EFFECTIVENESS COMPARISON BETWEEN COOPERATIVE MODELS WITH NUMBERED-HEADS-TOGETHER AND TEAM ASSISTED INDIVIDUALIZATION IN GEOMETRY

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Abstract
This is an experiment research aims to describe (1) implementation of cooperative learning model type Numbered-Heads-Together (NHT) and Team Assisted Individualization (TAI), (2) effectiveness of TAI based on three aspects: students’ learning outcomes, students’ activities, and students’ responses, (3) effectiveness of NHT based on onthree aspects: students’ learning outcomes, students’ activities, and students’ responses; and (4) comparison of the effectiveness of NHT and TAI. Two classes were selected from six classes in grade VII (Junior level) of SMP Negeri 2 Bua. One class used TAI and another used NHT. The effectiveness based on three aspects: students’ learning outcomes, students’ activities, and students’ responses. The results showed that: (1) The implementation of TAI is in high level with the average 3.60. (2) The implementation of TAI is effective in terms of the three aspects: (a) the learning outcomes of students with an average post-test score is greater than the average score of pretest, posttest score average is 79.47 ≥ KKM (standard score), and the percentage of students who completed is 88.89% ≥ 85%, (b) the students learning activities with an average of 3.24; and (c) the students’ responses with an average of 3.57 (positive category). (3) The implementation of NHT is in high category with an average of 3.69. (4) The implementation of NHT is effective in terms of three aspects: (a) the students’ learning outcomes with an average post-test score greater than average score pretest, posttest score average is 78.64 ≥ KKM (standard score), and the percentage of students who passed the score is 86.11% ≥ 85%; (b) the students learning activities with an average of 3.11; and (c) the students’ responses with an average of 3.46. (5) Based on the three aspects of effectiveness, it derives that the implementation of TAI is more effective than the type NHT.

Keywords: learning outcomes, Numbered-Heads-Together (NHT), Team Assisted Individualization (TAI), Cooperative model.

Background
Many students feel the difficulty learning mathematics. According to the rector of ITB, Ansjar (Kompas, November 2, 2009: 12) most students view mathematics as a subject that is scary and they always avoid it. According to Sidi and Marpaung in Saedi (2009: 3) Indonesia ranks 34 out of 45 countries on Trends and International Science Study (TISS). Similar facts on the Program of International Student Assessment (PISA) for Mathematics Literacy Indonesia were ranked 69 out of 76 countries.

One reason for the low quality of education is the teacher. The responsibilities of teacher include selecting the appropriate learning model that led to the managing the classroom. It range from preparing the learning instruments, media, and tools, as well as the evaluation tools that lead to achieving the learning objectives. Thus, if the teacher is wrong in choosing one learning model, it will be difficult to achieve the learning objectives. In line with Nurwati (2009: 8), she states that one of the causes of students experiencing learning difficulties are the teacher who implements inappropriate instructional models.
Learning mathematics is still dominated by conventional teaching. In this teaching, the teacher's role is dominant in presenting the material. Usually after presenting the material, the teacher asks some students to do the questions on the board regarding the material just described. Students who are able to do well will be more motivated, but for students who are not able to do the problem is going to get negative treatment from teachers and fellow friends. Teaching such as this puts the teacher as the center (teacher centered) learning. Soedjadi (2007: 27) argues that the concentration of activities on teacher learning is what is causing the imbalance between students and teachers in terms of thinking are required and need to be nurtured in the students’ self for the sake of his future. In addition, the learning model like this make students learn individually competitive.

The competitive nature of individuality can be eliminated by applying cooperative learning model. In this model, students regularly work in groups to help each other solve complex problems. There are several variations of learning in this model, such as: STAD (Student Teams Achievements Divisions), Jigsaw, TAI (Team Assisted Individualization), GI (Group Investigation), TGT (Teams Games Tournaments), TPS (Think Pair Share), NHT (Numbered Head Together), CIRC (Cooperative Integrated Reading and Composition).

The diversity of cooperative learning model make the teacher can implement an appropriate model in accordance with the character of the material and students. Therefore, in this paper we discuss the comparison of the effectiveness of the NHT and the TAI. The effectiveness that we concern based on three aspects: students’ learning outcomes, students’ activities, and students’ responses. We are focused on the topic geometry.

