

Effectiveness of Jigsaw Cooperative Learning Models in Lessons of the Basics of Building Construction on Students Learning 'Outcomes Viewed from Critical Thinking Skills

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ABSTRACT

This study aims to analyze the differences in the effectiveness of the Jigsaw cooperative learning model and the direct learning model of student learning outcomes in DKB subjects in class X DPIB of Vocational High School 2 Surakarta; to analyze the differences in learning outcomes between students who have high critical thinking skills and students who have low critical thinking skills in DKB subjects in class X DPIB Vocational High School 2 Surakarta; and to analyze whether there is an interaction between the learning model and students' critical thinking skills towards student learning outcomes in the class X DKB DPIB Vocational High School 2 Surakarta. This study is a quantitative experimental study with a 2x2 factorial design. The sample of this study was the tenth grade students of DPIB Vocational High School 2 Surakarta in the 2018/2019 academic year, totaling 64 students. Data obtained from the results of observations, interviews, and tests. The data analysis technique uses 2-way Anava technique. The results is study's learning using Jigsaw cooperative learning model obtain the results of cognitive learning higher significant than learning outcomes cognitive students learn by using direct learning model on the subjects of DKB in Vocational High School 2 Surakarta; cognitive learning outcomes for students who have critical thinking skills height significantly higher than the results of cognitive learning students who have the skills to think critically low on the subjects of DKB in Vocational High School 2 Surakarta; and there is a very significant interaction between the learning model and the skill level which is critical to the cognitive learning outcomes of students in the DKB subjects at Vocational High School 2 Surakarta.

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1. INTRODUCTION

Increasing the quality of education in Indonesia, especially in vocational education can be improved, one of which is through the learning process in the classroom (Mustofa et al, 2019). The learning process must be effective and efficient so that learning outcomes can be achieved optimally (Noviandari & Mursidi, 2019). The learning process can be created effectively and one of them is the *Jigsaw* cooperative model . The *Jigsaw* cooperative learning model supports the development of problem solving in students because students learn with smaller groups that are more specific (Buhr et al., 2014). These findings are important for the progress of fish educators because they can help teachers to use a type of student-centered learning model that is better suited to the

needs of students in the 21st century (Azmin, 2015; Dasining *et al.*, 2019; Erma *et al.*, 2019).

In connection with the learning process of Vocational students, the learning process that occurs in DKB subjects in class X DPIB of State Vocational High School 2 Surakarta generally uses direct learning models. The disadvantage of applying direct learning models is that students are given by teachers declarative and procedural knowledge so that only a few students ask questions and are active in the learning process. The direct learning model is designed to teach students about knowledge that is well structured and can be taught step by step (Nur, 2011; Noviandari & Mursidi, 2019; Erma *et al.*, 2019).

The learning model used by the teacher should be able to actively involve students, both active thinking and motoric. One learning model that can involve students actively is the cooperative learning model. 65% of field study studies on cooperative learning models show that cooperative learning models are effectively used in various classes, subject areas, grade levels, and students (Johnson & Johnson, 2009).

The *Jigsaw* cooperative model shows significant positive changes in learning outcomes and student learning styles compared to conventional learning models (Basyah & Muslem, 2017). The results of this study were strengthened by Ritonga & Ruslan (2017), which in the results of his research stated that the learning outcomes of students taught using the *Jigsaw* learning model had improved and were better than conventional learning models.

The difference between the *Jigsaw* type cooperative learning model and the other cooperative learning models is that in the *Jigsaw* cooperative learning model students are grouped twice, that is when they are with their own groups and in groups of experts. The application of cooperative learning models in groups for two times can train students to exchange ideas and opinions with peers. In addition, students are trained to be responsible for understanding the discussion with expert groups so that they can share the results of their discussions with the original group.

In addition to the models and methods used, in the 21st century Vocational High School students must be able to think logically, creatively, innovatively, and in critical thinking skills (Baedhowi et al., 2017). Critical thinking skills are not skills inherent in humans since birth, but must be trained in the learning process (Rahmawati & Hidayat, 2016) and developed by always tucking critical thinking skills in each class assignment (Utami et al., 2017). In addition, it is necessary to pay attention to the factors that can hinder students in critical thinking (Utami et al., 2017) in the scope of teaching and learning activities both in theory and practice subjects.

