

# The effectiveness of Challenge Based Learning and Case Based Learning to improve students' Critical Thinking Skills

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**Abstract:** *This study aimed to investigate the effectiveness of increasing the critical thinking skills of students who were taught using a Challenge Based Learning model and a Case Based Learning model in history subjects. This research was a quasi-experimental design with a sample of 66 senior high school students. Data collection used a performance test (project) in the form of historical stories. The data analysis technique was the t-test (Paired Sample t-Test). The results of the t-test analysis of the critical thinking skills of students taught with the Challenge Based Learning model obtained an average value of 75.18. Meanwhile, the average value of students' critical thinking skills with a Case Based Learning model was 69,12. Based on these results, it can be concluded that the Challenge Based Learning model is more effective in improving students' critical thinking skills with a higher effectiveness level than the Case Based Learning model of 0.72. The recommendation from the results of this study is that optimizing students' critical thinking skills in history learning can be done using the Challenge Based Learning model because it is more challenging and fun.*

**Keywords:** Challenge Based Learning, Case Based Learning, Critical Thinking Skills

## 1. INTRODUCTION

The current vision of education emphasizes on life skills in the 21<sup>st</sup>-century. The 21<sup>st</sup>-century skills are the main competencies in dealing with technological developments by optimally developing the various bits of students intelligence [5, 28], so it is urgent to integrate them into the learning process. One of the skills prioritized in education systems and the history curriculum is the critical thinking skills [19, 32, 1]. Critical thinking skills prepare students for a higher level of education [1, 38] and are one soft skill needed in the world of work. Critical thinking as a 21<sup>st</sup>-century skills characterized by students' ability to think logically, reflectively, analyze, evaluate, and solve problems with in-depth knowledge. According to Ennis [7], critical thinking skills focus on deciding what to believe or to do. Meanwhile, according to Facione [8], critical thinking skills aim to solve problems, formulate conclusions, consider possibilities and make decisions. Critical thinking skills lead to the ability to uncover the truth and discard all existing errors [37]. Therefore, critical thinking becomes an important component of work and education that is crucial for learners to compete in the era of Industrial Revolution 4.0 and Society 5.0.

Historical learning that examines past events requires analyzing historical events to reveal the meaning of these events [18, 34]. Historical studies cannot be separated from the critical thinking process in reconstructing the past, collecting, verifying, and interpreting historical sources, and the process of historical historiography. If viewed from the purpose of learning history, critical thinking skills are an essential component of the objective of learning history. The purpose of learning history in the Merdeka Curriculum is to train diachronic (chronologically), synchronic, causality, imaginative, creative, critical, reflective, contextual, and multiperspective thinking skills [20]. Students must understand historical interpretation, analyze and evaluate various historical events, and interpret the values of these events to contextualize them in today's life [20, 3]. Therefore, critical thinking skills are a component that learners need in the elements of historical process skills.

The description above shows the urgency of critical thinking skills in learning history. However, in reality, the results of previous research show that students have a low level of Critical thinking skills [25]. Rahmawati's research problem (2019) shows that the average value of students' critical thinking skills in history subjects is low at 32.62%. Irfan, na'im, and puji's research problems also show that the classical completeness of students' critical thinking skills indicators is less than 60% and includes unfavorable criteria [14]. Erlina's research problem (2019) shows that the average value of students' critical thinking skills is low at 38.23% on the indicator of focusing questions, 41.17% on the indicator of analyzing arguments, 38.97% on the indicator of identifying assumptions, 25.73% on the indicator of determining action and 46.32% on the indicator of interacting with others. These problems indicate that the low level of critical thinking skills in learning history is a problem that requires resolution.

Developing critical thinking students need innovative learning. Innovative learning facilitates the learning process of learners by discovering and building an understanding of information independently [13] However, the problem with previous research is that educators use learning methods that tend not to develop students' thinking skills. Educators still use learning models that are less

innovative [36, 31]. Other research shows that 31.2% of educators have not implemented innovative learning models [35]. The results of this study encourage learning innovations that can improve students' critical thinking skill.

