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THE EFFECT OF BLENDED LEARNING MODEL TO CRITICAL THINKING SKILL STUDENTS IN SENIOR HIGH SCHOOL

Johana Theresia Sinaga dan Mariati P. Simanjuntak
Jurusan Fisika FMIPA Universitas Negeri Medan
johanatsinaga@gmail.com

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ABSTRACT

This study aims to determine the effect of applying blended learning in improving students' critical thinking skills. This type of research is a quasi-experiment design of two groups pre-test and post-test. The study population was all students of class XI IPA SMA Negeri 5 Medan A.Y. 2019/2020 consisting of 9 classes. The research sample was taken by cluster random sampling technique consisting of two classes, namely XI IPA 2 as an experiment class and XI IPA 9 as a control class, each class consist with 34 students . This research instrument uses essay test consisting of 10 questions that measure critical thinking. The research hypothesis was tested using the t-test. The results of data analysis obtained the average value of pretest critical thinking skills of the experiment class was 50.44 and the control class was 47.14, it means the initial ability of students is same. The average posttest critical thinking skills of the experiment class was 85.05 and the control class was 68.05. Based on t-test can be concluded there is an effect of blended learning on students' critical thinking skills. The results of the N-gain critical thinking skills test showed an increase in the critical thinking of the experiment class 71% and the control class 38%. The result of the manova test from the posstest data show that there is a significant difference in sritical thinking skills with conventional learning, in other words, the blended learning model is better at improving students' critical thinking skills than conventional learning.

Keywords: blended learning, critical thinking skill, optical instrument

INTRODUCTION

The era of the industrial revolution 4.0 is currently an important world issue including Indonesia. This era has influenced many aspects of life both in the economic, political, cultural, artistic, and even educational fields. Education in this era is demanded to be able to equip students with 21st century skills. The term 21st Century skills is a comprehensive description of knowledge, skills and dispositions as a prerequisite for success in the workplace in the future (Germaine., et al, 2016). Critical thinking is one of the skills demanded in 21st century education (Fatmawati, 2009). Critical thinking skills is a basic skills that can encourage students to look at each problem faced critically (Herpiana., et al, 2019).

Critical thinking is the skill to carry out various analyzes, assessments, evaluations, reconstructions, decision making that lead to rational and logical actions to make decisions (King., et al, 2010; Dwijananti, 2010). Feldman (2010) states that critical thinking is the ability that includes actions to evaluate a situation, problem or argument, and choose an investigation that produces the best answer that will be obtained. Filsaime (2008) suggests that critical thinking is a disciplined way of thinking that a person uses to evaluate the validity of something (statements, ideas, and arguments). Critical thinking applied in the world of education has proven to prepare students to think in various disciplines,

towards self-fulfillment of intellectual needs and to develop students as potential individuals (Fisher, 2009). Critical thinking allows students to analyze their thoughts in making choices and draw conclusions intelligently. These skills require students to be able to use their abilities to try to solve the problems independently.

One of the subjects that provide opportunities to practice students' critical thinking skills is physics lesson. Learning in physics is based on observations about nature and its symptoms (Sears, 2004). Therefore, students really need to be trained to be able to think critically, this is a bridge between problems in calss with problems that exist in real life.

The researcher conducted a preliminary study regarding the level of critical thinking skills of students at SMA Negeri 5 Medan. Based on observations showing that the learning process that has taken place has not stimulated students to think critically, the learning process carried out by the teacher still uses conventional methods and practice exercises only. When learning takes place, the media used by the teacher is generally a whiteboard, so students only hold all the information from the teacher without thinking of acting actively and the class looks passive because many students do not listen to the teacher, talk to friends and play handphone. This statement is supported by the results of the initial tests conducted in class XI of SMA Negeri 5 Medan by giving questions related to students' critical thinking skills, obtained data from 34 students as follows: 7 students (21%) are good at critical thinking, 11 students (32%) are classified as medium critical thinking and 16 students (47 %) are lacking critical thinking levels.

Other problems that affect the process of implementing learning are the absence of teachers in learning and the existence of a series of activities / events for example teacher's day activities at school. Because of that events sometimes the class being empty without the teacher as a companion to learn. Sometimes the class is empty without assignments or material that needs to be studied, so most students choose to play games on the cell phone or leave

the classroom. This causes students to less time to interact with the teacher, and learning material delivered by the teacher becomes faster because of the limited time they have to interact. The current state of the COVID-19 pandemic has also disrupted learning in schools.

