

# Artikel

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**Submission date:** 02-Aug-2023 01:11PM (UTC+0700)

**Submission ID:** 2140309762

**File name:** Draft\_Artikel.pdf (305.31K)

**Word count:** 5037

**Character count:** 28076

# Scenario Problem Based Learning on the Critical Thinking Ability of Vocational High School Students using the Piagetian Approach

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**Abstract.** Students' low critical thinking skills in the learning process can affect the quality and results of student learning. This study aims to determine the influence of students' critical thinking skills by applying problem-based learning scenarios in primary computer and network subjects. This study used the Pre Experimental Design research with the One Group Pretest-Posttest Design. The subjects of this study were students of class X TKJ as the experimental group. The data collection technique used in this research is a critical thinking instrument. The data analysis used is a descriptive quantitative analysis using the Paired-Samples T-Test. The results showed that the problem-based learning scenario had no significant effect on the thinking skills of class X TKJ students.

**Keywords** – problem based learning; critical thinking skills; vocational high school

## I. INTRODUCTION

Critical thinking is a high-level ability that students need to analyze and manipulate information [14]. Students can have critical thinking skills through practice in solving problems found in everyday life. This encourages students to use their knowledge and experience so that their critical thinking skills can develop properly [1]. Students who are able to think critically in solving problems will indirectly have a positive impact on their implementation in everyday life [27]. The ability to think critically is also an ability that students must have to be able to adjust to a pluralistic society and make it an asset in dealing with various problems that will be faced in the future [15]. However, implementation in the learning process, students' critical thinking skills in solving problems can be said to be still low and is one of the problems that often arises in Indonesia. The results of the 2018 PISA survey in the field of Science prove that Indonesian students' critical thinking skills are ranked 70 out of 78 survey participating countries [15]. The lack of critical thinking skills of Indonesian students is a factor in Indonesia's low ranking in the results of the PISA survey [23].

This is in line with some of the results of research conducted regarding the development of students' critical thinking skills in several regions of Indonesia. Stated that students' critical thinking skills at SMAN 4, 5 and 10 Malang were still low [16]. States that the critical thinking skills of class XI students at SMA Batik 2 Surakarta are still low, namely below 20% [12]. States that the level of students' critical thinking skills is classified as low which can be seen based on the results of the achievement of critical thinking ability scores which are still below the standard at Cendika Bangsa Kepanjen Vocational School [8]. Research showed that 50.12% of students in East Java had a low level of critical thinking skills [18]. The results of another study showed that 29.44% of students at SMKN 1 Lingsar had critical thinking skills which were still relatively low in mastering the concept of learning materials [4].

SMK Dian Indonesia is a vocational school located in Sidoarjo Regency which has the same problem, namely the low ability to think critically in solving problems. The level of students' critical thinking skills can be seen through the intensity of students in conveying ideas and solutions to a problem that occurs [11]. The observation results of students' critical thinking skills in class X TKJ SMK Dian Indonesia show that they are still not optimal. Learning models that do not involve the active role of students in the learning process are one of the causes of students' critical thinking skills not being maximized [6]. Students tend to be less active when the learning process takes place because learning is teacher-centered [25]. This can be seen by the lack of motivation of students to issue questions or opinions when the question and answer activity takes place. Understanding of the problems faced by students is also limited to what is conveyed by the teacher. Learning models that cannot develop students' critical thinking skills in solving problems can also have an impact on decreasing student learning outcomes [19]. The learning outcomes of some students have not yet reached the Minimum Completeness Criteria standard value set by the school, which is 75.4 out of 8 the number of students in class X TKJ have not reached the standard value set. These problems can affect the quality of learning if they are not addressed immediately [6].

The learning model applied during the learning process should be able to train and improve students' critical thinking skills. [13] said that in the independent curriculum initiated by Mr. Nadiem Makarim, he explained that the ability to think critically and solve problems is an embodiment in responding to educational challenges in the era of

the industrial revolution 4.0 [9]. But in fact according to the research data above, students' critical thinking skills are still relatively low and cannot be developed optimally. The right alternative solution to address the above problems is to apply a learning model that can train and develop students' critical thinking skills. The learning model that can be applied is Problem Based Learning with the Piagetian approach. The concept and theory of constructivism put forward by Piaget is the theoretical basis of the learning model Problem Based Learning [22]. In his theory of constructivism, Piaget emphasizes on the process that students go through to find out something and the stages that go through to acquire that knowledge[24]. This constructivism theory is aligned with the learning model Problem Based Learning which focuses on the use of problems as an aspect that is able to improve students' cognitive abilities in the realm of critical thinking skills and problem solving [22].