One of the learning models that emphasize critical thinking skills is the Challenge Based Learning model. Challenge Based Learning is multidisciplinary learning that encourages learners to utilize technology to solve challenges [15]. The Challenge Based Learning model allows students to organize their learning in groups and explore "big ideas" to solve challenges. Students can connect what they learn in school with what they experience in their surrounding environment by solving challenges [15]. History learning also encourages students to examine various historical stories and connect them with current events [39]. The stages require finding sources of information, analysis, conclusions, and evaluation [2] to enable students to examine historical events. The characteristics of learning history that need social science in studying historical events are relevant to the aspects of the multidisciplinary Challenge Based Learning model. Previous research shows that the Challenge Based Learning model can improve student critical thinking skills [6, 11, 2]. Other research also indicates that the Challenge Based Learning model can increase learning motivation [9], independent learning, communication skills, problem-solving, and creativity [21, 40]. Students are active in exploring their knowledge so that they can train their critical thinking skills.

Another learning model that emphasizes critical thinking skills is the Case Based Learning model. The Case Based Learning model emphasizes high-level thinking skills, such as critical thinking and problem-solving [33]. Case Based Learning is a learning model that involves issues, situations, or questions that must be solved and requires students' thinking skills [24]. Learners explore the topic through their understanding, thus promoting independent learning [24, 22]. Case-based learning models encourage self-evaluation and reflection [23]. The problem can be student orientation. So it is relevant to history learning that must contextualize historical events to be evaluated and used as an orientation for a better life. Previous research shows that the Case Based Learning model can train critical thinking skills [12, 17, 23, 40]. The presentation of a topic accompanied by questions and activities that encourage group discussion and problem-solving requires in-depth identification so that it trains critical thinking skills.

The Challenge Based Learning and Case Based Learning models have the same focus on improving students' critical thinking skills. History learning is oriented toward thinking skills and requires historical research skills relevant to the characteristics of the Challenge Based Learning and Case Based Learning models. This research will verify which learning model is more effective for students' critical thinking skills in history subject.

## 2. RESEARCH METHODS

This research is a quasi-experimental design with a quantitative approach, because it's not possible of researchers choosing groups randomly [11]. The selected group is a pre-existing group. The research sample used was 66 students of class XI IPS 1 and class XI IPS 2 at SMAN Tamanan academic year 2022/2023, selected through homogeneity test. In this study, researchers treated the Challenge Based Learning and Case Based Learning models and observed their effectiveness on students critical thinking skills. Research variables consist of independent variables and dependent variables. The independent variables in this study are Challenge Based Learning model (X1) and Case Based Learning model (X2). The dependent is the variable that is affected. The dependent variable in this study is critical thinking skills (Y). This study uses indicator of Facione's critical thinking, including (1) Interpretation; (2) Analysis; (3) Evaluation; (4) Inference; (5) Explanation; (6) Self-regulation. The data collection method consists of documentation and tests to acquire data on the number of students in grade XI and the value of the research population and the value of the research sample. Test to obtain information about students' critical thinking skills. The research instrument used was a performance test (project) in the form of a historical story and developed according to Facione's critical thinking skills indicators.

The data analysis technique used the t-test (Paired Sample t-Test) assisted by SPSS for Windows version 24. The t-test (Paired Sample t-Test) aims to determine the difference in critical thinking skills of experimental class 1 students treated with the Challenge Based Learning model and experiment class 2 treated with the Case Based Learning model. The t-test conducted the data prerequisites are normal distribution and homogeneous. The normality test uses Kolmogorov-Smirnov, then the homogeneity test uses Homogeneity of Variance. Decision-making criteria in this study use a significance level of 5%. The effectiveness test used to measure the effectiveness of critical thinking skills is the Eta Squared effectiveness formula with the effectiveness test interpretation criteria below.

Table 2: Criteria for effectiveness test

Score	Interpretation
0,01	Small Effect
0,06	Moderate Effect
0,014	Large Effect

Source: Cohen, 1988

### 3. RESULTS AND DISCUSSION

#### 3.1 Results

Before the data is analyzed using the Paired Sample t-Test, the data is first tested for normality using the Kolmogorov-Smirnov formula assisted by SPSS for Windows version 23. The normality test was measured on the test results of both samples, XI IPS 1 as the experimental class 1 which was treated with the Challenge Based Learning model and XI IPS 2 as the experimental class 2 which was treated with Case Based Learning model. The decision-making criteria in this study used a significance level of 5%. The results of the normality test are presented in the table below.

