Experimentation of cooperative learning model Numbered Heads Together (NHT) type by concept maps and Teams Games Tournament (TGT) by concept maps in terms of students logical mathematics intelligences

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ABSTRACT: This research is aimed to find out the effect of learning model towards learning achievement in terms of students’ logical mathematics intelligences. The learning models that were compared were NHT by Concept Maps, TGT by Concept Maps, and Direct Learning model. This research was pseudo experimental by factorial design 3x3. The population of this research was all of the students of class XI Natural Sciences of Senior High School in all regency of Karanganyar in academic year 2016/2017. The conclusions of this research were: 1) the students’ achievements with NHT learning model by Concept Maps were better than students’ achievements with TGT model by Concept Maps and Direct Learning model. The students’ achievements with TGT model by Concept Maps were better than the students’ achievements with Direct Learning model. 2) The students’ achievements that exposed high logical mathematics intelligences were better than students’ medium and low logical mathematics intelligences. The students’ achievements that exposed medium logical mathematics intelligences were better than the students’ low logical mathematics intelligences. 3) Each of student logical mathematics intelligences with NHT learning model by Concept Maps has better achievement than students with TGT learning model by Concept Maps, students with NHT learning model by Concept Maps have better achievement than students with the direct learning model, and the students with TGT by Concept Maps learning model have better achievement than students with Direct Learning model. 4) Each of learning model, students who have logical mathematics intelligences have better achievement than students who have medium logical mathematics intelligences, and students who have medium logical mathematics intelligences have better achievement than students who have low logical mathematics intelligences.

Keywords: NHT, TGT, Concept Maps, Logical Mathematics intelligences

1. Introduction

Learning model is very influential in attempt to increase the achievement of mathematics learning. The use of appropriate learning models can encourage students’ sense of happy towards lessons and able to achieve better learning outcomes. The appropriate learning model to make students more active is cooperative. It can solve issues together so that the purpose in learning can be achieved.

The fundamental principle of cooperative learning is the group members are linked together in such a way that they cannot succeed unless everyone succeed, they will actively assist each other to make sure that the assignment is done and the purpose of the group achieved. Cooperative learning model in practice is centered on students so able to active student’s cognitive activity. The learner-centered approach makes it possible to activate the cognitive and educational activity of every student and provide them with opportunities to practice oral communication. Expressed that cooperative learning is the pedagogical use of a small group to enable each student to maximize the results of your learning and at the same time learning all others.
Cooperative learning involves many activities, so it can enhance the interactions between students. Cooperative learning to involve many activities, such as communication, observation, and support. In addition, students changed their learning behaviors, stimulated their cognitive activity, and improved the relationships among students. Besides that, cooperative learning has far-reaching effects that extend beyond the classroom, into professional participant and personal lives. In mathematics learning, cooperative is able to contribute significant achievements in achievement and students' attitude. Cooperative learning had significant effects on the mathematics achievement and attitudes towards mathematics.

Cooperative learning model that can be applied in learning mathematics is a cooperative learning model of Numbered Heads Together (NHT) and Teams Games Tournament (TGT). The learning model Numbered Heads Together (NHT) is a model of learning that can eliminate the gap between students who are intelligent and not intelligent so, each student will play actively in discussion. This learning model demands a responsibility of each student, because in practice, teachers will designate one of the students randomly to answer each question. Effective teaching of mathematics is interactive, two-way process in which students play an active part by answering questions and discussion, explaining and demonstrating their methods to others in the class. It will ensure the involvement of all students and it is a very good attempt to increase individual responsibility in group discussion. Cooperative learning model of Teams Games Tournament (TGT) is a learning model that provides a challenge to students to compete as individuals who represent their respective groups to collect as much as score in game tournaments. This technique provides an opportunity for all members of the group to be able to participate to get value.

In addition to the learning models, the other factor that may affect the achievement of learning mathematics is a logical mathematical intelligence possessed by each student. Logical mathematics intelligence is able to complete a wide range of issues related to patterns of figures through thinking capability based on the rules of logic. The logical mathematics intelligence is intelligence that contains a person's ability in inductive and deductive thinking, thinking ability according to the rules of logic, understanding, and analyzing patterns figures and solving the problem using the thinking ability. Logical-mathematical intelligence consisted of the capacity to analyze problems logically, carry out mathematical operations, and investigate issues scientifically. In mathematical education, our aims are solving problem with thinking logically, and reason deductively.

Mathematics is a subject which requires lengthy reasoning in solving any problems. Therefore, a good strategy is needed to give well understanding to the students. One of the strategies that are able to give contribution is strategy of Concept Maps. The strategy of Concept Maps is a strategy that is created by connecting the core concepts. The relationship between these concepts is a visual representation of other concepts is interrelated. Concept maps visualized through a graphical representation are commonly defined u.s. two dimen framework diagrams that consist of concepts or nodes (put into an ellipse, circle, rectangle or square) jointed by labelled lines (the words or phrase) to show relationships (propositions).
and interrelationships between those selected concepts. Concept maps is an effective strategy for teaching and learning mathematics. This strategy is also capable of improving students’ mastery of content at the higher-order levels of cognition.

