

The effect of blended learning of Student Teams Achievement Division (STAD) and jigsaw towards higher-order thinking skills

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Abstract— Higher order thinking skills (HOTS) are abilities that should be possessed by all vocational high school (VHS) students, because VHS graduates are required to have good soft skills and hard skills. The reality that occurs the ability of HOTS possessed by students is still very low, it is proven based on the exposure of several researchers strengthened by conducting observations and observations in VHS. Therefore, the research aims to determine student learning activities when taught using blended learning Student Teams Achievement Division (STAD) and jigsaw, using direct learning models, and their effects on HOTS. This research is a quantitative study with a quasi-experimental nonequivalent control group design method with research subjects of 50 students using simple random sampling. Data collection techniques using the test instrument in the form of multiple choice and description and non-test instruments in the form of observation sheets. Research data were analyzed by independent sample t-test. The results showed that the use of STAD and jigsaw blended learning in learning made students more active and enthusiastic in participating in learning activities, direct learning models made students less active and lacked enthusiasm in the learning process, and STAD and jigsaw blended learning significantly affected compared to learning models directly to HOTS.

Keywords: Blended learning, STAD, Jigsaw, Learning activity, Higher order thinking skills

I. INTRODUCTION

Vocational high school (VHS) aims to create a national investment to generate quality human resources following their fields (UU RI No 20, 2003). Quality human resources will bring this nation towards progress. However, in practice, a gap between vocational education results with the society's demand can be seen from the VHS graduates' level of knowledge and skills that are not equal to the workplace demand. The problem causes an increase in VHS graduates to be unemployed and challenging to get a job based on their vocational certifications, as referred in Statistics Indonesia' data in February 2018, that stated that the open unemployment for VHS was 8.92% (Suhariato, 2018).

A nation's life quality is determined by the educational factor because education has an essential and significant effect on their life. Without a good education, a human would be unable to know how to

do their work and thinking to improve their countries. Education is an effort that human does consciously to make their personality follows the values in society and culture (Purwanto, 2012). Based on the above explanation, education is vital in creating smart, skilled, tenacious, and broad-minded human resources.

Public education's purpose is to develop the learners' potential to be the people who believe and fear God Almighty, noble, healthy, knowledgeable, capable, creative, independent, and become citizens of a democratic and responsible. Various efforts had been conducted to achieve the national education goals that are designed, for example, integrating Higher-Order Thinking Skills (HOTS) in the learning process. The Ministry of Education and Culture stated that to prepare the students who can compete in the millennium and Industry revolution 4.0 eras, the learning system was set to fulfill the demands that are called the 21st-century learning system. In this system, teachers should be able to

instruct the students in critical and analytical thinking and to achieve conclusion or problem-solved (Istiqomah, 2018).

A learning process that prepares human resources to obtain the thinking skill has become a global demand. It is a big mistake if a school graduate does not have the 21st-century competency, namely creativity, critical thinking, communication, and collaboration (Sani, 2019). Critical thinking is related to the ability to conclude a statement or given data. Someone with critical thinking should be able to reason or make an interpretation, whereas creativity refers to the ability to develop new ideas or product.

The research of Pamuja (2017) found that the students' higher-order thinking skills had yet been well trained. This condition causes the students' higher-order thinking skill, a requirement in education, was not going well. In general, Indonesian students have low: (1) understanding complex information, (2) theory, analysis, and problem-solving, (3) tools usage, procedure and solving a problem, and (4) conducting an investigation (Fanani, 2018).

Based on the observation in Public Vocational High School 6 Malang, this research obtained the learning process in the CNC Machine Engineering subject. The learning process mainly centered on teacher-oriented using a lecture; in other words, the teacher still plays a significant role during the process. The teacher tends to be the primary source of knowledge development on the material. This process causes the students to be passive and disinterested in digging more in-depth into the content. During field practice, the researcher taught CNC Machine Engineering subject with Basic Competency (BC) and evaluated the failure results of the CNC milling machine in Year XII with the teacher-oriented learning process (conventional). During the procedure, students tended to be passive and gave no attention to the lecture. In the evaluation using essays in the HOTS category with C4, C5, and C6 competencies, most students achieve the results below Minimal Completeness Criteria (MCC) with the most score interval between 35–50.

Based on the above introductory, since most of the students got results below MCC, it was evident that students were not used to doing a test in the HOTS category. Several factors influenced the low results, particularly the usage of incorrect learning processes and technology. It also can be concluded that the learning process unable to form students with critical and analytical thinking and able to give conclusion or problem-solving by argument.

The research of Achmadi (2015) opened that blended learning application in the learning process

improved the achievement of Year XI students from the Machining Engineering Program in VHS Muhammadiyah 3 Yogyakarta. The statement was proved by the difference in the pretest and posttest scores of the experimental class. The average pretest score was 52.5, while the average posttest score was 78.6. This research aligned with the study of Yaniawati (2013) that stated that students' higher-order thinking skills taught using blended learning were better than conventional education with the averaging results of 68.13.