One learning model that is suitable for practicing critical thinking skills is blended learning. Blended Learning is a learning model that integrates traditional student-centered learning in the classroom using mobile and online in order to realize strategic advantages for the education system (State of Victoria, 2012). Blended learning is also interpreted as learning that combines face-to-face learning and distance learning using online learning resources and a variety of communication options that can be used by teachers and students (Harding., et al, 2005; Hardiyana, 2015; Capone., et al, 2017). This learning model is an inexpensive and effective way of learning (Suyono, 2011).The use of blended learning can be done by teachers anywhere and anytime (Alonso, 2005). Blended learning in its use can increase student knowledge and can improve students' thinking skills (Hardiyana, 2015).

Blended learning is one of the solutions to overcome the limitations of time and place that can be implemented in the learning process (Inggriyania, 2019), especially during the current COVID-19 pandemic (WHO, 2020) all learning activities must be carried out from home, changing conventional patterns to be online-based (Narici., et al, 2020; Almarzooq, 2020). Blended learning can be one of the variations of teachers to be more creative in providing learning material, so that learning and teaching activities can continue even with technology intermediaries.

One important element in blended learning is application utilization (Suhartono, 2017). One application that can be used is google classroom. Google classroom is an application that can be used to support

technology-based learning. Google classroom is a school-oriented learning platform designed to simplify the work of assignments, and distribute them without paper (Pradana., et al, 2017).

The use of blended learning if it is actually done at school will have an extraordinary impact because students will be actively and independently involved in building their own understanding, teachers and students can be more flexible in management and time efficiency, simplifying and accelerating the process of non-stop communication between teacher and students, and the teacher can easily manage and control the learning done by students outside of class hours.

The objectives to be achieved in this research are to know differences in students' critical thinking due to influence *blended learning* on the material optical instrument. Then to find out the N-gain between each indicator in critical thinking skill between experiment class and control class on the material optical instrument using blended learning.

RESEARCH METHOD

This research was conducted at SMA Negeri 5 Medan. The research was conducted in the second semester of A.Y 2019/2020 consisting of 9 classes. The sampling technique was done by using cluster random sampling. The selected sample consisted of 2 classes namely class XI IPA 2 as an experiment class using blended learning and class XI IPA 9 as a control class using conventional learning.

The type of this research is quasi experiment and the desain of this research using two-group prestest-posttest as shown in Table 1.

Table 1. Two Group Pretest – Posttest Design

Class	Pretest	Treatment	Posttest
Experiment	Y	X_1	Y
Control	Y	Y_2	Y

Information:

X_1 = blended learning model on material optical instrument.

X_2 = conventional learning on material optical instrument.

Y = *pretest* and *posttest* given the critical thinking test to experiment class and control class, before and after treatment.

The research instrument is a test of critical thinking skill on material optics instrument, the test which is given in the form of problem essay based on problems as many as 10 valid questions.

As a prerequisite, before the t test, data from both classes should be normal and homogeneous. Normality tests are performed to see if the sample comes from a normal distributed population or not. Test normality data using kolmogrov smirnov test with SPSS 25.0. A homogeneity test was conducted to find out if both groups of research sample classes had the same variance and could represent the entire population what it does. Homogeneity tests are performed using SPSS 25.0. The existing hypothesis is tested using the t test.

The percentage of critical thinking skills improvement is calculated using the N-gain formula, namely:

$$g = \frac{posttest\ score - pretest\ score}{maximum\ score - pretest\ score}$$

(Hake, 1998)

RESULT AND DISCUSSION

Research Result

Before starting the learning, the two class given the pretest of critical thinking skill with the result shown in Table 2.

Tabel 2. Pretest Data of Critical Thinking Skills in Experiment Class and Control Class.

Control Class		Experiment Class	
Score Interval	**Frequency**	**Score Interval**	**Frequency**
26-31	2	37-41	3
32-37	4	42-46	9
38-43	7	47-51	11
44-49	6	52-56	3
50-55	6	57-61	3
56-62	9	62-66	5
Total	**34**	**Total**	**34**
Average	**47,14**	**Average**	**50,44**

The experiment class was treated with a blended learning model and the control class was given conventional learning. The learning has been carried out respectively on the optical instrument sub material, the two classes were given the posttest questions of critical thinking skills which were identical to the pretest questions which aimed to see the improvement in learning after the students were given treatment. The results of the posttest critical thinking skills in this study are shown in Table 3.

Table 3. Posttest Data of Critical Thinking Skills in Experiment Class and Control Class

Control Class		Experiment Class	
Score Interval	**Frequency**	**Score Interval**	**Frequency**
60-62	4	75-77	3
63-65	5	78-80	1
66-68	13	81-83	10
69-71	5	84-86	7
72-74	4	87-89	8
75-77	3	90-93	5
Total	**34**	**Total**	**34**
Average	**68,05**	**Average**	**85,05**

The normality test of the pretest and posttest data of the experiment class and the control class was used to determine whether the pretest and posttest data were normally distributed. The normality test was carried out using the Kolmogrov Smirnov test using SPSS 25.0. The results of the pretest and posttest data normality test for both classes are stated in Table 4.