Learning model problem based learning is a problem-based learning model that is centered on students as learning centers and teachers as facilitators so that students can have an active role when teaching and learning activities take place [7]. Problem based learning apply learning by associating the material studied with problems that occur in everyday life so that students can develop knowledge [3]. In this learning model, students are also required to think, search, process and exchange information to solve a given problem during the learning process so that students do not only read, listen, write and memorize the material provided by the teacher. This is what can train students' abilities to think critically and work together with groups to find the right solutions to problems that arise related to this material [22]. In practice, students' thinking skills can be developed by making decisions and solving problems which are related to the ability to analyze (analysing), evaluate (evaluating), and create (creating) [2]. In the cognitive domain, the ability to analyze is included in C4, students analyze relevant information to find the best solutions to problems that arise and are related to the material. Evaluating ability (C5), students are assisted by the teacher to collect several different opinions from several students to choose the best opinion as a solution to the problem. Creative ability (C6), students provide new ideas or thoughts that have never been done before.

Model problem based learning has five stages in its application [22], (1) giving directions to students by the teacher on problems that arise to provide feedback to students in the form of text and pictures about computer networks; (2) guide students to divide tasks related to problems that are obtained by each group so that each student has their own role; (3) direct students to search for information through several sources to find and find the right solution to problems that arise in computer networks; (4) presentation of written reports by each group to collect information obtained by conducting presentations and group discussions; (5) analyze and evaluate the results of group discussions about the problem to draw conclusions with explanations given by the teacher so that students are able to understand better.

Based on the description above, the application of a new learning model that can improve students' critical thinking skills needs to be applied to improve students' critical thinking skills. In this problem the researchers experimented with applying the scenario learning model problem-based learning with the Piagetian approach in learning to see its influence in improving students' critical thinking skills in class X TKJ SMK Dian Indonesia. Scenario problem-based learning with this Piaget approach it is classified as a new learning model that has never been applied in this class, especially in computer and basic networking subjects. This is what encourages researchers to apply and see the results of the application. This research is important to do because it is a form of effort to improve students' critical thinking skills through the application of new learning models.

## II. METHODS

This type of research uses research methods pre experimental one group pretest-posttest design. Pretest conducted to measure students' initial critical thinking skills before implementing scenarios problem based learning, where as posttest carried out to determine the final ability of students after implementing the scenario problem based learning. The research design used by researchers can be seen in table 1. The subjects of this study were class X students of TKJ (Network Communication Engineering) SMK Dian Indonesia in the 2022/2023 academic year. The instrument used to measure students' critical thinking skills in data collection techniques uses questions essay which consists of 10 questions. The data analysis technique used in this study is a descriptive quantitative analysis approach using the T test for two paired samples (paired-samples T test) which was tested using the help of the SPSS 26 for Windows program. Analysis is used to measure the difference in the average value of students before being given treatment and after being given treatment so that it can be said to have an influence or not.

**Table 1.** One Groups Pretest-Posttest Design Experiment Design

$$\frac{O_1 \quad X \quad O_2}{\text{Source (Campbell \& Stanley, 1963)}}$$

Information :

- O1 : Pretest before scenario implementation problem based learning  
 O2 : Posttest after scenario implementation problem based learning  
 X : Scenario implementation problem based learning.

### III. FINDINGS AND DISCUSSION

From the results of research conducted in class X TKJ SMK Dian Indonesia, value data were obtained pretest and posttest students' critical thinking skills through questions in the form essay. The total number of students in this study were 8 students who were given scenario applications problem-based learning. Initial ability data or pretest which is used to determine students' critical thinking skills before being given treatment is taken from the results of the final examination of class X TKJ students. This decision was taken by the researcher because of the limited time the researcher had. Initial ability data or pretest students can be seen in table 2.