**Literature Review**

**Team assisted Individualization (TAI)**

TAI is a type of cooperative learning model that form small groups heterogeneous background of thinking of different ways to help each of the other students who need help. The TAI is developed by Slavin. This type combines the advantages of cooperative learning and individual learning. This type is designed to address individual students’ learning difficulties. Therefore, learning activities more widely used to solve a problem.

Characteristic of the type of TAI are students studying learning material that has been prepared by the teacher individually. The results of individual study brought to their group to be discussed, and all the members of the group responsible for the overall response as a shared responsibility.

TAI type of cooperative learning model has 8 (eight) components, namely:

1. **Teams**, the formation of a heterogeneous group consisting of 4 to 6 students;
2. **Placement test**, the provision of pre-test to the student or looking at the average daily score of the students so that teachers know the weaknesses of students in a particular field;
3. **Student Creative**, carry out the task in a group to create a situation where the individual success is determined or influenced by the group's success.
4. **Study Team**, in which stages of learning actions to be implemented by groups and teachers provide individual assistance to students who need them;
5. **Team Scores and Team Recognition**, scoring the groups’ work and provide award criteria for successful groups and groups that are considered less successful in completing the task;
6. **Teaching Group**, teacher explained briefly the topic before the group work;
7. **Test facts**, giving small tests based on facts obtained by the students;
8. **Whole Class Units**, the teacher explains the topic again at the end of time by providing problem-solving strategies;

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The TAI is in accordance with Pern that one teaching strategy characterized as a constructivist model of learning if it has a cycle with three phases, namely exploration phase, introduction of the concept phase, and application of concepts phase (Ratna: 1983). In exploration phase, the students are given opportunity to explore their own materials or ideas through sources that exist. In introduction of the concept phase, students talk to each other in the group to match each other ideas and concepts that they have learned. In application of the concept phase, the students have the opportunity to apply the concepts they have agreed through discussion and answer quizzes or post-test given by the teacher.

**Numbered Head Together (NHT)**

The NHT is one type of cooperative learning model introduced by Russ Frank, a teacher at Chaparral Middle School in Diamond Bar, California. Each student from a group has one number and the students know that there is only one student in their group will be asked to represent their group. The lively discussion was an attempt by the students to share information so that everyone knows the answer. In this way, they will earn points no matter which number was called. NHT is the kind of learning that is designed to affect the pattern of interaction of students and as an alternative to the traditional class structure.

**Geometry**

In junior level, the lesson of geometry begins with accepting the concept of points, lines, and areas. The topic geometry in the second semester of grade VII based on curriculum 2013 is about triangles and quadrilaterals. The topic is divided into four basic competences:

1. Identifying the properties of triangles based on sides and angles.
2. Identify the properties of a rectangle, square, trapezoid, parallelogram, rhombus, and kites.
3. Calculate the circumference and area of a triangle and quadrilaterals and use them in solving a problem.
4. Draw the triangle, the altitude, the bisector, and the axis lines.

In applying one learning model, there are a few things to consider: characteristics of the topic, cognitive development level of students, the ability of teachers, and the availability of supporting tools. The effectiveness of one learning model will be known after it is being applied or experimented in classroom setting.

**Methods**

This research is an experimental research comparing the effectiveness of the implementation of cooperative learning model NHT and TAI on the geometry in grade VII (Junior high school level). The research was conducted in SMP Negeri 2 Bua Luwu. The population was all students of grade VII SMP Negeri 2 Bua with two classes as the experimental class which were selected randomly based on pre-test. One class used the NHT and another used TAI. The results of this treatment are seen by observing their effectiveness based on three aspects: students’ learning outcomes, students’ activities, and students’ responses.

The instruments used were questionnaire, observation sheets, and test. The questionnaire used to determine a student's response. Observation sheet used to look after the activity of students in learning and the implementation of the model used. Achievement test used to determine learning outcomes of the students as the posttest.
Results and Discussion

The Implementation of Model

The implementation of the model for both types TAI and NHT obtained that the average of TAI was 3.60 (in a high category) while the NHT was 3.69 (high category). The data indicates that both types were in a good implementation. The average differences of the implementation of those types only about 0.09 which is a small number. It indicates that the two types are considered equally implemented and it is worthy to compare the effectiveness.