Table 4. The Normality Test of Pretest and Posttest

Information	Experiment		Control	
	Pretest	Posttest	Pretest	Posttest
Sig	0,18	0,58	0,49	0,35
Conlusion	normal	normal	normal	normal

The requirement for data to called normal is sig < 0.05. Based on Table 4, the sig of the pretest and posttest data is greater than 0.05. So, it can be concluded that the data is normally distributed. The homogeneity test of the pretest and posttest data for the experiment class and control class was carried out by using the two-variance similarity test, showing that the data from the two classes were homogeneous, which meant that the data obtained could represent the entire population. The results of the homogeneity test using SPSS 25.0 can be seen in Table 5.

Table 5. Homogeneity Test of Pretest and Posttest Data

	Class	Sig	Conlusion
Pretest	Control Experiment	0,89	homogeneous
Posttest	Control Experiment	0,608	homogeneous

Based on Table 5, the sig of the pretest and posttest data is greater than 0.05. So it can be concluded that the data has a homogeneous distribution.

After the prerequisite test was carried out and it was known that the data were normally distributed and homogeneous, then the hypothesis was tested using the t test. The results of the calculation of the hypothesis test using the t test pretest data for the experiment class and control class can be seen in Table 6.

Table 6. Hypothesis Test of Critical Thinking Skill Pretest

Class	Average	t_{hitung}	t_{tabel}
Control	47,14	1,492	1,996
Experiment	50,44		

Table 6 shows that $t_{hitung} < t_{table}$ is 1.492 < 1.996, it means the initial ability of students' critical thinking skills in the experiment class is the same as the control class in optical instrument. After giving different treatments to the two classes, posttest was given and different final abilities were obtained as shown in Table 7.

Tabel 7. Hypothesis Test of Critical Thinking Skill Posttest

Class	Average	t_{hitung}	t_{tabel}
Control	68,05	15,89	1,996
Experiment	85,05		

Based on Table 7, obtained that the posttest average score of the experiment class is higher than the control class and $t_{hitung} < t_{table}$ is 15,89 > 1,996. Based on these results it can be concluded that there are differences in students' critical thinking skills due to the influence of blended learning models on optical instrument in class XI, even semester, SMA Negeri 5 Medan A.Y 2019/2020.

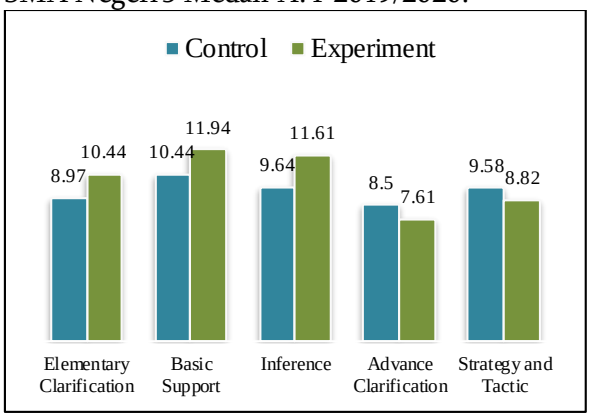

Figure 1. N-gain pretest score average for each indicator of critical thinking skill in pretest

Based on Figure 1, it is shows that the experiment class N-gain pretest average are higher than the control class. Basic support indicator is the highest indicator between the experiment class and control class.

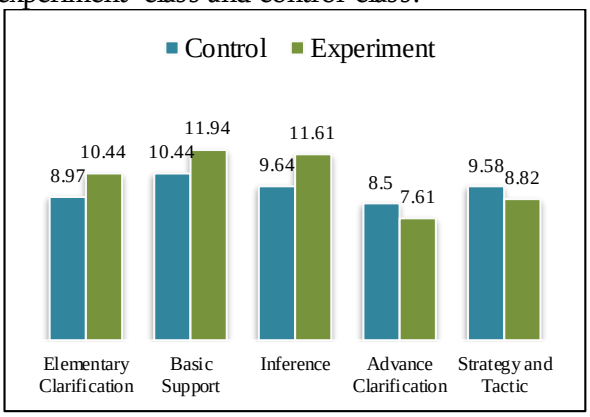

Figure 2. N-gain posttest score average for each indicator of critical thinking skill in posttest

Based on Figure 2, it is shows that the experiment class N-gain posttest average are higher than the control class. Basic support is also the highest indicator between the experiment class and control class.