2. METHODS

This research was conducted in the even semester of the academic year 2018/2019. The sample used in this study was class X DPIB of SMK Negeri 2 Surakarta, Central Java, 2018/2019 school year with a total of 64 students consisting of two classes namely class X DPIB A as the experimental class using a type of cooperative learning model *Jigsaw* and class X DPIB B as a control class using the direct learning model.

2.1 Amblycarpa Seed Extraction Method

Research conducted using a quantitative approach. The type of research used in this study was *quasi experimental design*. This type of quasi experimental design research is used to overcome difficulties in determining the control group in the study (Sugiyono, 2011). The design in this study used a 2x2 factorial design. In the design of this

study there were two classes that were chosen not randomly, then were given a *pre-test* to find out the initial conditions regarding the differences between the experimental class and the control class. In this design not only pay attention to the independent variables and the dependent variable, but also pay attention to the moderator variables that might influence the treatment of student learning outcomes.

2.2 Statistical Data Analysis

The technique used to test hypotheses is variance analysis, or abbreviated as Anova (Analysis of Variance) or also referred to as Anova (Analysis of Variance). According to Budiyo (2017) it is called a variance analysis because in this technique the variations that appear are caused by the existence of several treatments to see whether there is an average difference in the population. Furthermore, the Anova test was used with the aim of testing whether there were differences in treatment effects on the dependent variable with probability 5%.

3. RESULTS AND DISCUSSION

3.1 Normality Test

The sample used in this study was class X DPIB of Vocational High School 2 Surakarta, Central Java, 2018/2019 school year with a total of 64 students consisting of two classes namely class X DPIB A as the experimental class using *Jigsaw* and class cooperative learning models X DPIB B as the control class using a model pe m belajaran directly.

After the treatment given class X DPIB A as an experimental class using cooperative learning model *Jigsaw* and class X DPIB B as the control class using a model pe m belajaran directly, then the data obtained cognitive learning outcomes of students. Cognitive learning outcomes are prerequisite before testing the hypothesis. The first prerequisite test is the data normality test.

Table 1. Normality Test Results of Experimental and Control Class Data

Learning model	Test Statistic	Sig.
<i>Jigsaw</i> Cooperative learning Model	0.152	0.056
Direct learning model	0.115	0.200

Learning outcome data Building Construction Basics cognitive domain by using the *Jigsaw* cooperative learning model tested normality with the *Kolmogorov-smirnov* test and using SPSS 24, obtained SPPS *output* value $D = 0.152$ and $sig = 0.056$. Thus it can be concluded that the sample comes from a normal distribution ($p > 0,05$). While the data learning outcomes DKB cognitive using direct learning model was tested for normality by the test of *Kolmogorov-Smirnov* and using SPSS 24 is obtained *output* SPPS value of $D = 0.115$ and $sig = 0.200$. Thus it can be concluded that the sample comes from a normal distribution ($p > 0,05$).

3.2 Homogeneity Test

Cognitive domain learning outcomes data that have been tested for normality, then tested their homogeneity with the *Levene* test using the 0.05 significance level. The cognitive learning outcomes of DKB data of students using the *Jigsaw* cooperative learning model and the learning model were directly tested for homogeneity by *Levene* test using SPSS 24, the SPSS output of *Levene* test value = 2,241 and sig = 0,139, thus it can be concluded that the sample came from variance homogeneous ($p > 0.05$).

3.3 Anova Test

Cognitive domain learning outcomes data that have normal data distribution and homogeneous variance, then tested the hypothesis using Analysis of Variance (Anova).

Table 2. SPSS Output of Anava Test Two Learning Outcomes in the Cognitive Domain

Tests of Between-Subjects Effects					
Dependent Variable: Learning Outcomes of the Cognitive Realm					
Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	1406,253 ^a	3	468,751	11,640	.000
Intercept	313054,233	1	313054,233	7773,544	.000
Model Build	359,557	1	359,557	8,928	,004
Critical Thinking Skills	100,182	1	100,182	2,488	,012
Model*Critical Thinking Skills	305,063	1	305,063	7,575	,008
Error	2416,305	60	40,272		
Total	424293,750	64			
Corrected Total	3822,559	63			

a. R Squared = ,368 (Adjusted R Squared = ,336)

Based on the SPSS output, the results of testing the first hypothesis are the values for the two path Anova test, namely $F = 8.928$ and $\text{sig} = 0.004$, thus it can be concluded to accept H_1 , meaning that there are significant differences in students' cognitive domain (0.05) between students who study using the *Jigsaw* type cooperative learning model and students who learn by using the direct learning model at the class X DKB Subject DPIB Vocational High School 2 Surakarta.