**Table 3:** Normality test results

Sample	Data	N	Sig.	Notes
Experiment 1	Pre-test value	33	0,143	Normal distribution
	Post-test value	33	0,068	Normal distribution
Experiment 2	Pre-test value	33	0,099	Normal distribution
	Post-test value	33	0,200*	Normal distribution

Source: Primary data processed

Table 3 shows the results of the normality test of critical thinking skills for the experimental class 1 and experimental class 2. The significance level of the pretest of experimental class 1 is  $0.143 > 0.05$ , the significance level of the posttest of experimental class 1 is  $0.068 > 0.05$ . The significance level of the pretest of experimental class 2 is  $0.099 > 0.05$  and the significance level of the posttest of experimental class 2 is  $0.200 > 0.05$  shows a number greater than 0.05 so that the pretest, and posttest in experimental class 1 and experimental class 2 were declared normally distributed. Furthermore, the results of the homogeneity test are presented in the table below.

**Table 4:** Homogeneity test results

Data	Lavene test Statistic	df2	Sig.	Notes
Pre-test value	.017	64	0,897	Homogeneous

Source: Primary data processed

Table 4 shows the results of the homogeneity test of critical thinking skills for experimental class 1 and experimental class 2. Based on the results of the homogeneity test above, it shows that the homogeneity test of the Levene test statistic for the pretest in experimental class 1 and 2 is 0.17 with a significance value 0.897 ( $0.897 > 0.05$ ), then  $H_0$  is accepted and  $H_a$  is rejected, and the pretest critical thinking skills of experimental class 1 and 2 are declared homogeneous.

After the prerequisite test for data analysis is met, a t-test is conducted to then see the effectiveness of the Challenge Based Learning model and the Case Based Learning model on critical thinking skills. Paired Sample t-Test is used to see the difference in the average value of students' critical thinking skills and the t-value that will be used in the effectiveness test formula. The results of the t-test on the critical thinking skills test for experimental class 1 and experimental class 2 are presented in the table below.

**Table 5:** Results of the t-test of experiment 1 and 2

Experiment Class		N	Mean	Std. Deviation	Std. Error Mean
Pretest	Experiment 1	33	64,06	8,849	1,540
	Experiment 2	33	62,64	8,649	1,506
Posttest	Experiment 1	33	75,18	6,903	1,202
	Experiment 2	33	69,12	10,931	1,903

Source: Primary data processed

The average value of the pretest in experimental class 1 which was taught by the Challenge Based Learning model is 64.06 and the average value of the post-test is 75.18. The average value of the pretest in experimental class 2 which was taught by the Case Based Learning model is 62.64 and the average value of the post-test is 69.12. Based on the difference in the average value of the pretest-posttest in experimental class 1 and experimental class 2, it can be concluded that the critical thinking skills of students taught using the Challenge Based Learning model are better than students taught using the Case Based Learning model.

The decision-making criteria were based on a significance level of 5% with the following hypothesis: (a) If Sig value (2-tailed)  $> 0.05$ , then there is no significant difference; (b) If Sig value (2-tailed)  $< 0.05$ , then there is a significant difference. The following

are the results of the t-test on the pretest and post-test to measure critical thinking skills before and after treatment in experimental class 1 and experimental class 2 are stated in the table below.

**Table 6:** Results of paired sample t-test for experimental class 1

		<b>95% Confidence Interval of the Difference</b>							
		<i>Mean</i>	<i>Std. Deviation</i>	<i>Std. Error Mean</i>	<i>Lower</i>	<i>Upper</i>	<i>t</i>	<i>df</i>	<i>Sig. (2-tailed)</i>
Pair 1	Pretest – Posttest	-11,121	6,927	1,206	-13,577	-8,665	-9,223	32	0,000

Source: Primary data processed

The data presented in table 6 above shows that the Sig. (2-tailed) pretest-posttest data is 0.000 < 0.05. Based on the decision-making criteria, it can be concluded that there is a significant difference in the level of Critical Thinking Skills between students who are taught before using the Challenge Based Learning model and after using the Challenge Based Learning model. Next is the effectiveness test stage with the relative effectiveness formula. The results of the effectiveness test of Challenge Based Learning model are as follows:

$$\begin{aligned}
 \text{Eta Squared} &= \frac{t^2}{t^2 + (N-1)} \\
 &= \frac{(-9.223)^2}{(-9.223)^2 + (33-1)} \\
 &= \frac{85.063}{117.063} \\
 &= 0.726
 \end{aligned}$$

The result of the effectiveness test of the Challenge Based Learning model is 0.72, shows the large effect criteria. This means that the Challenge Based Learning model is effective for improving students' critical thinking skills with a high level of effectiveness.