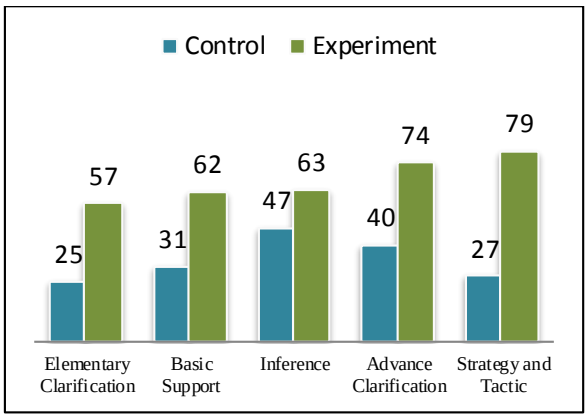

Figure 3. Percentage of N-gain score for each indicator of critical thinking skill

Based on the results of the study showed that there is a significant influence of creative thinking and critical thinking skills of students with the blended learning model and conventional learning on the material in optical equipment class XI second semester at SMA Negeri 5 Medan TA 2019/2020. Based on the statistical test using the t test it can be concluded that there is a significant difference between the control class using the conventional model and the experiment class with the blended learning model on the material of Optical instrument Class XI IPA Even Semester SMA Negeri 5 Medan.

Based on the N-gain test, the percentage increase in the N-Gain of students' critical thinking skills in the experiment class was 71% and in the control class was 38%. The results showed that students who were taught with the blended learning model using increased their critical thinking skills higher than conventional learning.

The average critical thinking skills of students who learned the blended learning model were 85.05 and those who were taught conventionally were 68.05. Based on this explanation, it can be concluded that there is an effect of the application of the blended learning model to critical thinking skill on optical instrument material.

The influence of blended learning on critical thinking skills during the learning process because students are faced with problems found in the worksheet. Student Worksheet presents the problems to be solved. This worksheet will really help students to get

directly involved in problem solving. One of the problems presented in the worksheets at the first meeting about the loop material is "*a watchmaker finds difficulty to see parts of a very small clockwork. What do you think using optical devices can help watchmakers see clock parts? Why and design the optical device*". Through these problems students asked to find ideas and find information related to the problem given. The information sought is related to physics related topics and additional information needed from various sources.

When working on the worksheet the students are trained to focus on the questions and analyze the questions (*elementary clarification*). Students started to think the right ideas to help watchmakers. When students analyze these questions students begin to look for information that can help solve the problem by reading a book or searching on the internet in this case students build their basic skills (*basic support*). After collecting various appropriate information, students draw conclusions (*inferences*), namely the watchman needs a loop to be able to see the parts of the clock. Then, students begin to identify assumptions and terms (*advanced clarification)* that they get when looking for information about the loop, so that they do not misunderstand the principle of the loop work. Then, students started giving a simple explanation of the ideas put forward to make a loop such as using a used light bulb, a plastic bag filled with water, a glass bottle and a mineral water bottle from the exposure it appears that students generate many ideas, students try to give some opinions and ideas that unique and different.

The next stage, students think about how the design and the tools and materials they will use to solve the problem, when students carry out this activity, students are trained to detail these activities so as to produce a detailed and detailed design (*stratefy and tactic*). Students begin to organize their strategies and tactics such as determining the stages in designing the tool, preparing tools and materials that do not cost more, and identifying the work steps that will be taken. When students begin to draw a loop design, students are trained by creating an original work, although some students' ideas look the same but there are given differences such as in terms of decking the design of students have different innovations.

In the control class, researchers used conventional learning. During learning in the control class, students were not given any problems. Students also do not making groups and experiments. Students only listen to explanations of optical instrument. The learning process that is the lecture method, questions and answers in the end of learning the teacher gives the task. This causes the five indicators of critical thinking to be untrained.

CONCLUSION AND SUGGESTION

Conclusion

Based on the results obtained, it can be concluded that there is an effect of blended learning model in improving students' critical thinking skills, and percentage increase in N-gain critical thinking skills in the experimental class due to the influence of the application of blended learning was 71%, and the control class was 38% on optical instrument material of class XI, even semester at SMA Negeri 5 Medan A.Y 2019/2020.

Suggestion

Based on the discussion of the results As technology advances, it is better if the teaching and learning process involves technology. Technology will assist teachers in presenting teaching materials and making teaching and learning activities more tangible. The blended learning model can be used to overcome the limitations of space and time when learning. The teacher can use this model to overcome these problems in order to make the quality of learning more optimal.

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