Realistic Matematic Approach through Numbered Head Together Learning Model

A C M S Sugihatno¹, Budiyono¹ and I Slamet²
¹Magister Pendidikan Matematika, Universitas Sebelas Maret, Jl. Ir. Sutami No 36 A, Surakarta 57126, Indonesia
²Fakultas Matematika dan Ilmu Pengetahuan Alam, Universitas Sebelas Maret, Jl. Ir. Sutami No 36 A, Surakarta 57126, Indonesia

¹ayu_choirul@yahoo.com

Abstract. Recently, the teaching process which is conducted based on teacher center affect the students interaction in the class. It causes students become less interest to participate. That is why teachers should be more creative in designing learning using other types of cooperative learning model. Therefore, this research is aimed to implement NHT with RMA in the teaching process. We utilize NHT since it is a variant of group discussion whose aim is giving a chance to the students to share their ideas related to the teacher’s question. By using NHT in the class, a teacher can give a better understanding about the material which is given with the help of Realistic Mathematics Approach (RMA) which known for its real problem context. Meanwhile, the researcher assumes instead of selecting teaching model, Adversity Quotient (AQ) of student also influences students’ achievement. This research used the quasi experimental research. The samples is 60 students in junior high school, it was taken by using the stratified cluster random sampling technique. The results show NHT-RMA gives a better learning achievement of mathematics than direct teaching model and NHT-RMA teaching model with categorized as high AQ show different learning achievement from the students with categorized as moderate and low AQ.

1. Introduction
Education is an important thing for a nation, because quality education will create intelligent, productive, responsible and independent people. Along with the development of society, education in Indonesia faces many challenges related to the quality of education in Indonesia. Mathematics is a subject in which there is the ability to count, think logically, and think creatively. Mathematics is one of the most important subjects. According to Kline [1] mathematics is a symbolic language and its main feature is the use of deductive reasoning but it does not forget the inductive reasoning.

The reality of the field shows that there are still many students who consider mathematics as a difficult lesson and become a scourge in the national exam, so it gives impact on students’ achievement. It can be seen from the indicators of students’ learning outcomes which are relatively lower that other subjects. It can be seen from the results of the National Examination of Junior High School in Surakarta in 2016 as the result shown in Table 1. The table shows that the average score of Mathematics in Junior High School in Surakarta in academic year 2015/2016 is lowest among the other.
Table 1. The average of Final Examination Score of all of State Junior High School in Surakarta in Academic Year 2015/2016.

| Score | Bahasa Indonesia | English | Mathematics | Science |
|-------|------------------|---------|-------------|---------|
| Average | 81,04 | 62,81 | 55,60 | 62,07 |
| Lowest | 34,0 | 18,0 | 12,5 | 12,5 |
| Highest | 100,0 | 100,0 | 100,0 | 100,0 |

Based on the result of National Examination of State Junior High School in Surakarta in academic year 2015 and 2016, it was found that the understanding of students in Surakarta in Surakarta in 2015 for the tested ability is solving the problems related to the area and circumference of plane is 66.30% while in 2016 is 55.64%. These results indicate that students in Surakarta have difficulties to solve math problems related to the area and circumference of plane.

The difficulties of learning which are experienced by the students in solving the problems related to the area of plane are influenced by internal and external factors. Internal factors are factors that come from the students such as independence, self-esteem, learning motivation, confidence or logical intelligence. Meanwhile, external factors are factors derived from outside students, such as learning environment, learning tools, teachers, curriculum, or teaching methods [2]. The factors that influence the success of learning mathematics are the use of approaches, learning models, and students’ intelligence.

The use of the right approach will affect students’ achievement. One approach that can be used to motivate students relates to learning mathematics is the approach of Realistic Mathematics Approach (RMA). RMA is a learning approach that combines the views of mathematics, how students learn mathematics, and how to teach mathematics. In addition, the research conducted by Uzel and Uzangor [3] showed that learning with RMA has better mathematics learning achievement than learning with traditional methods since it effects positive attitude of students to learning mathematics. Thus, it supports that RMA is appropriate to be implemented in learning.

The use of cooperative learning can improve students’ learning achievement and can develop intergroup relationships, acceptance of weak classmates in the academic field, and increase sense of self-worth [4]. Based on that opinion, the use of cooperative learning model with RMA can be one alternative solution that can be applied in learning mathematics.

