

DISCOVERY AND CORE LEARNING MODEL TOWARD CREATIVE THINKING VIEWED FROM LOGICAL MATHEMATICAL INTELLIGENCE

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Abstract

This research aims to 1) which learning model that supports students' creative thinking ability whether discovery, CORE, or conventional learning model, 2) which model that supports creative thinking ability the most to high, moderate, and low level students, 3) know if there is interaction between learning model and students' logical mathematical intelligence, and creative thinking ability. This is a quasi-experimental research with the population of eighth graders of junior high schools in Madiun Regency. The research design used a group pretest-posttest control design. The sample was determined using stratified cluster random sampling. This research uses two-way unequal ANOVA. This research concluded that 1) students' creative thinking skill is developed better using Discovery than CORE and conventional learning model, 2) students with high logical mathematical intelligence have higher creative thinking ability than those with moderate and low logical mathematical intelligence, 3) there is no interaction between learning model and logical mathematical intelligence with creative thinking ability.

Keywords: Creative thinking; learning model; logical mathematical intelligence.

Abstrak

Tujuan dari penelitian ini untuk mengetahui 1) model pembelajaran manakah yang memberikan kemampuan berpikir kreatif yang lebih antara model pembelajaran discovery learning, CORE atau konvensional, 2) manakah yang memberikan kemampuan berpikir kreatif yang lebih baik siswa yang memiliki kecerdasan logis matematis tinggi, sedang, atau rendah, 3) apakah terdapat interaksi antara model pembelajaran dan kecerdasan logis matematis dengan kemampuan berpikir kreatif siswa. Metode yang digunakan pada penelitian adalah eksperimen semu, dengan populasi siswa kelas VIII SMP N Se-Kabupaten Madiun. Desain penelitian menggunakan group pretest-posttest control design Pemilihan sampel dengan menggunakan stratified cluster random sampling. Teknik analisis penelitian ini menggunakan anava dua jalan dengan sel tak sama. Kesimpulan pada penelitian ini 1) kemampuan berpikir kreatif siswa yang kenai model discovery learning lebih baik daripada model pembelajaran CORE dan konvensional, 2) Kemampuan berpikir kreatif siswa yang memiliki kecerdasan logis matematis tinggi lebih baik daripada siswa yang memiliki kecerdasan logis matematis sedang dan rendah, 3) tidak ada interaksi antara model pembelajaran dan kecerdasan logis matematis dengan kemampuan berpikir kreatif.

Kata kunci: Berpikir kreatif; kecerdasan logis matematis; model pembelajaran.



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INTRODUCTION

Mathematics is one of the essential fields of science, and a basic of other fields of sciences. Mathematics also has an important role in developing education and technology nowadays. In this 4.0 era, students are expected to master high level thinking skills. Creative thinking ability is one of high level thinking skill. Creative thinking is the ability to provide various interpretations in solving problems (Ulfah et al., 2017). There are three components of creative thinking ability: fluency, flexibility, and novelty.

The research conducted was the preliminary research related to creative thinking and obtained the result in the indicator of fluency with the average score of 55,27; flexibility is 47,23; and novelty is 40,11. This happens since students were not able to find other ways to solve problems, provide various answers, and answer the directions in sequence. This is in line with Hanipah (2018) that students' ability in providing suitable ideas and producing various ways in solving problems are categorized as good creative thinking ability.

Students' creative thinking ability is in a low category. This is supported by the interview with some Mathematics teachers who stated that there were no questions that lead students to have creative thinking ability; most of them tend to do answer the common questions using the directed steps. Teachers still used that conventional method. They had not applied a learning model that lead students to be active in learning and manage their cognitive thinking ability so that they will create new creative ideas.

Therefore, it is important to change the learning model in students

learning process in order to develop their creative thinking ability. This agrees with Fitriyah (2017) that most Mathematics teachers explain the material in a conventional way, so there are no students' actively involved in the activity. Therefore, two learning models that have the potential to make students actively take part in the learning process and train their thinking ability is discovery and CORE learning model (connecting, organizing, reflecting, dan extending).

Discovery learning model is a learning method based on students' own discovery (Sihombing, 2017). The process is the main key in developing students' thinking ability and the cognitive process is discovery. This depends on how the learning process runs (Sahara & Mardiyana, 2018). According to Suhana (2014), this learning model can discover understanding in students' own way using their abilities in finding information. The characteristic in this model is exploring and solving problems to create and generalize science; the activity to combine new and old knowledge, and based on students-centered (Putriani et al., 2018).