The results also showed that there was a development of the implementation models in each type for each meeting. On average of TAI, the implementation score for the first meeting was 3.17 (middle category), the second meeting was 3.67 (high category), the third meeting was 3.75 (high category), and the fourth meeting is 3.83 (high category). Meanwhile, the implementation score for NHT at the first meeting was 3.33 (middle category), the second meeting was 3.78 (high category), the third meeting was 3.78 (high category), and the fourth meeting was 3.89 (high category).

The development and differences in the implementation of both types as a result of the learning experiences. These imperfections are also due not the teacher and the students who did not use to these two types of learning. The last two meeting were getting better because of the evaluation that we made for the first two meetings.

The Effectiveness of TAI

The mathematics learning outcomes of students taught by cooperative learning model type TAI was in the high category (66.7%) and in very high category (27.8%) with classical completeness rate reached 88.9%. Students’ abilities showed a significant improvement after learning by applying TAI. Students’ activities was in high category, and students’ responses of the learning and the instruments are in positive category.

TAI as a whole can improve the ability of students to understand the topic geometry, especially on the triangles and squares even when providing them in context or realistic problems. The learning was also able to increase the activity of students in learning and provides opportunity for students to interact with the teacher directly, in terms of conveying the problems faced by the students about the topic geometry.

Activities of students in this learning takes place in an optimal start of the activity in groups to solve problems that have been presented in the worksheets, and activities in the classroom to interact with other groups through classroom discussion. In this study, the opportunities to improve students’ ability through independent study by providing materials or other relevant learning resources improve students’ motivation in doing group discussion. Besides, the topic geometry in grade VII is the repeated topic that they had learned in elementary level. Therefore, by providing the opportunity to read or study by them, students will remember what they have ever learnt.

In this learning, the students were led to build his own knowledge through a series of problem solving are formulated in worksheet. The optimal activity of students as part of a result of the worksheets design that is able to provoke the students in terms of doing the reinvention of the students’ understanding of the past, this was seen when students seem to recall material that has been previously obtained and discuss with their teammates. It was highly prevalent in mathematics as a whole, because the mathematical concept is hierarchical and interrelated. It is also stated by Hudojo (1990: 15) that in order to learn mathematics, it must be continuous and uninterrupted, learn mathematics with discontinuous would disrupt the learning process. Thus, it can be said that the implementation of cooperative learning model type TAI fulfill the principle of continuity of mathematical concepts.
The Effectiveness of NHT

The mathematics learning outcomes of students taught by NHT was in high category (66.7%) and in very high category (30.5%) with classical completeness level reached 86.1%. The knowledge of students showed significant improvements after learning by applying cooperative learning model NHT. Students’ activities were in high category, and the response of the learning and the instruments are in positive category.

Overall, the study of mathematics by NHT can improve the ability of students to understand the topic, especially on the topic geometry, triangles and quadrilaterals. As in the model TAI, the learning was also able to increase the activity of students in learning and provides ample opportunity for students to interact with the teacher directly, in terms of conveying the problems related the topic geometry. By integrating learning with contextual approach or realistic mathematics, it will make easier for students to understand the concept since each concept is always associated with objects in everyday life that can be imagined by the students.

Activities of students in this learning takes place in an optimal start of the activity in groups to solve problems that have been presented in the worksheets, and activities in the classroom to interact with other groups through classroom discussion. The high activity of students in the group and in the learning overall was the result of the tendency of the competition posed by this model. The fears of the students to represent the group turn to motivation in learning activities. The concerns were becoming a strong motivation to always prepare to perform. This is shown by the enthusiasm of some students who always raised their hands when it comes to presentation to the class. It indicated that they are already understood with the topic provided.