Student Initial Ability Data (Pretest)  
**Table 2.** Frequency Distribution of Students' Initial Ability

Interval Value	Frequency	Presentase (%)	Qualification
90-100	2	25	Very Good
80-89	-	-	-
70-79	2	25	Well
60-69	2	25	Enough
50-59	1	12,5	Not Good
40-49	1	12,5	Not Good
Total Students	8	100	

Table 2 shows that there are 4 students who have achieved the Minimum Completeness Criteria (KKM) standard score with 2 students getting very good score qualifications in the 90-100 interval and 2 other students getting good score qualifications in the 70-79 interval. There are 4 students who have not achieved the KKM score, with 2 students getting adequate score qualifications at intervals 60-69 and 2 other students getting poor grade qualifications at intervals 40-59. Results pretest This shows that students' initial critical thinking skills cannot be classified as good because there are still students who do not meet the standard values set with a percentage of 50% of the total number of students. After value pretest obtained, the normality test was carried out by researchers to find out whether the value pretest obtained are normally distributed or have not used the normality test Shapiro-Wilk. Value normality test results pretest can be seen in table 3.

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In the normality test Shapiro-Wilk, the data is said to be normally distributed if the significance value (p) obtained is greater than 0.05. From the results of the normality test in table 3, it shows that the significance value is 0.652 or greater than 0.05, so according to the normality test Shapiro-Wilk normally distributed data. After that, students are given the application of scenarios problem-based learning given problems related to computer network material. Then students discuss the problem in divided groups and present the results of the discussion. In the final stage, students are given an assessment of learning outcomes or posttest which aims to measure the influence of scenario implementation problem-based learning on students' critical thinking skills which can be seen from the final grade. Study results data or posttest students can be seen in table 4.

Table 4 shows that there are 5 students who get scores in the interval 70-79 with good qualifications. 2 students get scores in the interval 60-69 with sufficient qualifications and one student gets scores in the interval 50-59 with poor qualifications. Value results post-test students' critical thinking skills did not increase significantly. This can be seen from the decrease in the 2 students who got very good scores on grades pretests and there are still students who have not reached the standard value set. Based on value pretest and posttest students' critical thinking skills

above, there are differences in the average scores obtained. The difference in values is called gain score. Data gained from score students' critical thinking skills can be seen in table 5.

Based on table 5, the average value is the value pretest higher than the average value posttest after being given the implementation of the scenario problem-based learning. Results of pretest and posttest it can be said that it does not have an increase in students' scores on critical thinking skills or values posttest. This indicates that the application of the scenario problem-based learning does not have a significant effect on students' critical thinking skills as measured by tests.

**Table 3.** Normality Test Results Shapiro-Wilk

Shapiro-Wilk		
Statistic	df	Sig.
.944	8	.652

Student Learning Outcome Data (Posttest)  
**Table 4.** Frequency Distribution of Student Learning Outcomes

Interval Value	Frequency	Presentase (%)	Qualification
90-100	-	-	-
80-89	-	-	-
70-79	5	62,5	Well
60-69	2	25	Enough
50-59	1	12,5	Not Good
40-49	-	-	-
Total students	8	100	

**Table 5.** Data Gain score Students' Critical Thinking Ability

Total Students	Average value pretest	Average value posttest	Gainscore
8	70,75	68	2,25

**Table 6.** Hypothesis Test Results Paired-Samples T test Critical Thinking Ability

	Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference		t	df	Sig. (2-tailed)
				Lower	Upper			
Before - after	2.750	11.683	4.131	-7.018	12.518	.666	7	.527

Based on table 6 the significance value of the hypothesis test Paired-Samples T test critical thinking skills obtained results  $0.527 > 0.05$  then the scenario problem-based learning does not have a significant influence on the critical thinking skills of vocational students. This is also evidenced by the difference in the average value pretest which is greater than the average value posttest student.

Based on the research results obtained, there is a difference between the initial ability values (pretest) with the value of learning outcomes (posttest) in class X TKJ. Mark posttest which was obtained indicates a decrease in the average value of students with value pretest. This can be proven by the average value pretest of 70.75 greater than the average value posttest of 68 with a difference in the value of both of 2.25. Therefore, the application of the scenario problem-based learning to improve students' critical thinking skills can be said to have no significant influence, then viewed from the average value that has been described.