Ningsih (2018) informed that a learning model in a learning process greatly influences the learning quality, whether it follows the learning's purposes as planned or not. In this context, the required learning model is a model that could realize the higher-order thinking school from the students. An example that can be used is the blended learning of the Students Teams Achievement Division (STAD) and Jigsaw.

Blended learning between Student Teams Achievement Division (STAD) and Jigsaw enables students to improve their skill and potential positive and diminish the argument that students only listen during the learning process. This model also improves the interest and motivates the students during the learning process. Besides, students have the freedom to find and process the information correlated with the learning material. In other words, students are accustomed to critical and analytical thinking on the content. This model uses a group learning system where students were grouped in 4–5 to discuss and study together on the content. This model makes students active in cooperation and collaboration to finish the problem in the group. This model also utilizes technology to overcome the limited learning resources (Edelson, et al, 1999). Each group is facilitated with a gadget to access information through the internet. By using technology, students get vast knowledge of the material.

Based on the relevant theories and researches, this study aimed to: (1) students' learning activity using blended learning of Student Teams Achievement Division (STAD) and jigsaw, (2) students' learning activity using direct instruction model, and (3) the effect of blended learning between Student Teams Achievement Division (STAD) and jigsaw towards higher-order thinking skills.

II. METHODS

This research is pseudo-experimental. The design used nonequivalent control group design with 50 students as the subject consisted of 25 Year XII TPM 1 students and 25 Year XII TPM 2 students.

The classes were selected by random sampling technique. Year XII TPM 1 was chosen as the experimental class, while Year XII TPM 2 was selected as the control class. The instruments in this research were test and non-test.

Test instruments were ten multiple choices and five essays, while the non-test instrument was observation sheets and questionnaires. The instrument validation was divided into two stages: content validation and construct validation. Two experts validated the content, and the test could be used after revision. Construct validation was given to 10 students that have taken the material (r table = 0.632). All test item was valid because of r measurement $>$ r table. The reliability of the test was adequate (Cronbach's α = 0.418). The data from this research: (1) students' pretest score in the experimental class before treatment, (2) pretest score from the control class, (3) posttest score from students' higher-order thinking skills in the experimental class using blended learning of STAD and jigsaw, (4) posttest from students' higher-order thinking skills in the control class using direct instruction model, (5) learning activity score of the experimental class, and (6) learning activity score of the control class.

This research analyzed the data using: (1) normality test with the Shapiro-Wilk method, (2) homogeneity test with the Lavene test method, and (3) hypothesis test using the Independent Sample T-test.

III. RESULTS AND DISCUSSIONS

The normality test result showed that the pretest data in the experimental class had a significance of 0.069, and the control class had a significance of 0.298. The posttest data in the experimental class had a significance of 0.065, and the control class had a significance of 0.155. It is safe to conclude that the distributed data was homogenous. The learning activity analysis showed that the experimental class had a better score compared to the control class, averaging 70.56 on 51.52. Table 2 presents the results of the Independent Sample t-Test with α = 0.05.

The hypothesis was accepted ($\text{sig } p = 0.000 < \alpha = 0.05$). There was a difference in students' higher-order thinking skills between using blended learning of STAD and jigsaw and direct instruction model. This result stated that blended learning between STAD and jigsaw influence students' higher-order thinking skills.

Table 1. Result of the hypothesis test

		t	df	Sig.
HOTS	Equal	3.824	48	0.000
	Variances assumed			
	Equal	3.824	43.635	0.000
	Variances assumed			

1. Students' learning activity using blended learning of STAD and jigsaw

The learning activity analysis results of students in the experimental class had an average score of 70.56. The score showed that students were in the active category. The blended learning of the Student Teams Achievement Division and jigsaw greatly influence students' learning activity, in line with the research of Khasanah (2018). This learning model enables the student to be active in seeking information, collaboration, and communicating within-group friends, following the research of Berlyana & Purwaningsih (2019). Students' skills during in-class presentations also positively improved as the results of this learning model. Gadget usage also had an improvement in critical thinking and problem-solving.

The blended learning of STAD and jigsaw could be used as a reference during teaching because it has been proven based on empirical studies that blended learning of STAD and jigsaw made students active during the learning process and influenced their higher-order thinking skills.

2. Students' learning activity using direct instruction model

Students' learning activity results in the control class had an average score of 51.52. The score showed that students were in the less active category. The direct instruction model in the control class was proven less effective in the learning process that enables students to be passive, in line with the research of Zahra N, Suherman A, Permana T (2017).

The direct instruction model did not always result in inactive students because there are many factors besides learning models that affect the learning activity, such as the teacher. There are differences in the teachers' character, for example, the way new teacher and teacher who teaches for years in their approach to managing the class, how they explain the material, etc. These differences follow the research of Mustaqin N.H, Yamtinah S, Utomo S.B (2018) that stated that direct instruction

followed by discussion improved students' learning activity in chemical bounds material in Year X.1 Islamic High School 1 Surakarta School Academic Year of 2016/2017. The students' learning activity in Cycle I was 92.59%.

A good learning activity resulted in positive students' results. Therefore, during teaching, the teacher should attend all components that influence learning activity so that students are interested in the process and indirectly affect the results. Jigsaw, by utilizing information and communication technology aspect that is gadget connected to the internet to support the learning process.