This research is supported by some research related to cooperative learning model type NHT, TGT, Logical Mathematics Intelligence and the use of Concept Maps strategy. Research regarding to cooperative learning model type NHT performed by Mahaedy et al (2006) this research showed that Numbered Heads with incentives was more effective in raising academic achievement than Numbered Heads without incentives and both methods were more advantageous for learning than traditional methods. The difference with this research is located on the strategies used in modifying the learning model of NHT. In this study the researchers modified the NHT with Concept Maps. Research about cooperative learning model of type TGT was conducted by Veloo and Chairhany. This research showed that significant differences in the improved attitude and achievement towards probability. In addition, cooperative learning TGT also creates an active learning environment in solving exercises, and discussions among students and teachers. This study provides evidence that learning probability with TGT benefits students. The difference with this research is TGT modified with Concept Maps. Research conducted by Niroo et al (2012) this research showed that in the case of pre-test, there exists a significant relationship between the mathematical Intelligencer and students' mathematical functioning in general and in levels of application and reasoning. Based on the results of the research, researchers were taking research review of logical mathematics intelligence. Research that has been done by Kamble and Tembe (2013), the results suggest that the concept mapping strategy improved the students' performance in problem solving than the traditional teaching method. This research aims to find out 1) which produce better learning achievements of mathematics, learning model cooperative of NHT with Concept Maps, TGT with Concept Maps, or Direct learning model; 2) which had better mathematics learning achievements, student with high, medium, or low logical mathematics; 3) on each model of learning, which had better mathematical learning achievements, students with high, medium or low logical mathematics intelligence; 4) on each intelligence, which produce better mathematics learning achievements, learning model cooperative of NHT with Concept Maps, TGT with Concept Maps, or Direct learning model.

2. Research Method
This type of research was quasi experimental with 3 x 3 factorial designs. The population in this research was the whole XI students of Science at Senior High School in the regency of Karanganyar in Academic Year 2016/2017. Sampling technique used was Stratified Cluster Random Sampling. This research was conducted in Kebakkramat, Senior High School of Kerjo and Mojogedang. In each of school was taken three classes, with two classes of experimental and one control class. Data collection method used documentation and tests. Before the research conducted, researchers did test normality and homogeneity to the data of student ability, and then tested the balance with variable analysis of one road with the same cells. On the beginning ability data and and learning mathematics achievement normality
used Liliefors test, and homogeneity test used Bartlet test. Hypothesis test used the variable analysis test two paths with different cells and test comparison test with double Scheffe.

3. Result and Discussion
The prerequisite of analysis have been completed that it distributed normally and homogenous to the group of learning model and logical mathematics intelligence group then preceded with variable analysis test two paths with the different cells. In Table 01, was presented the result summary of variable analysis counting by two paths with different cells.

Table 01. The Summary Of Variable Analysis Two Paths With Different Cells

| Source | S.S    | D.F | M.S.S  | F_{obs} | F_{table} | Decision |
|--------|--------|-----|--------|---------|-----------|----------|
| A      | 9317.32| 2   | 4658.66| 30.62   | 3.00      | H_{0A} rejected |
| B      | 92377.67| 2   | 46188.83| 303.63  | 3.00      | H_{0B} rejected |
| AB     | 328.31 | 4   | 82.07  | 0.54    | 2.37      | H_{0AB} accepted |
| Error  | 47157.87| 310 | 152.12 | -       | -         |          |
| Total  | 149181.19| 318 | -      | -       | -         |          |

Based on Table 01 above can be concluded that: 1) there was a difference in student learning achievement given the learning model of NHT with Concept Maps, TGT with Concept Maps and Direct learning model; 2) there was a difference in student learning achievement which has the logical mathematical intelligence of high, medium and low; 3) there was no interaction between the learning model with logical mathematics intelligence towards the students’ learning achievements. Before the double comparison tests conducted in advance were presented the summary of marginal average on each learning model and mathematics intelligence. As shown in the following table 02

Table 02. The Summary Of Marginal average

| Learning Models | Logical Mathematics Intelligences | Marginal Average |
|-----------------|-----------------------------------|-----------------|
|                 | High | Medium | Low |                 |
| NHT-CM          | 93.09 | 69.73  | 49.10 | 71.76 |
| TGT-CM          | 85.56 | 62.70  | 45.14 | 64.63 |
| Direct Learning | 77.18 | 57.44  | 36.84 | 56.43 |
| marginal average| 85.35 | 63.19  | 43.18 |          |

Comparison test between the lines was done because H_{0A} was declined. In table 03, the summary of testing results of comparison between lines on each learning model was presented.

