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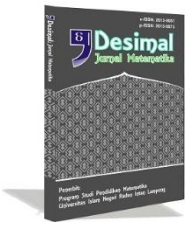

Cooperative learning and group learning: The impact on high order thinking skills in the pythagorean theorem material

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ABSTRACT

This study aims to improve students High Order Thinking Skills through the application of the Group to Group Exchange learning model. The research method used is a quasi-experimental model with a Pretest-Posttest Control Group research design and a sampling technique using Cluster Random Sampling. The results showed that based on the research results obtained during the study, the average N-Gain Score for the experimental group using the Group to Group Exchange learning model was 59% with a minimum N-Gain Score of 51% and a maximum of 67%. While the average N-Gain Score control group with the Direct Instruction learning model is 39% with a minimum N-Gain Score of 34% and a maximum of 45%. This means that the Group to Group Exchange (GTGE) learning model is quite effective compared to the Direct Instruction (DI) learning model to improve students High Order Thinking Skill (HOTS).

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INTRODUCTION

The skills to analyze, evaluate, and create solutions to problems in this era of rapid scientific and technological progress are urgently needed, due to the increasingly complex problems that often arise and demand the best way to solve them. This has made the government prepare the next generation who are creative, productive and competitive by taking concrete steps in order to improve the quality of student learning, especially the Ministry of National Education. The efforts made include updating the education curriculum, providing learning media, implementing more innovative and flexible learning models and providing training to teachers. However, all of these efforts have not been able to produce output that is in accordance with expectations. Efforts are needed from educators in solving learning problems, such as the ability of educators to manage the teaching and learning process. One way is to apply the right learning model, especially in learning mathematics. According to (Mulyasa, 2009) explains that "the teacher's most important task is how to conditioning a pleasant learning

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atmosphere, so as to arouse the curiosity of students so that the desire to learn grows." Providing the right learning model for students, makes educators need to choose and sort out learning models that will be used in teaching and learning activities, which aims to make students more easily to achieve learning goals properly.

The learning model that can be developed for the learning process of students is the GTGE learning model, because it is able to direct students to learn independently and freely in exploring their curiosity as well as training student communication in the classroom. (Rusman, 2012) states that "the GTGE is a learning model in which students study in small groups consisting of four to six people in a heterogeneous manner where students work together with each other, are positively interdependent and are responsible independently." The steps in the GTGE learning model are as follows.

Table 1. Learning Steps

Phases	Educator Behavior
Phase 1 Convey goals and motivate students	Educators convey all the learning objectives to be achieved in the learning and motivate students in learning.
Phase 2 Present information	Educators present information to students by presenting facts, experiences that are directly related to learning material.
Phase 3 Original group	Students are grouped into groups of origin with 5 to 6 members with heterogeneous academic abilities. Each group member is given a different sub-material to learn.
Phase 4 Expert group	Educators direct students who get the same topic to discuss in expert groups.
Phase 5 Members of the expert group return to the original group	Students return to their original group to explain what they got in the expert group.
Phase 6 Evaluation	All students are given tests that cover all topics.
Phase 7 Give awards	Educators give awards both individually and in groups.

(Rusman, 2012)

According to (Isjoni, 2013) the GTGE is a learning model that encourages students to be active and help each other in mastering the subject matter to achieve maximum performance. Meanwhile, according to (Shoimin, 2012) the GTGE learning model is a learning model that focuses on group performance in small groups, each group member is given a section of material that must be learned by the whole group and become an expert in their section. Thus making the team appreciate the contribution of each member.

Based on previous research, efforts to improve students HOTS have been extensively researched (Kurniasih et al., 2020); (Rahayuningsih & Jayanti, 2019); (Khairani et al., 2016) as well as the use the GTGE learning model has also been widely used (Junaety, 2003); (Zainal et al., 2016); (Manurung, 2017); (Rahayu et al., 2018). However, there is no research that seeks to improve HOTS through the GTGE learning model assisted by Ethnomatematics LKPD in terms of the cognitive style of students.

The novelty of this research lies in the use of the GTGE learning model assisted by Ethnomatematics LKPD as an effort to improve students HOTS. So, the purpose of this research is to improve students HOTS and describe the process of learning mathematics with the GTGE

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learning model assisted by Ethnomatematics LKPD.

RESEARCH METHODS

This research is a Quasy Experimental Design with Non Equivalent Pretest-Posttest Control Group Design. The research design is presented in the following table.