The Comparison of the Effectiveness of TAI and NHT

Students Outcomes

Although the application of TAI and NHT are both effective in learning from the aspect of students learning outcomes, but the facts show that the implementation of TAI is more effective than the NHT. The steps or phases of TAI effect more to improve students’ learning outcomes than the NHT. In TAI, the students are given the opportunity to learn individually which a process of exploration of students through learning instruments. This phase is the trigger for readiness of the students in a discussion with their teammates. For students who have better skills than the other members, they have the opportunity to learn and strengthen their understanding before the discussions or they can learn together. Hence, in this discussion, they are better prepared to help the friends when there are problems or questions relating to the topic being studied at the time. This makes learning more meaningful and leads to a better learning outcomes.

Building a students' thinking (constructivism) in learning is one instructional strategy that can foster understanding of the concept and makes learning becomes meaningful. The mechanism of learning with TAI leads to this constructivism models. This is in accordance with the opinion of Pern that one teaching strategy is a model of constructivist is the use of the learning cycle with three phases, namely the phase of exploration in which students learn from learning resources before the discussion, the phase the introduction of the concept where students talk to each other in the group to match the concept has been understood previously, and the application of the concept phase when students are given assignments or quizzes by the teacher.

The higher spirit of the discussion, the higher motivation. It also make students more serious in discussing the problem given by the teacher with the initial understanding gained from learning individually. It was a reason why the negative activities which are unrelated to the task were reduced. It is one of the main advantages of TAI.
While the NHT, the concerns of the students to present asa representative of their groups burden enough the concentration of the students in the learning. As the result, the students were more focus on understanding the assignment from the teacher rather than understanding the concept. This happens because during discussions, the students were more discuss the answers of task than discuss the concept should be understood.

In terms of topic, especially area and perimeter of triangles and quadrilaterals are not new topics for students of grade VII. They have learned the topics in elementary school. It means the students only needs a recall the topics. The students generally had some concepts of area and perimeter of triangles and quadrilaterals, so it is suitable to provide learning opportunities to individually adjust the scheme of students thinking of what has been understood by the individual learning.

Students’ Activities

In general, the implementation of TAI and NHT make the activity of students in high categories. It also provides a great space for teachers and students to interact. The teachers act as a facilitator and mediator to maximize the learning process for students. This is in line with the Piaget that the knowledge is construct by students due to the interaction of the students constantly with their environment.

Discussion activities in TAI runs more active than in the NHT. It caused that the students in the TAI have mastered the topic individually before the group discussion. Thus, all the students were actively giving opinions based on their individual learning result. As for the NHT, it is not as active as on the TAI. It is because the process of exploration and the introduction of the concept were in the same time. The students were difficult to organize time and concentrate to carry out two learning process. When the students were busy for learning to understand the concept through a source of learning or teaching materials, the other students were sometimes too busy looking for answers from a given task. This raises the lack of group’s work to do the same learning activities, and then the discussion did not go well.

In another case, one of the mechanisms of learning by NHT is presentation phase of group’s work. The students referred by teachers who happened to be less running well because not all students have the courage to perform in front of his friend to convey the group's work. This can be seen when they are called to present. But, it is being a good thing for students who have the ability and the courage for it. This is what makes the student activity on the TAI slightly better than the activity of students in the NHT.

Students’ Responses

Basically two types NHT and TAI got a positive response by the students. But the different treatment or learning phase mechanisms cause different response although it was very small in terms of the response index. Of the four aspects of the response is used as the focus of the observation, the most aspects that bring the difference was in terms of the instructional model.

Thus, the cooperative learning model type TAI is one of the better solutions to improve the quality of student learning in the heterogeneous classroom, especially on the repetition topic such as geometry (calculating the circumference and area of triangles and quadrilaterals and use them in solving a problem).

Conclusion and Suggestion

Based on the criteria of effectiveness, it shows that the three aspects, students’ learning outcomes, students’ activities, and students’ responses is higher that the TAI. It indicates that the implementation of TAI is more effective than the NHT in the topic of Geometry for grade VII (Junior high school level).
There will likely be the type of cooperative learning model more effective apart from two types that exist in this study, either in the topic geometry or other topics in mathematics. Therefore, it is suggested to researchers in Mathematics Education who are interested in doing a similar study, to compare the effectiveness of more types of cooperative learning model in a particular topic.

References