There are many cooperative learning models, including Numbered Head Together (NHT). The NHT learning model is a variant of group discussions which aim to give the students opportunity to share ideas and consider the answers to each question. Beside the factor of learning model, the learning process will also be influenced by other factors such as Adversity Quotient (AQ). AQ is an intelligence or ability to change or cultivate a problem or difficulty and make it a challenge that must be solved, so it cannot obstruct the students’ dream [5]. AQ can be used as an indicator for a person’s mental viewing. So, the high and low can show how a person can continue to survive in the face of difficulty in the struggle until in the end someone can come out as a winner or backed up in the middle of the road or even unwilling to accept the slightest challenge [6]. AQ is divided into several levels: climbers, campers, quitters. Every level shows students’ ability to face the difficulties.

AQ is concerned with the attitude of a person who in this case is a student in understanding the mathematics concepts that affect student learning achievement of mathematics, especially in understanding the problem of triangle and square plane. The conditions in the field show that there will be children who strive to understand and solve the problems that it faces regardless of the end result. But there will be children who stopped in the midway to solve the problems because they surrendered and felt no longer able to. There are even children who immediately give up without making efforts in finding a solution of the questions given. So, AQ can affect student’s learning achievement in understanding and solving the problem especially on the building of flat. This is supported by the results of research [7] which states that the potential AQ is required by the students who have difficulty in learning mathematics.
Based on the previous description, the researcher conducted a study by applying the NHT learning model on the material area and the circumference of the triangle and square with RMA approach in terms of AQ for the seventh grade students of Junior High School in Surakarta in the academic year 2016/2017.

2. Experimental Method
This research was conducted in state Junior High School located in Surakarta whose the population is all students of class VII (seven) in academic year 2016/2017 with the samples is 60 students of junior high school divided into 2 classes.

The type of research which was used in this study is quasi experimental research because the researcher is not possible to control or manipulate all relevant variables except for several variables which were studied. This study aims to provide treatment of samples, then researchers want to know the effects of such treatment. The intended treatment is a learning strategy using cooperative learning model type NHT-RMA and direct learning model. While the instrument was a questionnaire that was used to obtain data category students’ AQ and tests that were used to obtain the data of students’ achievement.

In this research, the data analysis which was used is two way anava with unequal cell. Before conducting variance analysis, a prerequisite test of variance analysis was conducted, the normality of the population used to find out the samples came from normal distributed populations and the homogeneity population test which was used to find out whether the sample came from populations having variances of homogeneous. After the result of two ways variance analysis, so it was conducted a test post anava. The steps of this research are showed as figure 1.

![Figure 1. The steps of the research](image-url)
3. Result and Discussion

3.1 Results

3.1.1 Prerequisite test

a. Normality test

The result of normality test from mathematics achievement test with Lilifors test were obtained statistic test as follows:

- for Initial ability of control class = 0.12263
- for Initial ability of experimental class = 0.10435
- achievement test for control class = 0.1254
- achievement test for experimental class = 0.1564

Because of \( l_{0.05;n} = 0.161 \) and \( l_{0.05;0} > l_{0.05;n} \), the result of normality test is Ho is accepted. So we can conclude that all samples come from normality distributes populations.

b. Homogeneity test

The results of homogeneity test using Bartlet are as follows:

- Initial ability = 3.215
- Achievement test = 3.714
- \( \chi^2_{aq} = 5.81 \)
- \( \chi^2_{0.05;4} = 3.841 \) and \( Dk = \{ \chi^2_{aq} > \chi^2_{0.05;k-1} \} \)

Because of \( \chi^2_{aq} < \chi^2_{0.05;k-1} \), the result of homogeneity test is Ho is accepted. So we can conclude that every population variance is homogeneous.

c. Equilibrium Test

The result of equilibrium test for initial students’ achievement is \( F_{obs} = 1.02744,4 \) and \( F_{tabet} = 1.96 \). Because \( F_{obs} = 1.02744 < F_{tabet} = 1.96 \), so the result of equilibrium test is Ho is accepted, then it can be concluded that the average of both of population is equal. It means that the students’ achievement of the two groups in a balanced condition.

3.1.2 The analysis of two-way anova with unequal cells

In order to know whether there are differences in students’ learning achievement with NHT model and directly, the differences of students’ learning achievement depend on category of students’ AQ, and whether there is interaction between teaching model used and student’s AQ toward learning mathematics; thus, the result of two ways variance analysis was shown as follows:

| Sumber            | JK  | Dk | RK  | \( F_{obs} \) | \( F_{a} \) |
|-------------------|-----|----|-----|--------------|--------------|
| Teaching Model    | 1253,944 | 1  | 12538,94 | 155,985      | 4.02         |
| AQ                | 8365,349  | 2  | 4182,674 | 52,5879      | 3.17         |

According to Table 2 it was found that the three hypotheses were rejected, so it can be concluded as follows: There is differences of Mathematics achievement between the students who learned with NHT-RMA model and directly, there is significant differences on students’ achievement at each AQ, and there is an interaction between teaching model and each category students’ AQ.