Table 2. Research Design

Research Design	
Experiment	$O_1 \rightarrow X_1 \rightarrow O_2$
Control	$O_1 \rightarrow X_2 \rightarrow O_2$

(Dantes, 2017)

Information:

O_1 = First observation (*Pretest*)
O_2 = Final observation (*Posttest*)
X_1 = Treatment with the Group to Group Exchange learning model assisted by LKPD
X_2 = Treatment with the Direct Instruction learning model

The research population was grade VIII students at SMP Al-Kautsar Bandar Lampung for the 2022/2023 academic year. Two classes were randomly selected using the Random Sampling technique, where one class studied using the GTGE learning model assisted by Ethnomatematics LKPD and the other class studied using the DI learning model.

The results of the HOTS and cognitive style research in this study were collected by the HOTS test and the GEFT test. Furthermore, the results of this study were analyzed with the Two Way Anova test with a significance level of 5% using SPSS 25.0 for windows. The research results were analyzed in stages according to each variable to answer the research problem.

RESULTS AND DISCUSSION

Students cognitive style was measured using the GEFT test, which consisted of 18 questions. The cognitive styles are then grouped into 2 categories, namely Field Independent (FI) and Field Dependent (FD). It was found that 24 students had a FI cognitive style for the experimental class and 13 students for the control class. As for the FD cognitive style, the experimental class consisted of 6 students and the control class consisted of 18 students.

The HOTS measurement of students uses the HOTS Test in the form of an essay which totals 10 questions with a maximum score of 4 for each question if correct and 0 if not answered. Measurement of students HOTS was carried out after giving treatment (Posttest) and before giving treatment (Pretest), both in the experimental class and the control class.

Prior to testing the hypothesis using the Two Way ANOVA, a prerequisite analysis test was carried out which was then followed by calculating the N-Gain Score to determine the effectiveness of using the learning model on students HOTS as follows.

Table 3. Description of N-Gain Score Calculation

Statistic		Control	Experiment
Mean		39.74	59.09
95% Confidence Interval for Mean	Lower Bound	34.11	51.26
	Upper Bound	45.36	66.91
Std. Error		2.75	3.83

Based on the results of calculating the N-Gain Score, the average N-Gain Score for the experimental class is 59% with an N-Gain Score of at least 51% and a maximum score of 67% included in the fairly effective category. While the average control class is 39% with an N-Gain score of at least 34% and a maximum score of 45% included in the ineffective category. It can be concluded

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that the use of the GTGE learning model assisted by Ethnomatematics LKPD is quite effective in increasing HOTS in the mathematics subject matter of the Pythagorean theorem in grade VIII students at SMP Al-Kautsar Bandar Lampung in the 2022/2023 academic year. The next step is to test the hypothesis using the Two Way ANOVA as follows.

Table 4. Results of Two Way ANOVA Analysis

Dependent Variable: N-Gain					
Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Model	2991.7	1	2991.7	9.4	.003
Cognitive	1325.6	1	1325.6	4.2	.046
Model * cognitive	106.4	1	106.4	.335	.565

Based on the table of the results of the two-road analysis of variance, it is obtained;

1) H_{0A} is rejected, because it is significant at 0.003 <0.05, so there is a difference in High Order Thinking Skills between students who are given the GTGE learning model assisted by Ethnomatematics LKPD with students who are given the DI learning model.
2) H_{0B} is rejected, because it is significant in cognitive style of 0.046 <0.05, there is a difference in HOTS between students who have FD and FI cognitive styles.
3) H_{0AB} accepted, because it is significant at the interaction of 0.565 > 0.05 so it can be concluded that there is no interaction of media-assisted learning models with cognitive styles on HOTS.

SPSS 25.0 is used for futher testing on H_{0B} . Because H_{0B} is rejected.

Table 5. Results of Multiple Comparison Analysis

Dependent Variable: Value						
(I) Cognitive Style	(J) Cognitive Style	MD (I-J)	Std. Error	Sig.b	95% Confidence Interval for Differenceb	
					Lower Bound	Upper Bound
FD	FI	-8.383*	2.540	.002	-13.470	-3.297
FI	FD	8.383*	2.540	.002	3.297	13.470

Based on estimated marginal means
*. The mean difference is significant at the ,05 level.
b. Adjustment for multiple comparisons: Least Significant Difference (equivalent to no adjustments).