Table 03. The Summary Of Testing Results Of Double Comparison Between Lines

| $H_0$ | $F_{obs}$ | $2F_{0.05;2:319}$ | Decision Test |
|-------|-----------|------------------|---------------|
| $\mu_1 = \mu_2$ | 173.59 | 6.00 | Rejected |
| $\mu_1 = \mu_3$ | 140.94 | 6.00 | Rejected |
| $\mu_2 = \mu_3$ | 599.44 | 6.00 | Rejected |
Based on Table 03 marginal average, it can be concluded that 1) Learning Model of NHT with Concept Maps was better than learning model TGT with Concept Maps. 2) Learning Model of NHT with Concept Maps was better than Direct learning model; 3) Learning Model of TGT with Concept Maps was better than Direct learning model.

The test double comparison between lines was done because $H_{0b}$ was declined. In table 04, the summary of testing results of comparison between columns on each logical mathematics intelligence was presented.

Table 04. The Summary of Testing Results of Double Comparison between Columns

| $H_{0}$ | $F_{obs}$ | $2F_{0.05;2;319}$ | Decision Test |
|---------|-----------|-----------------|---------------|
| $\mu_1 = \mu_2$ | 70.71 | 6 | Rejected |
| $\mu_1 = \mu_3$ | 62.73 | 6 | Rejected |
| $\mu_2 = \mu_3$ | 254.80 | 6 | Rejected |

Based on the table 04, it can be concluded that: 1) the students who have high logical mathematics intelligence had better learning mathematics achievement then students who have medium logical mathematics intelligence. 2) The students who have high logical mathematics intelligence had better learning mathematics achievement then students who have low logical mathematics intelligence. 3) The students who have medium logical mathematics intelligence had better learning mathematics achievement then students who have the low logical mathematics intelligence.

Double comparison tests between cells were not done because $H_{0ab}$ accepted, then there was no interaction between the learning model with logical mathematics intelligence towards the students’ learning achievement. Comparison test between cells on the same line and between cells on the same column did not need to be done. The conclusion of comparison between cells on the same line was based on the conclusion of comparisons test between lines, namely; 1) learning model of NHT with Concept Maps better than learning model TGT with Concept Maps; 2) cooperative learning model of NHT with Concept Maps are better than Direct learning model; 3) learning model of TGT with Concept Maps are better than Direct learning model.

The comparison conclusion between cells in the same column were based on comparisons between test conclusion of double column namely; 1) students who have high logical mathematics intelligence had better learning mathematics achievement then students who have medium logical mathematics intelligence.; 2) students who have high logical mathematics intelligence had better learning mathematics achievement then students who have low logical mathematics intelligence.; 3) students that have medium logical mathematics intelligence had better learning achievement then students who have low logical mathematics intelligence.

4. Conclusion and Suggestions
Based on the results of research data analysis and discussion, it can be concluded. 1) Student Learning Achievement given the cooperative learning model of NHT with Concept Maps was better than learning achievement of students who were given the cooperative learning
model TGT with Concept Maps and models of learning directly. The students’ learning achievements that were given the cooperative learning model of TGT with Concept Maps produced better learning achievement than those who were given Direct learning model; 2) Learning achievements of students who have high logical mathematics intelligence were better than those who have medium and low logical mathematics intelligence. The learning achievements of students who have medium logical mathematics intelligence were better than those who have low logical mathematics intelligence; 3) On each logical mathematics intelligence, students who were given learning model of NHT with Concept Maps have better learning achievements than those who were given learning model of TGT with Concept Maps, the students who were given the learning model of NHT with Concept Maps have better learning achievement than students who were given direct learning model, and the students’ learning achievement who were given the learning model of TGT Concept Maps have better learning achievement than students who were given direct learning model; 4) On each learning model, students who have high logical mathematics intelligence have better learning achievements than students who have medium logical mathematics intelligence, and students who have medium logical mathematics intelligence have better learning achievements than students who have low logical mathematics intelligence.

Based on the results of the study, the researchers gave advice as follows: 1) Teachers should be able to develop creative learning processes, effective and enjoyable so that student learning achievement increased. It can be realized if the teachers used appropriate mathematics learning models. One of learning model that can be applied in learning mathematics in terms of opportunities material was learning models Numbered Head Together; 2) Teacher should use the strategy Concept Maps in modifying the learning model because these strategies were able to make students understanding mathematics concepts quickly and optimally so that learning mathematics achievement will be better; 3) Teacher should notice the students’ logical mathematics intelligence, so that in cooperative learning, teachers can create heterogeneous groups due to the level of the students’ logical mathematics intelligence; 4) On this study, researchers used logical mathematics intelligence review. Logical mathematical intelligence was selected because it was intelligence that contributed greatly in learning mathematics. For further researcher, it was possible to conduct different views, such as on learning style, creativity, Advertise Question, Reading comprehension and others.

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