more structured way, through projects that have been given by the teacher (Widiyantini et al., 2023). The application of PjBL can improve critical thinking skills, which can also be seen in every activity carried out by students, student involvement makes them better understand what they are learning and doing (Paramita et al., 2023; Umayroh & Siregar, 2024). Class control using conventional learning models tends to be more monotonous so students feel less interested in what the teacher says. The experience gained by students during the learning process is one of the indicators to be able to foster changes in student behavior while understanding the material received to improve critical thinking skills which can be reviewed from several aspects or indicators of critical thinking (Umayroh & Siregar, 2024).

Based on Figure 1, it is known that on average each indicator of critical thinking skills shows a very good number. There is a difference in the value of each indicator of the experimental class and the control class. The highest value of the experimental class is in the indicator of making conclusions of 86.80% and the lowest is in the indicator of estimating and making conclusions with an integration of 80.33. In the control class, critical thinking skills are still relatively low from the five aspects when compared to the experimental class. Measuring critical thinking skills based on the application of the PjBL learning model that has been carried out, it is known that there are several indicators that have high values compared to other indicators. Based on research conducted in the experimental class, the highest indicator of critical thinking skills is in the indicator of making conclusions with a value of 86.80%. The ability of students in this indicator is very good when they convey conclusions from the results of the projects they have worked on. This indicator is carried out by identifying the elements needed when drawing conclusions based on existing data and the skills of expressing opinions by students. Students are able to interpret virus material starting from an explanation of the virus seen from its form, how the reproduction process works, its role, and its impact on everyday life. Students easily draw conclusions after carrying out activities/projects so that they are able to conclude material from the general to the specific which is shown by good communication when delivering conclusions.

Indicator ability with a bottom value that is found on the indicator makes forecasting and integration. Indicators This is the indicator final in the measurement of the ability to think critically or the highest level of indicator Conclusion. Participants are educated Still need to Keep improving in indicators, especially in learning often giving mentoring related to integration material with others , especially with life daily (Huda et.al., 2024). This makes it necessary to improve the forecasting and integration indicators by providing follow-up projects in the form of student group abilities in designing and creating simple tests on virus material. After being able to draw and explain a conclusion, students must also be able to try to prove the results of the design they have made as an effort to improve critical thinking skills (Kanca et al., 2020; et al., 2020). In general, overall learning using the project-based learning model on this PjBL material has a major influence on students' critical thinking skills in terms of several aspects of critical thinking skills, this is also supported by research conducted by Pujaningtyas et al., (2019) and Rahardian (2022) which explains that the use of the PjBL learning model produces significant changes in students' critical thinking skills. Documentation of learning implementation activities using the project-based learning model can be seen in the following picture.

Figure 2. The teacher explains implementation workmanship project Virus material (Source: Documentation Personal)

E. Conclusion

Based on research and data analysis that has been done researchers conclude that the application of learning models based on the project using a learning model PjBL influential to ability to think critically participant educate. Research results that there is a difference significant between the group given treatment using a learning model PjBL and group class control using a learning model. Improvement in the ability to think critically in class experiments was found on the indicator drawing conclusions with a value of 86.80%. This will become Back-notes so the researcher can maximize the increased ability to think critically in all the indicators.

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