3.1.3 Double comparison test between columns

The result of double comparison test between columns as follows:
Tabel 3. The summary of double comparison between columns

| $H_0$ | $(\overline{x}_i - \overline{x}_j)^2$ | $\left(\frac{1}{n_i} + \frac{1}{n_j}\right)$ | $F_{obs}$ | $F_{a}$ |
|-------|-----------------------------------|---------------------------------|-----------|--------|
| $\mu_1 = \mu_2$ | 294.7375 | 0.1003 | 32.0413 | 6.36 |
| $\mu_1 = \mu_3$ | 1759.3364 | 0.1026 | 206.1374 | 6.36 |
| $\mu_2 = \mu_3$ | 655.1162 | 0.0976 | 82.9990 | 6.36 |

According to Table 3, it was found that the three hypotheses were rejected, so it can be concluded as follows: There is a significant difference in students’ mathematics average achievement between the student who has a high AQ category and those who have a moderate AQ category, there is a significant difference in students’ mathematics average achievement between the student who has a high AQ category and those who have a low AQ category, and there is a significant difference in students’ mathematics average achievement between the student who has a moderate AQ category and those who have a low AQ category.

3.1.4 Double comparison test between cells at the same row

The result of double comparison test between cells at the same rows as follows:

Table 4. The summary of double comparison between cells at same row

| Ho | $F_{obs}$ | $F_{a}$ | Result |
|----|-----------|--------|--------|
| $\mu_{11} = \mu_{12}$ | 15,4690 | 11.95 | $H_0$ is rejected |
| $\mu_{11} = \mu_{13}$ | 32,8940 | 11.95 | $H_0$ is rejected |
| $\mu_{12} = \mu_{13}$ | 86,1228 | 11.95 | $H_0$ is rejected |
| $\mu_{21} = \mu_{22}$ | 12,4757 | 11.95 | $H_0$ is rejected |
| $\mu_{21} = \mu_{23}$ | 24,8292 | 11.95 | $H_0$ is rejected |
| $\mu_{22} = \mu_{23}$ | 3,4301 | 11.95 | $H_0$ is accepted |

According to Table 4, we can conclude two conclusions. The first conclusion is that the student who is implementing NHT-RMA teaching model with categorized as high AQ shows different learning achievement from the students with categorized as moderate and low AQ than the students with categorized as moderate AQ show different learning achievement from the students with categorized as low AQ. While the conclusion of both is that the student who is implementing direct teaching model with categorized as high AQ show different learning achievement from the students with categorized as moderate and low AQ and the students with categorized as moderate AQ show different learning achievement from the students with categorized as low AQ.

3.2 Discussion

Generally, the result of the research showed that NHT teaching model – RMA delivers better achievement than direct teaching model. It is appropriate with the result of the research conducted by [8] which concluded that cooperative teaching model can improve students’ achievement in learning mathematics, and it is also in line with the result of a research conducted by [3] which
showed that learning with RMA has better mathematics learning achievement than learning with conventional model.

The result caused by the use of context in RMA motivates the students to use their experience and thought to face their difficulties without memorize the formula [9]. In addition, the students can improve their understanding to learn mathematics by using RMA than using conventional model [10].

According to those researches, it can be seen as the figure below. Figure 2 and 3 showed that the students who are implemented by using NHT-RMA teaching model can explain the derivation of triangle area formula. As a result, the students do not need to memorize many formulas as direct teaching model.

Figure 2. The students’ answer in NHT-RMA teaching model class.

Figure 3. The students’ answer in direct teaching model class.

Figure 4 and 5 show that the students who learn mathematics with NHT-RMA teaching model can understand easily especially for the calculation of perimeter and area.

Figure 4. The students’ answer in NHT-RMA teaching model class
4. Conclusion
Based on the study of theory and supported by the results of research, it can be concluded that the use of NHT learning model with RMA approach gives a better learning achievement of mathematics than direct teaching model, in the NHT learning model with the RMA approach, students with high AQ have better mathematics learning achievement than students with moderate or low AQ, and students with moderate AQ have better mathematics learning achievement than students with low AQ and the last conclusion is in direct teaching model, students with high AQ have better mathematics learning achievement than students with moderate or low AQ, and students with moderate AQ have better mathematics learning achievement than students with low AQ.

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