Implementation of Virtual Classroom Critical Thinking in High School Physics Classes

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ABSTRACT

This study aims to measure the effectiveness of the Virtual Classroom Critical Thinking (VC2T) Model in improving students' critical thinking skills. There are six steps in the VC2T model, namely: problem orientation, formulation, group discussion, analysis, result discussion, and reflection. This study involved 30 students of Science Class 1 and 31 students of Science Class 3 of SMA Dr. Soetomo Surabaya who took part in teaching physics in the even semester of the 2020/2021 school year. The results showed that: (1) the VC2T model was valid, which was indicated by the mean score of the validity of supporting tools. The VC2T model was declared very valid with an average of 4.13 (2) The VC2T model was said to be effective, increasing of Critical Thinking Skills which was statistically significant at alpha 0.05, the mean n-gain is 0.61 in class XI SCIENCE 1 which is in the medium category, the mean n-gain is 0.66 in class XI SCIENCE 3 which is in the medium category, and the average student response results is 88,94% in class XI SCIENCE 1 with very good category and 89.51% in class XI in SCIENCE 3 with very good category.

Keywords: Virtual classroom, Critical thinking, Physics.

1. INTRODUCTION

In everyday life, education is needed to build knowledge. To achieve proper knowledge, we have to integrate some knowledge including the old knowledge which we have in our mind before [1]. When someone receives new knowledge, everyone will relate the new knowledge and old knowledge. Thinking is a cognitive process that is the link between old knowledge and new knowledge [2]. There are two thinking abilities of each person, namely higher-order thinking and basic-level thinking. Basic level thinking is the process of thinking to use memory for understanding something, while higher order thinking is the process of thinking critically and creatively [3]. In this pattern of thinking, the brain no longer thinks based on memorization or memory, but based on what it seeks and finds for itself. Critical thinking skills are needed by students to understand information that runs very quickly. In addition, this skills are needed for responding in the disruption era.

In fact, Indonesian students are still not able to use their critical thinking skills. We can know from the results of Program for International Student Assessment (PISA) 2018 which showed that there was a decline in all fields, including the field of science. On the field of science obtained an average score is 396, while the OECD average achievement is 489, this shows that Indonesian students are still in the stage of remembering and knowing phenomena. It can be interpreted that Indonesian students do not have the reasoning skills needed in critical thinking and have not been able to make

conclusions. From the results obtained by Indonesian students under level 5, which critical thinking at this level includes the concepts to explain an event by explaining causal relationships and providing arguments [4].

The emergence of COVID-19 in Indonesia on March 2020 made all schools closed and changed the learning system to distance learning or online learning [5]. During the COVID-19 pandemic crisis, education must continue to run as it should because education is needed by students. When distance learning is implemented, teachers and students accept injustice because it suddenly has to be implemented and they are not prepared [6]. Teachers need to prepare distance learning plans and students need to prepare supporting devices such as mobile phones or computers [7]. It is not easy for the teacher to prepare for this lesson, because the teacher does not yet have distance teaching experience. Few teachers are able to carry out this learning with learning management system, but do the teachers apply it correctly, how the teacher applies it, what model the teacher uses and they think that it is "important that the material is conveyed". Students who are accustomed to face-to-face learning at school are then forced to study at home online using LMS [8]. No one knows how long the distance learning will take place, because COVID-19 is still looming over public health in Indonesia.

One of the learning models that can be used is the virtual classroom critical thinking (VC2T) model. VC2T model is a combination model between blended learning model and inquiry learning model [4]. This model has 6 phases, namely problem orientation, formulation, group

discussion, analysis, result discussion, and reflection which trains 5 indicators of critical thinking skills, namely interpretation, analysis, evaluation, inference, explanation [4]. From the results of research conducted by Lestari et al. (2021) that the VC2T model is effective to increase students' critical thinking skills during COVID-19 and 85% of students give a good response to this model [4]. Based on the problems mentioned above, this study aims to implement the VC2T model in high school physics classes.