Based on the results of multiple comparison analysis it can be concluded that $H_0: \beta_1 \neq \beta_2$ is rejected, due to obtaining Sig. of 0.002 <0.05, which means there is a significant difference between students who have a FD and FI cognitive style.

Based on the research results obtained during the research in the experimental class is useful for honing students abilities in analyzing problems, creating solutions to existing problems, and evaluating. This is also in line with the acquisition of grades or student learning outcomes which have increased after being given the GTGE learning model assisted by the Ethnomatematics LKPD. Different from the learning process with DI learning models.

The treatment of the DI learning model is a direct learning model that begins by delivering Pythagorean theorem material and providing examples and exercises which are then discussed

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together and giving students to record them. This learning model makes students less active in participating in the learning process because they take notes more often than completing exercises. Students only pay attention and listen to whatever is conveyed by the educator, only a few students are active and courageous in asking questions or material provided.

After the learning process of the Pythagorean theorem material is completed, a final evaluation of learning (Post-Test) is carried out to find out the students HOTS. it was found that the average score of the HOTS test results of the two groups was different. The class that applied the GTGE learning model assisted by the Ethnomatematics LKPD produced better Posttest scores than the class that applied the DI learning model.

This is in line with the results of the research analysis which found that the average N-Gain for the experimental class using the GTGE learning model assisted by the Ethnomatematics LKPD was greater than the average N-Gain for the control class using the DI learning model. This is caused by a different learning process, the GTGE learning model assisted by Ethnomatematics LKPD in the process students are encouraged to analyze the problems they are assigned or encounter, then create solutions to these problems, and carry out evaluations. Whereas in the DI learning model in the process students are encouraged to remember, understand and apply. So it can be concluded that the GTGE learning model assisted by Ethnomatematics LKPD is quite effective compared to the DI learning model which is not effective for increasing students HOTS.

This research has just been carried out and based on previous research regarding efforts to improve HOTS that have been carried out by (Marwah et al., 2017) regarding increasing HOTS after being given the treatment of the Science Technology and Society learning model. This is in line with (Predi et al., 2022) regarding the Radec learning model and IQ showing an increase in numerical abilities that are related to HOTS, as described in research conducted by (Ismafitri et al., 2022) regarding the Characteristics of HOTS and their relation to numeracy literacy skills. In addition to the use of learning models, literacy test instruments can give impact on students HOTS ability. Such as the research conducted by (Arriah & Romba, 2022) on the Development of a numeracy literacy test instrument based on high-level thinking skills in junior high school. This explains that there are other learning models that can be used to improve students HOTS apart from the GTGE learning model.

Furthermore, the use of cognitive style in influencing HOTS is of course no less important, because it becomes an internal factor for students in learning a material. Research conducted by (Mawardi et al., 2020) obtained the results that there were differences in learning outcomes between students who had FI and FD cognitive styles. This research is similar to research conducted by (Amina et al., 2020) concerning students creative thinking skills in solving HOTS type problems based on FI and FD cognitive styles resulting in different ideas in solving problems. Furthermore, research conducted by (Widyastuti & Jusra, 2022) regarding the ability to think critically mathematically in solving HOTS questions has differences based on students cognitive styles and gender. This explains that students with FI and FD cognitive styles have their own characteristics in thinking and determining the resolution of a problem, with FI getting better results in solving HOTS questions than FD. These results are in line with research conducted by researchers on the application of the GTGE learning model assisted by Ethnomatematics LKPD on HOTS in terms of students cognitive styles.

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CONCLUSIONS AND SUGGESTIONS

Through the description of the analysis of research results and hypothesis testing that has been carried out by researchers, it can be concluded that there is an effect of using the GTGE learning model assisted by the Ethnomatematics LKPD on students HOTS, and there are differences in the HOTS with the FD cognitive style and the FI cognitive style of students, and there is no interaction of the GTGE learning model assisted by Ethnomatematics LKPD with cognitive style on students HOTS.

Based on the conclusions from the research results, there are several things that the writer needs to suggest. In general, the GTGE learning model assisted by Ethnomatematics LKPD is very influential on students HOTS. Therefore it is suggested for educators to be able to manage time well so that the learning process can run well and the expected material can be conveyed properly. Researchers hope that there will be further research regarding the GTGE learning model assisted by Ethnomatematics LKPD with the addition of an experimental class. So that it can be seen that the increase in HOTS occurs due to the use of the applied learning model or due to the use of learning media in the form of LKPD.

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