The findings of this study are in line with the theory proposed by Hedeem (2003), namely *Jigsaw* can be an alternative effective learning model used to encourage students to interact and exchange ideas with peers, thus influencing higher learning outcomes.

The results of this study are in line with the research of Yemi, et al. (2018) entitled "*Effect of Jigsaw Strategy of Cooperative Learning on Mathematics Achievement Among Secondary School Students*". The results of the study explained that the achievements of students from the experimental group who studied with the *Jigsaw*

model were better than students who studied with the lecture method.

Furthermore the results of this study are in line with the research from Gülşen Çağatay (2013) entitled "*The Effect of Jigsaw-I Cooperative Learning Technique on Students' Understanding About Basic Organic*" showing that experimental group students taught with *Jigsaw I* type cooperative learning techniques were much better in the *post-test* than the control group students taught with conventional models.

The results of the study are also in line with the research of Andriani, et al., (2013) entitled "*Experimentation of Cooperative Learning Models of Jigsaw II and Think Pair Share in terms of Emotional Intelligence of Junior High School Students in the City of Kediri in Academic Year 2012/2013*" shows that mathematics learning achievement of students subject to *Jigsaw II* is better than direct learning and TPS.

The results of these studies are in line with the research of Dhage et. al., (2016) entitled "*Effect of the Jigsaw-Based Cooperative Learning Method on Engineering Students*". The results of the study show that the *Jigsaw* learning model managed to achieve the most important goals in learning techniques and understanding technical concepts to apply them in applications simultaneously by developing *soft skills* for students.

Furthermore, this research is in line with the research of Suparman, et al., (2014) entitled "*The Application of the Jigsaw Cooperative Learning Model to Increase Science Learning Activities and Results in the Concept of Environmental Pollution*" shows that the application of the *Jigsaw* type learning model to the concept of environmental pollution can increase learning activities biology class VII students of SMP Negeri I Sahu.

Based on the findings of the research, theory, and relevant research results as described above, it is known that the *Jigsaw* cooperative learning model is very effective when applied to DKB Subjects. This is because during the learning process students who learn using the *Jigsaw* cooperative learning model are trained to carry out active learning activities, such as: (1) practicing understanding and explaining with their group mates in more specific material; (2) practicing speaking, arguing, and tolerating friends' opinions regarding the material of stone and concrete construction work; (3) practice cooperation in solving problems in groups, both with groups and between groups; (4) practice the responsibility of resolving the problem that is part of it; (5) practice solving problems more independently, the teacher only provides guidance if students experience difficulties; (6) practice actively in finding answers and explaining to group friends about problems that are part of their responsibilities. Thus the cognitive learning outcomes of students in DKB Subjects can be better and improved.

The results of testing the second hypothesis are known that the cognitive learning outcomes obtained an F value of 2.488 with a significance value of 0.012. Based on these

results we can conclude that there are differences in average learning results are significant ($p < 0.05$) among students who have a high level of critical thinking skills with students who have a low level of critical thinking skills in the eye DKB Class X DPIB Vocational High School 2 Surakarta.

The results of this study are in line with research from Fuad, Zubaidah, (2017) entitled "*Improving Junior High Schools' Critical Thinking Skills Based on Test Three Different Models of Learning*". The results of the study explained that there were significant differences between high and low critical thinking skills. Critical thinking ability is strongly influenced by the learning model used.

Furthermore, this study is in line with the research from Pratiwi (2015) entitled "Analysis of critical thinking skills of prospective biology teacher students through cooperative learning in 2014/2015 learning design courses" shows that there are differences between students who have high, medium, and critical thinking skills. low after learning using the *Jigsaw* cooperative learning model.

This research is in line with research from Lloyd & Bahr (2010) entitled "*Thinking critically about critical thinking in higher education*". The results of the study reveal that students who have critical thinking skills have a high sense of accuracy at all levels of the study program. In addition, critical thinking skills that can both influence the learning process and the process of thinking, not only affect the final assessment.

The results of these studies are reinforced by research from (R & James, 2015) entitled "*Evaluation of critical hinking in higher education in Oman*". The results of the study show that there are several levels of critical thinking. Students who have critical thinking skills have high levels of inference, high levels of assumption and deduction.

The results of the study are in line with the research conducted by (Adnyana, 2003) entitled "*Critical thinking skills and understanding students' concepts in the deductive hypothesis learning cycle model*". The results of the study explained that there were differences in thinking skills of students who followed the deductive hypothesis learning cycle model and the direct learning model. Increasing the ability of critical thinking is related to increasing understanding of students' concepts and influencing their intellectual abilities so as to improve their ability to understand the concepts under study.