2. METHODS

This is an experimental research conducted in online system. The subjects were students of class XI SMA Dr. Soetomo Surabaya in the even semester of the 2020/2021 academic year. The population were 30 students of class XI SCIENCE 1 and 31 students of class XI SCIENCE 3 of SMA Dr. Soetomo Surabaya. This study trains critical thinking skills in KD 3.5, which analysing about the heat and heat transfer in everyday life. The research method used is one group pre-test and post-test design which can be written as follows [9]:

$$O_1 \quad X \quad O_2$$

Remarks:

O_1 = Test before learning using the VC2T model.
X = Giving treatment to students by applying the VC2T model
O_2 = Test after learning using the VC2T model.

The data collection technique in this study was giving a test of students' critical thinking skills which was carried out in class XI SCIENCE 1 and XI SCIENCE 3, besides that the researchers also give response questionnaires to students online. This aims to obtain data that is effective and in accordance with the objectives of this study

2.1 Analysis of student's critical thinking skills

The increasing of students' critical thinking skills can be seen from the CTST instrument given before and after implementing the VC2T Model. The instrument is given essay questions to students with the highest score is 4 and the lowest is 0. The indicators of critical thinking skills trained in this study were Interpretation, Analysis, Evaluation, Inference, and Explanation. After getting the score from giving the instrument to students, the next is calculate the data using the normalized gain equation as in equation (1) with the aim to know the increase of students' critical thinking skills after the students leaned with VC2T model. Normalized gain categories can be seen in Table 1 [9].

$$n - gain = \frac{X_m - X_n}{100 - X_n} \qquad (1)$$

Remarks:

X_n = score of before learning
X_m = score of after learning
n-gain = normalized gain

Table 1. Normalized gain category

Interval	Category
N-gain > 0,7	High
0,3 ≤ *N-gain* ≤ 0,7	Medium
N-gain < 0,3	Low

The Paired Sample t-test in this study was used to determine whether there is a difference between the score of before learning and after learning from the application of the VC2T model. The difference of pre-test and post-test the students' achievement is to know the significant differences from the implementation of the VC2T model. This study applied SPSS version 22 to analyze the paired sample t-test. The implementation of this model is effective if: (1) the students' achievement improve significantly at alpha 0.05, (2) the result of the calculation normalized gain is minimal in the medium category, and (3) the student's response is minimal in the good category.

2.2 Analysis of student's response

Student response data was obtained from the provision of student response questionnaires to learn activities using the VC2T model, then analyzed descriptively qualitatively and quantitatively. Student response questionnaire format using a likert scale with positive questions [9].

$$P = \frac{\sum K}{\sum N} x \ 100\% \qquad (2)$$

Remarks:

$\sum K$: the number of scores performed by students
P : Percentage of students reaction about VC2T model
$\sum N$: the highest number of scores achieved by students
The result of the calculation of percentage student responses is converted by the categories in Table 2 [2].

Table 2. The category of student's percentage reaction

Interval (%)	Category
80 - 100	Very Good
60 - 79	Good
40 - 59	Adequate
20 - 39	Not Good
0 - 19	Bad

3. RESULTS AND DISCUSSION

The application of the VC2T model was implementing in class XI SCIENCE 1 and XI SCIENCE 3 at SMA Dr. Soetomo Surabaya by giving tests of critical thinking skills before and after learning using the VC2T model. Giving a test before learning which is useful for knowing students' initial knowledge about the material to be studied, while giving a test after learning is to know the effect of the VC2T model on learning. From the results of the data collected, pre-test and post-test data were obtained which were analyzed to calculate the increase of students' knowledge after learning using the VC2T model. The value was analyzed descriptively and continued with the calculation of normalized gain to calculate the increase of students' critical thinking skills. The average pretest and posttest scores of students' critical thinking skills in class XI SCIENCE 1 and XI SCIENCE 3 can be seen in Figure 1.
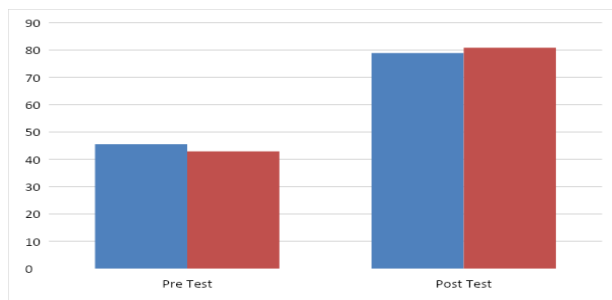

Figure 1 Mean of pre-test and post-test for each class.