Based on the results of statistical tests, it also shows that there is no effect in its application. This can be seen with data analysis through Test T-test which obtained a significance value of 0.527, so it can be interpreted that the significance value is still greater than 0.05 or it can be said  $H_0$  accepted and  $H_1$  rejected indicating the class has no influence in applying the scenario problem-based learning on critical thinking skills.

The research results obtained have similarities with several previous studies which did not have a significant influence on application problem-based learning towards students. Research conducted by Fitriani shows its application problem-based learning does not have a positive effect on student learning motivation with a significance value obtained of  $0.371 > 0.05$  [5]. Research conducted by Sujatmika obtained similar results, the significance value obtained was 0.620 which indicated that there was no effect of applying problem-based learning on student learning achievement [20]. And the results of another study conducted by Siddiq et al. found that the application of problem-based learning did not affect aspects of attitudes and cognitive abilities which could be seen through grades pretest and posttest which still does not have a significant difference [17]. Based on the results of the research above, it shows that the problem-based learning that is applied still has problems which result in the treatment not having an effect.

If you trace back the research conducted on the results obtained, there are several possible causes treatment given does not have a significant effect. The first possibility is that the implementation of the syntax has not been maximized problem-based learning especially in the first syntax which can affect the continuity of the following syntax. Syntax that has not been maximized in its implementation is to orient students on problems related to the material. Siddiq et al. also revealed in their research that the unsuccessful application of problem-based learning to students' cognitive skills was allegedly due to the suboptimal first syntax in problem-based learning [17]. The problem that the researcher uses is likely to be more difficult so that students have a little difficulty understanding it. This is also in line with the characteristics of the problems used in problem-based learning according to Ibrahim which among other things explains that the problems used in learning must be based on the latest knowledge possessed by students [7]. Ibrahim also argues to avoid problems that are difficult for students to solve even if they get help from teachers or other learning resources [7].

The second possibility is that students are not used to learning with new learning models, especially learning models' problem-based learning which makes students the center of learning itself. Students have difficulty finding solutions to problems due to their unfamiliarity with solving a problem [26]. Students tend to be used to conventional learning models that focus on teacher learning. Teacher-centered learning encourages students to understand material through listening and paying attention. This can be proven by the magnitude of the value pretest taken from the results of the student's last exam using conventional learning models rather than grades posttest taken through the application of scenarios problem-based learning.

Even though the statistical test results state that the scenario problem-based learning does not significantly influence students' critical thinking skills. But there are several points that show that scenario problem-based learning is a good learning model to apply. In terms of increasing scores, there were several students who experienced an increase, although not too big or significant. This is supported by the results of research conducted by Ningsih et al. that the application of problem-based learning can improve student learning outcomes in several aspects [10]. This can imply that each student has different abilities and characters in how to learn so that the application of learning models can affect the success of the learning objectives to be achieved. Sukirman said that there are important points which are the goals and benefits of holding a variety of learning activities, one of which is adjusting the learning model to different student learning styles [21]. Therefore, applying a variety of learning models is worth trying so that students don't feel bored with the same learning model and are able to adjust to different student learning styles.

In addition, the application of scenarios problem-based learning makes students more active in group learning. They work together and discuss to find the right solution to the problem given. Students who act as learning centers make the teacher do not have a significant role such as when applying the conventional model of lectures and questions and answers. The teacher acts as a facilitator whose job is to guide students in solving problems. This is in line with Iwan's research which found that problem-based learning can increase student motivation and make students active in learning.

#### IV. CONCLUSION

Based on the results of research and data analysis, it can be concluded that the application of scenarios problem-based learning on the critical thinking skills of class X TKJ students at SMK Dian Indonesia did not have a significant effect. This is stated based on the average value pretest students are greater than the average value posttest and the significance value obtained is greater than 0.05. To apply maximum learning, especially in terms of students' critical

thinking skills, provide the variety of learning models used is one of the efforts to improve the critical thinking skills of each student. Scenario implementation problem based learning also worth a try again with a more optimal implementation of each syntax

### ACKNOWLEDGMENTS

I would like to thank Allah SWT because of His permission I can finish this journal. Then I also thank my supervisors and examiner lecturers who have helped me and provided input and directions to complete this journal. For the third time, I would like to thank the informants who have agreed to be part of my research. Furthermore, I would like to thank my mother, family, and friends who have given me their prayers and support in completing this journal. And for myself, thank you for fighting until now..

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