This is supported by the research of the result from Fitriya (2017) which stated that discovery learning model gives a positive effect on students learning output. According to Werdiningsih (2019), Discovery Learning method can improve students' creativity, participation, and confidence in the learning process at school.

CORE (connecting, organizing, reflecting, dan extending) learning model emphasizes discussion in groups that can influence students' knowledge development (Mafthukhah, 2017). According to Virginiawaty (2019) there

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are four aspects: *connecting* is an activity that connects old and new information, *organizing* is an activity that organizes ideas to understand, *reflecting* is the process of thinking, organizing, and penetrating information obtained, *extending* is an activity that uses, expands, and discovers new things. This model is emphasized to students by involving thinking activity through organizing data obtained (Karyati, 2020). This is in line with Arifah (2016) that creative thinking supported by CORE learning model is completed and gives a significant impact on students' learning process.

Besides the learning model, there are factors that influence students' creative thinking ability. One of which is logical mathematical intelligence. This is the intelligence related to Mathematics since it involves reasoning, numbers, and mathematical ability in solving a problem (Arismayani, 2015). According to Safranji (2016), a person with this ability will pay close attention to procedures and tend to be systematic based on reasoning. Students with high logical mathematical ability will be able to count systematically using various mathematical skill, and can analyze situations (Arum, 2018).

This research aims to 1) figure out which learning model supports students' creative thinking ability whether discovery, CORE, or conventional learning model, 2) find out which model that supports creative thinking ability the most to high, moderate, and low level students, 3) know if there is an interaction between learning model, and students' logical mathematical intelligence and creative thinking ability.

METHODS

This is an experimental research with the population of eight graders of junior high schools in Madiun Regency in the academic year of 2019/2020. The research design is Quasi Experimental Design. The experimental research design used in this study was the Group Pretest-Posttest Control Design. The technique of sample selection is Cluster Random Sampling using the score of the National Examination of Mathematics in Madiun Regency in 2019. The population was divided based on the school rank from low, moderate, to high. Then, each group was decided randomly in a school that was used as a sample through lottery. It was obtained 3 schools: State Junior High School of 1 Geger, State Junior High School of 1 Jiwan, and State Junior High School of 2 Wungu. In each chosen school, it was obtained 3 classes randomly with a lottery as a class of experiment 1 (Discovery Learning), experiment 2 (CORE learning model), and control class (conventional learning model).

Then, three classes of each school were chosen as sample. The subjects in this research were 295 students with 195 in the experimental class, consisting of 98 students using the discovery learning model and 97 students using the CORE learning model, then for the control class consisting of 100 students. Then categorized into high, medium, and low which are presented in Table 1.

Table 1. The level of description in each learning model

The Category of Logical Mathematical Intelligence	Group		Total
	Experiment	Control	
High	69	19	88
Moderate	80	49	129
Low	46	32	78
Total	195	100	295

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Table 1 shows that students in the high level of logical mathematical intelligence is 88, those in the moderate level is 129, and those in the low level is 78.

The data collection method used in this research is a test. The questions were in the form of essay test. This test was used to obtain creative thinking ability data before and after treatment. Then the mathematical logical intelligence questions were in the form of multiple-choice questions. This test was used to obtain the students' logical mathematical intelligence after treatment.

After the test created, the validation test was conducted to some experts. Then, the test was experimented to eight graders in two schools out of the research sample to know the difficulty index, distinguishing power, and reliability. Based on the result of analysis of creative thinking instrument, it was obtained 2 questions, and it was obtained 27 questions for logical mathematical intelligence. The result of pre-test and post-test average score of creative thinking is presented in Figure 1.

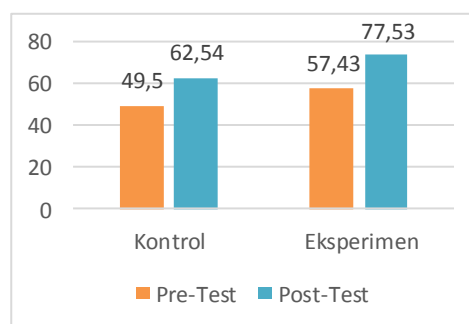


Figure 1. Students' average score of pre-test and post-test.

This research uses two-way unequal ANOVA. The Prerequisite test used in research analysis is normality test with Liliefors method and homogeneity test with Barlett method.

RESULTS AND DISCUSSION

The analysis of research data summary will be presented in the following table started from the description of variable average, normality test, homogeneity test, variance analysis result, to comparison test. After the data was processed, it was obtained the marginal average description for learning models and logical mathematical intelligence presented in Table 2.

Table 2. The description of the average of each variable.