**Table 7:** Results of paired sample t-test for experimental class 2

		<b>95% Confidence Interval of the Difference</b>							
		<i>Mean</i>	<i>Std. Deviation</i>	<i>Std. Error Mean</i>	<i>Lower</i>	<i>Upper</i>	<i>t</i>	<i>df</i>	<i>Sig. (2-tailed)</i>
Pair 1	Pretest – Posttest	-6,485	8,224	1,432	-9,401	-3,569	-4,530	32	0,000

Source: Primary data processed

The data presented in table 7 above shows that the Sig. (2-tailed) pretest-posttest data is 0.000 < 0.05. Based on the decision-making criteria, it can be concluded that there is a significant difference in the level of critical thinking skills between students who are taught before using the Case Based Learning model and after using the Case Based Learning model. Next is the effectiveness test stage with the relative effectiveness formula. The results of the effectiveness test of Challenge Based Learning model are as follows:

$$\begin{aligned}
 \text{Eta Squared} &= \frac{t^2}{t^2 + (N-1)} \\
 &= \frac{(-4.530)^2}{(-4.530)^2 + (33-1)} \\
 &= \frac{20.520}{52.520} \\
 &= 0.390
 \end{aligned}$$

The result of the effectiveness test of the Case Based Learning model is 0.39, shows the large effect criteria. This means that the Case Based Learning model is effective for improving students' critical thinking skills with a high level of effectiveness.

### 3.2 Discussion

This study examines the effectiveness of critical thinking skills of students who are taught using the Challenge Based Learning model and the Case Based Learning model. The results of the t-test analysis obtained the average value of the post-test critical

thinking skills of the experiment 1 class treated with the Challenge Based Learning model is 75.18. While the average value of post-test Critical Thinking Skills treated with the Case Based Learning model is 69.12, which shows that the Challenge Based Learning model is better at improving students' critical thinking skills. Based on the effectiveness test results, both models show high effectiveness, with the Challenge-Based Learning model having a higher effectiveness level is 0.72. While the effectiveness level of the Case-Based model is 0.39. So it can be concluded that the Challenge Based Learning model is more effective in improving students' critical thinking skills with a higher level of effectiveness.

If it is detailed more deeply based on the average value of each critical thinking skills indicator in experimental classes 1 and 2, it can be seen the difference in the level of critical thinking skills indicators between experimental classes 1 and experimental class 2. The results of the average difference in the highest indicator of critical thinking skills of experimental class 1 taught using the Challenge Based Learning model are as follows : (1) Interpretation indicator is 3.00; (2) Analysis indicator is 2.9; (3) Evaluation indicator is 3.1; (4) Inference indicator is 3.2; (5) Explanation indicator is 2.9, and (6) Self-regulation indicator is 3.6. While the difference in the average value of each indicator of critical thinking skills of experimental class 2 with the Case Based Learning model is: (1) Interpretation indicator is 3.3; (2) Analysis indicator is 3.6; (3) Evaluation indicator is 2.6; (4) Inference indicator is 2.6; (5) Explanation indicator is 2.2, and (6) Self-regulation indicator is 2.7. Based on the comparison of the average of each indicator of critical thinking skills of experimental class 1 and experimental class 2 shows that experimental class 1 using the Challenge Based Learning model is better at evaluating, inference, and self-regulation indicators. While the experimental class 2 using the Case Based Learning model is better at the interpretation and analysis indicators.

The Challenge Based Learning model involves the process of identification, analysis, and design of solutions to solve challenges [30]. Collaborative learning experiences, and multidisciplinary and decision-making processes involve many different perspectives. This allows students to share and exchange ideas to find the right solution. So that students are trained to conclude various points of view. Besides that, solution development includes the identification of solutions that have been made. Other components such as essential questions and information resources should also be identified, clarified, and evaluated [29]. This process trains learners to conclude various elements significant in the steps of the Challenge Based Learning model. Meanwhile, the conclusion stage in the Case Based Learning model requires learners to interpret and critically reflect on their knowledge and understanding [10]. This stage concludes the problem-solving solution based on the information obtained. The Challenge Based Learning model trains learners to make independent and reliable conclusions by providing organized and systematic questions [26] so that the Challenge Based Learning model trains students to have a more optimal conclusion ability.