3. Blended learning of STAD and jigsaw towards higher-order thinking skills

The posttest results of students' higher-order thinking skills using blended learning between STAD and jigsaw had an average of 59.2. The score, categorized according to the criteria of Arikunto (2013: 281), was in the adequate category. During posttest, the researcher observed how the students answered the multiple choices. Almost all students stated that the test was hard. The researcher also saw that students experienced difficulties in understanding the test's stimulus, and in return, affected the answer. From ten multiple choices, students could answer six questions at most. Students who answered correctly the six tests only four out of 25 students. This occurrence proved that students had difficulty in answering higher-order thinking skills test, This occurrence proved that students had difficulty in answering higher-order thinking skills test, following the research's result of Arsyadani H (2018) [25]. A factor that made students difficult in answering HOTS tests is students rarely solve tests with cognitive levels above C3. Thus, the teacher should apply the learning model and learning evaluation tool in higher-order thinking skills standard to accustomed to the students.

The blended learning model of Student Teams Achievement Division and jigsaw made students communicate and collaborate actively with their in-group friends to solve the problem from the teacher during the learning process, following the research of Alejandro Garcia, Ed.D, Jesus Abrego, Ed.D & Reguenes Robert, BA (2017). Based on the study of Pamuja (2017), he found that achievement motivation greatly affected students' learning result. A similar matter also occurred in this research. This research found that achievement motivation during learning also affects students to focus on and follow the Blended learning of STAD and jigsaw greatly influence students' higher-order thinking skills

because it consists of problem identification, analyzing causative factor, data collection, data interpretation, and conclusion development that require higher-order thinking skills. Applying this model gives students stimulation to optimize their higher-order thinking skills. The indicator of higher-order thinking skills is analysis, evaluation, and creation. These indicators are closely related to the syntax of blended learning between the Student Teams Achievement Division and jigsaw. Indirectly, the above syntax trains the students to have higher-order thinking skills.

Blended learning of STAD and jigsaw demand the students find the knowledge with the teacher's supervision. Blended learning of Student Teams Achievement Division and jigsaw improve their intellectual and skill in problem-solving. In other words, students have the freedom to solve their problems using any media. Thus, students obtain their in-depth knowledge and understanding and independently learn.

Knowledge obtained based on one's understanding will be more meaningful and impressive for students. This statement is proved by the average score of students that applied blended learning of the Student Teams Achievement Division and jigsaw because it is higher than the direct instruction model. This statement is also in line with the active learning principles that John Locke argued that knowledge based on experience would be more meaningful.

The application of blended learning of the Student Teams Achievement Division and jigsaw in the first meeting in the experimental class analyzed the failure results of CNC milling machine and evaluated the causative factors with the result. In the first step, teacher organized the classroom according to the research design; then teacher generally lectures the material. After, students were asked to discuss in group about the task. Each group was given a gadget that was connected to the internet to support the learning process. During students' discussion, teacher only observed and instructed the students who did not understand the task. In the second stage, the teacher asked each group to present and other groups to respond to the presentation. The discussion results went well, and the task was overall answered by each group.

Although group discussion went well, there was a disadvantage in the process. During the procedure, the researcher observed two students who less active and only followed the discussion. Besides, students also had difficulties in solving the problem with the cognitive level of C4 to C6, proved that students were not accustomed to answering the HOTS test. These obstacles became a challenge particularly in

VHS, to produce students with higher-order thinking skills by applying the correct system.

The second meeting in the experimental class discussed the conclusion to avoid the failure result in CNC milling activity well. This objective supports the factor that forms the students' HOTS. using blended learning of Student Teams Achievement Division and jigsaw. The gadget that was given greatly influenced the learning. Students were actively looking for materials by downloading and learning various failures with CNC milling machines through youtube, google, journals, etc. this event is in line with the purpose of 21st-century education that focuses on producing students with critical analytical thinking and able to conclude and problem-solving.

According to Vygotsky, higher-order thinking skills develop with the supervision of an expert colleague with higher expertise. That argument supports the blended learning of STAD and jigsaw to improve higher-order thinking skills. This type of education enables students to share their thinking with their in-group friends, communicating and collaborating on the problem given by the teacher, relevant to the statement of Raes, A., Schellens, T., Wever, B.D, & Vanderhoven (2011).

IV. CONCLUSION

It can be concluded that (1) learning activity of Year XII students taught using blended learning of STAD and jigsaw achieved the average score of 70.56. The score was of the active category. Therefore, the application of blended learning between Student Teams Achievement Division and jigsaw made the students active during learning process, (2) learning activity of Year XII students taught using direct instruction model achieved the average score of 51.52, the score fell into the less active category, therefore, the application of direct instruction model made the students less active during learning process, and (3) based on the analysis using the Independent Sample t-Test, the results showed significance of $0.000 < 0.05$, thus, H_a was accepted and H_0 was denied. Based on the report, there was a significant effect from blended learning of Student Teams Achievement Division and jigsaw on students' higher-order thinking skills.

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