Model (A)	Logical Intelligence (B)			Marginal Average
	High	Moderate	Low	
DL	85.29	81.74	74.87	80.65
CORE	79.82	73.74	69.66	74.40
PL	67.84	62.85	56.90	62.54
Marginal average	77.65	72.57	67.14	

Based on Table 2, the marginal average obtained for Discovery Learning model was 80,65, CORE learning model was 74,40, and conventional learning model was 62,54. The average score of high logical

mathematical intelligence was 77,65, moderate logical mathematical intelligence was 73,57, and low logical mathematical intelligence was 67,14. Then, the normality test is presented in Table 3.was conducted to figure out

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whether the sample came from the normal distribution population or not.

The result of normality test can be seen in table 3.

Table 3. The result of normality test

Data	Group	L_{obs}	$L_{(0,05;n)}$	Test Determination	Conclusion
Learning Model	Discovery	0,086	0,089	H_0 is not rejected	Normal
	Learning				
	CORE	0,079	0,090	H_0 is not rejected	Normal
Logical	Convensional	0,065	0,089	H_0 is not rejected	Normal
	High	0,065	0,094	H_0 is not rejected	Normal
Mathematical	Moderate	0,072	0,078	H_0 is not rejected	Normal
Intelligence	Low	0,089	0,100	H_0 is not rejected	Normal

The normality test was conducted to figure out whether the sample came from the normal distribution population or not. Based on table 3, it can be described that the result of normality test is $L_{obs} \notin DK = \{L | L > L_{0,05;n}\}$. Therefore, it can be concluded that the sample comes from the normal distribution population.

Another prerequisite test after normality test is homogeneity test. Furthermore, a homogeneity test will be carried out to determine whether the population has a homogeneous variance. The result of homogeneity test is presented in Table 4.

Table 4. The result of homogeneity test

	χ^2_{obs}	$\chi^2_{0,05;2}$
Creative Thinking	0,569	5,991
Logical		
Mathematical	4,558	5,991
Intelligence		

Based on table 4, it obtains $\chi^2_{obs} < \chi^2_{0,05;2}$, which means that H_0 is not rejected or the variances in the population are homogeneous. Then, after the prerequisite test was fulfilled, it was continued with the two-way ANOVA to find out whether the variable gives an effect on creative thinking or not presented in table 5.

Table 5. The result of unequal two-way ANOVA

Source	JK	dk	RK	Fobs	Ftab	Determination
Model (A)	16611.19	2.00	8305.60	42.93	3.00	H_0 is rejected
KLM (B)	5425.41	2.00	2712.70	14.02	3.00	H_0 is rejected
Interaction (AB)	82.93	4.00	20.73	0.11	2.37	H_0 is not rejected
Galat	55330.93	286.00	193.46			
Total	77450.46	294.00				

Based on the result of ANOVA test in table 5, it obtains:

- (1) The result of learning model factor obtains $F_{obs} = 42,93 > F_{tab} = 3,00$ which means that H_0 is rejected. Therefore, it can be concluded that there is a different

effect of between learning model with creative thinking ability.

- (2) The result of logical mathematical intelligence obtains $F_{obs} = 14,02 > F_{tab} = 3,00$ which means that H_0 is rejected. Therefore, it can be concluded that there is a

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different effect between high, moderate and low logical mathematical intelligence with creative thinking ability.

- (3) The result of learning model factor and logical mathematical intelligence obtains $F_{obs} = 0,11 > F_{tab} = 2,37$ which means that H_0 is not rejected. Therefore, it can be concluded that there is an interaction between learning model

and logical mathematical intelligence with creative thinking ability.

Since factor A (learning model) and factor B (logical mathematical intelligence) were rejected, ANOVA post-test was done through inter-lines comparison test and inter-column comparison test presented in table 6.

Table 6. The result of double comparison test

Double Line Comparison			
H_0	F_{obs}	$2F_{0,05;2;295}$	Test Determination
$\mu_1 = \mu_2$	9.86	6.00	H_0 is rejected
$\mu_1 = \mu_3$	83.94	6.00	H_0 is rejected
$\mu_2 = \mu_3$	35.78	6.00	H_0 is rejected
Double Column Comparison			
H_0	F_{obs}	$2F_{0,05;2;2} \zeta 5$	Test Determination
$\mu_1 = \mu_2$	6.96	6.00	H_0 is rejected
$\mu_1 = \mu_3$	23.58	6.00	H_0 is rejected
$\mu_2 = \mu_3$	7.40	6.00	H_0 is rejected

After the double line comparison test presented in table 6 it is, determined that H_0 is rejected. In other words, there is a difference between discovery and CORE learning model toward creative thinking ability. Then, by seeing the marginal average in the discovery learning, the average score is 80,65. The CORE learning model has an average score of 74,40 and conventional learning model has an average score of 62,54. Therefore, it can be concluded that discovery learning model develop students' creative thinking ability more than CORE and conventional learning model, and CORE learning model gives a positive impact on students' creative thinking ability more than conventional learning model.