Furthermore, the evaluation process in the Case Based Learning model is when students seek and utilize information to create problem-solving solutions. Meanwhile, the Challenge Based Learning model emphasizes the evaluation process in learning. In a learning environment, the Challenge Based Learning model is concerned with self-directed learning, content knowledge, and problem-solving [16]. To be successful, learners must develop strategies to identify challenges, and evaluate big ideas, questions, solutions, and information used. The evaluation process of Case Based Learning model is when learners seek and utilize the information for problem-solving solutions. Meanwhile, the Challenge Based Learning model emphasizes the evaluation process in learning. In a learning environment, the Challenge Based Learning model is concerned with self-directed learning, content knowledge, and problem-solving [16]. For successful challenge identification, learners must develop strategies, and evaluate big ideas, questions, solutions, and information used. The Challenge Based Learning model encourages learners to critically reflect on their knowledge and learning in everyday life [15, 16]. Learners also evaluate learning activities.

The Challenge Based Learning model encourages learners to organize their learning and think critically about how to apply what they learn [15]. In the Challenge Based Learning model, learners must identify problems or challenges, create questions, seek and analyze information and develop solutions [15]. Learners solve challenges and make connections between what they learn at school and in their surrounding environment [15].

The Case Based Learning model stands out on the interpretation and analysis indicators. A case or problem accompanied by questions and activities that encourage discussion activities for problem-solving requires in-depth analysis and interpretation of the problem [33]. The case analysis stage requires understanding the problem situation. Learners must be able to describe the events of the problem. Interacting with various thoughts in discussion activities requires an analysis process [21]. Levin (1995) says that case analysis improves quality, form, and thinking and enhances learners' understanding. The Case Based Learning model requires learners to interpret various resources and information used for the problem-solving process. While in the interpretation process of the Challenge Based Learning model occurs at the guiding resources stage when learners look for guiding resources used to solve challenges.

Johnson & Adams' research shows that the Challenge Based Learning model can improve students' critical thinking skills [16]. Farizi's research shows that the Challenge Based Learning model affects students' Critical thinking skills in historical subjects. Nawawi explained that the Challenge Based Learning model syntax is effective for training students' critical thinking skills because each syntax can train and develop Critical thinking skills [26]. The syntax of the Challenge Based Learning model makes students think deeply about the learning material. The Big Idea stage is related to the description of a topic, phenomenon, situation, and

problem to be studied and encourages learners to understand the meaning of big ideas [16]. The Essential Question stage focuses learners on improving their understanding of the big ideas. The challenge syntax includes guiding questions, guiding resources, and guiding activities that help learners identify the knowledge needed to develop solutions [29, 27]. This is the critical thinking phase in the Challenge Based Learning model [2]. In the challenge phase, learners must also identify all the components of the challenge, namely the big idea, guiding questions, guiding activities, and guiding resources [29]. Guiding questions require learners to create questions that represent the knowledge needed to develop solutions to solve challenges provided by the educator [27]. This activity helps learners identify challenges and provides in-depth understanding. Guiding resources train learners to identify, analyze and evaluate information sources [4]. The solution stage trains learners to make conclusions based on the information obtained. Learners' activities through the steps in the Challenge Based Learning model improve learners' thinking skills.

The Challenge Based Learning model also increases learners' active participation in the learning process. Learners can answer or solve challenges according to their understanding and knowledge. Thus helping learners master the learning material [16]. Learners can think critically through organized and systematic questions exploring a topic and provide conclusions independently. Organized and systematic questions through the guiding question stage allow learners to engage in activities that help them gain a deep understanding [26], so the Challenge Based Learning model is effective in training students' critical thinking skills.

#### 4. CONCLUSION

Based on the results of research on the effectiveness of the Challenge Based Learning model and Case Based Learning model on students' critical thinking skills in learning history, it can be concluded that the Challenge Based Learning model is more effective in improving students' critical thinking skills in historical subjects. The results of the t-test analysis show the average value of students' Critical thinking skills with the Challenge Based Learning model of 75.18. Meanwhile, the average value of critical thinking skills of students with the Case Based Learning model is 75.18. While the average value of students' Critical thinking skills with the Case Based Learning model is 69.12, it shows that the Challenge Based Learning model is more effective in improving students' critical thinking skills with a high effectiveness of 0.72.

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