Students who have critical thinking skills have advantages in managing knowledge from DKB material as follows: (1) students focus on understanding the material and solving problems; (2) active students in asking teachers and group friends; (3) critical students respond to the opinions of teachers and group friends; (4) students are able to explain the meaning, terms, and methods used; (5) students are careful in finding reasons when solving problems; (6) students pay attention to the objectives, environmental situation, and factors considered in

deciding the conclusions of the problem; (7) students draw conclusions based on facts; (8) independent students and do not depend on the teacher in solving problems; (9) students are able to examine and review the steps taken in making decisions.

Based on the findings of research, theory, and relevant research results as described above, it is known that students who have high critical thinking skills tend to obtain high learning outcomes compared to students who have low critical thinking skills. This is because during the DKB learning process students with high critical thinking skills tend to be more active in interacting and looking for answers to problems.

The results of testing the third hypothesis is known that the cognitive learning outcomes obtained F value of 7.575 with a significance value of 0.008. Based on these results it can be concluded that there is a significant interaction ($p < 0,05$) between the learning model and critical thinking skills on learning outcomes at the class X DKB Subject of DPIB Vocational High School 2 Surakarta. The interaction between learning models with critical thinking skills on student learning outcomes can be shown in the following figure.

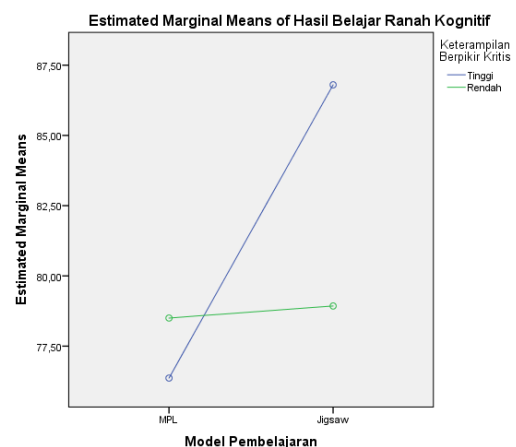


Figure 1. Interaction Between Learning Models with Critical Thinking Skills on Learning Outcomes in the Cognitive Realm

The results of this study are in line with research from Ariyanti (2013) entitled "*The effect of the jigsaw type cooperative learning model on critical thinking skills and student achievement in social studies learning in fourth grade students of SD Cipta Dharma Denpasar*". The results showed that there were differences in critical thinking skills and student achievement between those who followed the *Jigsaw* and conventional cooperative learning models.

The results of the study are also in line with research from (Khalistyawati, 2018) entitled "*The Influence of STAD and jigsaw models on the characteristics of cooperation, critical thinking skills, and cognitive learning outcomes*". The results showed that the use of the *Jigsaw* type cooperative learning model had more influence on the

character of cooperation, critical thinking skills, and cognitive learning outcomes of students than using the STAD type cooperative learning model.

The results of the study were also reinforced by research from (Andriliani, Maskun, & Basri, 2015) entitled "The influence of the *jigsaw* model on the critical thinking skills of SMAN 1 Way Jepara students" explained research results that the model of *cooperative learning* type *Jigsaw* significant effect on students' critical thinking skills.

Based on the findings of the research, theory, and relevant research results as described above, it is known that the application of the *Jigsaw* type cooperative learning model and critical thinking skills affect the learning outcomes of DKB, both in the cognitive domain. The influence of significance values on the application of the *Jigsaw* type cooperative learning model is determined from the high and low critical thinking skills of students. This is because students who have high critical thinking skills tend to be more active, motivated and have higher curiosity than students who have low critical thinking skills.

4. CONCLUSION

Based on the discussion on the results of the study it can be concluded that: (1) students who learn using the *Jigsaw* type cooperative learning model obtain significantly higher cognitive domain learning outcomes than the cognitive learning outcomes of students learning by using direct learning models on DKB subjects. at Vocational High School 2 Surakarta; (2) cognitive learning outcomes for students who have critical thinking skills height significantly higher than the realm kognitifsiswa learning outcomes that have the skills to think critically low on the subjects of DKB in Vocational High School 2 Surakarta; (3) there is a very significant interaction between the learning model and the skill level which is critical to the cognitive learning outcomes of students in the DKB subjects at High School 2 Surakarta.

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