Figure 1 shows that the pre-test is lower than the post-test score, this result indicates that there is an increase scores after learning with the VC2T model. This shows that the VC2T model can improve the students' achievement as evidenced by the results of the post-test being greater than the pre-test. To test whether the increase of students' achievement scores was statistically significant, a paired t-test with SPSS Version 22 software was used as shown in Table 3.

Table 3. The result of Paired t-test

	N	Mean	S	df	t	Sig. (*p*)
XI Science 1 Score	30	-33.40	5.16	29	-35.48	0.000
XI Science 3 Score	31	-37.90	4.13	30	-51.05	0.000

Table 3 shows that the results of the students' paired t-test with sig. 0.000, it means that there is a difference between the score of before learning and after learning. The t-value in Table 3 is negative because the score before learning is lower than after learning. This shows that learning with the VC2T model can affect student learning outcomes for the better, especially in students' critical thinking skills. According to the opinion of Utami et al. (2017) explains that students really need critical thinking skills to solve a problem in everyday life, besides that student need to use critical thinking skills effectively [10].

After the learning process is complete, the students fill out a response questionnaire by online containing the application of the VC2T model with positive types of questions that aim to determine student responses to the VC2T model learning which can be seen in Table 4.

Table 4. The results of student response assessment

No.	Statement	Response	
		XI SCIENCE 1 (%)	XI SCIENCE 3 (%)
1.	The activities are fun	91.30 %	90.27 %
2.	The activities and learning tools of the VC2T model is good	92.46 %	93.54 %
3.	Learning materials can be easily understand	82.10 %	84.20 %
4.	The learning activities are exciting and fun	89.50 %	88.32 %
5.	My critical thinking skills have improved after taking lessons using the VC2T model	85.90 %	87.67 %
6.	I hope that other subjects use the VC2T learning model	92.40 %	93.10 %
Average		88.94 %	89.51 %

The results of the responses of XI SCIENCE 1 show that the student's response obtained was 88.94% in the very good category and the results of the XI SCIENCE 3 showed that the students response questionnaire was 89.51% in the very good category. In general, this research shows that the VC2T model effective to increase

the students' achievement of high school students in learning physics; which includes 5 indicators. namely interpretation. analysis. evaluation. inference. and explanation. The students were actively when the VC2T model was implementing in the distance class. We can see it from the results of the students' response. some of them said if the learning activities were exciting and fun and they hope if the other classes can implement the model. This model effectively to use increasing the students' achievement when the coronavirus disease around us. The findings in this study that the VC2T model can increase the students' achievement and the students' critical thinking skills and this model can be implemented in some classes which apply the distance learning.

4. CONCLUSION

Based on the results of the discussion and results. it can be summarized that the implementation of the VC2T model is effective to increase the students' achievement of high school students in physics class. The results showed that (1) the statistically significant increase in students' Critical Thinking Skills is at alpha 0.05. the mean n-gain was 0.61 in class XI SCIENCE 1 which was in the medium category. the mean n-gain was 0.66 in the class XI SCIENCE 3 which is in the medium category. (2) the average student response results during teaching are 88.94% in class XI SCIENCE 1 in the very good category and 89.51% in class XI SCIENCE 3 in the very good category. It can be concluded that the application of the VC2T Model is effective to train high school students in physics class.

AUTHORS CONTRIBUTION

All authors conceived and designed this study. All authors contributed to the process of revising the manuscript, and at the end all authors have approved the final version of this manuscript.

ACKNOWLEDGMENTS

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