Next, double column comparison test is presented in table 6 and shows that H_0 is rejected. It can be said that

there is a difference between high, moderate and low logical mathematical intelligence toward creative thinking ability. By paying attention on marginal average about high logical mathematical intelligence obtains 77,65, moderate 72,57, and low 67,14. It can be concluded that students with high logical mathematical intelligence have better creative thinking ability than moderate and low one, and students with moderate logical mathematical intelligence have better creative thinking ability than the low one.

The result of this research showed that students' creative thinking using discovery learning model is better than CORE and conventional learning model, and CORE learning model is better than conventional learning model. This is supported by the field observation that students with discovery

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learning model tend to be more active, even able to find solutions well in learning activities. Students' activity was divided into some groups, then they were given LKPD based on learning material. As the learning process was conducted, the classroom environment became more active. Then, there was questions answers activity and sharing opinion when teacher delivered learning material. This is so much different with the conventional learning model where students were passive when teacher presented learning material.

This is in line with Sihombing (2017) that discovery learning model gives a positive impact on students' learning output because this model supports students' curiosity, active participation in gaining information from various resources to solve problems, and this activity also combine students' new and old knowledge. In addition, Virginiawaty (2019) stated that CORE learning model is a learning process that emphasizes students' thinking ability to combine, organize, comprehend, organize, and develop information.

In addition, the research found that students with high logical mathematical intelligence had better creative thinking ability than those who had moderate and low logical mathematical intelligence. This happens since high logical mathematical intelligence students had the ability to think mathematically and procedurally, and able to build the thinking framework in solving problems that affect students' learning experience.

The ability to calculate in the form of numbers, logic, and reason will be revealed when they create a solution. Therefore, creativity and attractiveness towards Mathematics will influence students' creative thinking ability. This

is different with the students who have moderate and low logical mathematical intelligence. They tend to be passive in group work, and only follow the learning process without having eager to solve problems. In other words, it influences their creative thinking ability.

That is in line with Azinar (2020) that this intelligence develop someone's rational thinking, reasoning, and logic. A person who is able to count, operate the numbers correctly and quickly, and understand material comprehensively belongs to high logical mathematical intelligence (Arum D, 2018). Someone with good logical mathematical intelligence will be able to understand material and manage it logically (Milsa 2018). According to Supardi (2014), logical mathematical intelligence gives a significant positive impact on students' learning process. This is in line with Milsan (2018), that logical mathematical intelligence gives a positive impact on students.

The result also found that there was no interaction between learning model and logical mathematical intelligence. This happens due to some factors during the data collection process: the mismatch between students' answers (sample) with the students' characteristics, the time limit in answering the questions related to the logical mathematical intelligence.

The result of the research is strongly supported by Fitriya (2017), which stated that discovery learning model gives a positive effect. According to Muslim (2016), discovery learning model can improve students' creative thinking ability. This is also in line with Mawaddah (2015) that discovery learning model can develop students' creative thinking ability in learning. Next, Cintia, N, et al. (2018) showed

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that discovery learning model can improve students' creative thinking ability. Based on Werdiningsih (2019), discovery learning model can improve students' creativity, participation, and confidence in joining learning process activities at school.

This research is theoretically expected to be able to give a contribution on the development of Mathematics learning, especially related to discovery and CORE learning model. The result of the research is expected to give information related to the use of discovery and CORE learning model on creative thinking ability, provide effective and innovative learning alternative to make students easy to learn.

CONCLUSION AND SUGGESTION

Based on the research conducted, it can be concluded that, (1) students' creative thinking ability with discovery learning model is better than CORE and conventional learning model, (2) students with high logical mathematical intelligence have better creative thinking ability than those who have moderate and low logical mathematical intelligence. (3) there is no interaction between learning model and logical mathematical intelligence with creative thinking ability.

For the next researches, this research becomes the consideration on the importance of discovery and CORE learning model in delivering learning material to make students easier to understand the material. In addition, the next researchers are better to use other innovative learning models that are able to support students' creative thinking ability. This research only observed students' logical mathematical intelligence. It is suggested that the next researches observe other variables such

as mathematics skill, mathematics dispositions, and others.

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