Think Pair Share Using Realistic Mathematics Education Approach in Geometry Learning

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Abstract. This research aims to determine the impact of mathematics learning applying Think Pair Share (TPS) using Realistic Mathematics Education (RME) viewed from mathematical-logical intelligence in geometry learning. Method that used in this research is quasi experimental research. The result of this research shows that (1) mathematics achievement applying TPS using RME approach gives a better result than those applying direct learning model; (2) students with high mathematical-logical intelligence can reach a better mathematics achievement than those with average and low one, whereas students with average mathematical-logical intelligence can reach a better achievement than those with low one; (3) there is no interaction between learning model and the level of students’ mathematical-logical intelligence in giving a mathematics achievement. The impact of this research is that TPS model using RME approach can be applied in mathematics learning so that students can learn more actively and understand the material more, and mathematics learning become more meaningful. On the other hand, internal factors of students must become a consideration toward the success of students’ mathematical achievement particularly in geometry material.

1. Introduction

Geometry learning is a difficult subject according to most students. Students regard geometry as an abstract material [1]. It is not appropriate with the fact that geometry is a basic skill which students need to understand [2,3]. Therefore, it is necessary to find a certain way in learning geometry so that students can understand it more easily. Think Pair Share (TPS) learning model and Realistic Mathematics Education approach have already been applied by former researchers. They propose that both have been successfully proven [4-5]. According to Gecu & Ozdener, the use of geometry software in geometry learning can affect students’ mathematical achievement, nevertheless students find difficulties in using the software at the beginning and moreover the software itself uses English as it operating language [6]. Bamiro through his research also concludes that TPS learning model can increase student’s chemical learning achievement [7]. A research conducted by Arssayathamby & Zubainur proves as well that the application of RME can give students opportunities to construct their understanding more actively, however RME is not implemented thorough fully during mathematics learning, there are several stages in RME approach which must have done [8]. Based on previous researches, it is necessary to conduct a research concerning TPS model which is integrated with RME approach use in geometry learning. The research aims to determine whether or not its result enable to increase students’ mathematical achievement particularly regarding geometry.
In Indonesia, geometry learning is commonly given in each stage of education which is primary, junior, and high stages. In this research, the proposed geometry learning is geometry in intermediate level, which is polyhedron. Polyhedron given in elementary school is not specifically taught. There are many kinds of polyhedron such as cube, cuboid, prism, pyramid, cylinder, sphere, and cone. This research will discuss the volume of prism in particular.

Most students are lack of understanding to comprehend geometry material particularly polyhedron if teachers merely explain its abstract concept. Students will probably comprehend more if teachers make a concrete relation between geometry and daily life which students have already had experiences on it. Hence, geometry learning should be elaborated concretely so that students can imagine and understand it more appropriately. For instance, in finding the formula of prism’s volume, teachers can show students how it relates with certain matter in daily life at first, as can be seen in Figure 1.

Figure 1 represents the steps how to find prism’s volume. Students must understand the prior material which is cuboid’s volume because they will need to use it to find prism’s volume formula. Figure 1 (a) gives students a description of daily life example, so they are able to figure it out and understand it well. Figure 1 (b) explains students how to find the formula of prism’s volume by using the description in figure 1 (a) and student’s prior knowledge. Based on figure 1, to find the formula students must divide a cuboid into two similar parts on its diagonal plane. Thus, it will result in two identical planes which is triangular prism. Subsequently, it can be understood that the volume of prism is half of cuboid’s volume, whereas the formula of cuboid’s volume is \( V = \ell \times w \times h \) and \( \frac{1}{2} \times \ell \times w \times h \) is bottom layer area of triangular prism. Thus, it is obtained that the formula of prism’s volume is bottom layer area times height of prism.

As explained previously, geometry learning will be meaningful more if students are able to achieve understanding through their own way of thinking through discussion and sharing ideas. This, then, will lead to a student-centered learning in which teachers place themselves as facilitators who give students guidance. This kind of learning model is usually known as cooperative learning model. One of cooperative learning models is Think Pair Share (TPS). The basic concept of this learning model is how to conduct a student-centered learning and to invite students to discuss with their classmate [9]. There are three stages in TPS; think, pair, and share [10-12].

To optimize learning result, an interesting approach is necessary to make students participate actively in learning process by using reality knowledge students have already owned in their mind that is called Realistic Mathematics Education (RME) approach. Firstly, RME was applied successfully in Netherland and followed by other countries such as United States. An essential principle of RME is that engagement in mathematics for students should begin within a meaningful context, which means that it is not merely making a relation to real life but also providing problems which students can figure out [13,14]. RME approach step according was carried out through four stages, that is understand contextual issues, solve contextual problems, compare and discuss answers, and conclude.
The learning model combined with the RME approach is expected to attract students' attention and improve students' understanding of the lesson matter [15].

Berdasarkan penjelasan model TPS dan pendekatan RME yang telah dipaparkan, proses pembelajaran Model TPS menggunakan pendekatan RME dapat dilihat pada gambar 2.

**Figure 2.** The learning process of TPS model using RME approach

Based on figure 2, it can be seen that the learning process of TPS model using RME approach. In specifically, geometry learning process applying TPS through RME approach begin with introductory activities. In introductory activities, teachers prepare the students, give them apperception, and deliver learning purposes. Afterwards, teachers conduct main activities which are started from think stage. In think stage, teachers give worksheets to students which are containing problems of finding the formula of volume and daily problems related to prism's volume. Students must understand problems given by teachers written in the worksheets (think and understand contextual problem stages). Subsequently, students pair themselves with their mates (pair), while students who are guided directly by teachers share their ideas with their partners and try to solve the given problems written in worksheets (problem solving stage). After students finish solving the given problems, they, guided by teachers, present their discussion result in front of the class and other groups give comments and responses (share stage, discussing and comparing answers). After class discussion is finished and problems are completed, students will draw conclusion simultaneously guided by teachers.

Learning model and learning approach that are used by teachers in class are not the only reasons that cause low learning achievement and mathematical disposition of students. Internal factor of students also influence their learning achievement and mathematical disposition. People using mathematical-logical intelligence are skilled in inductive/deductive reasoning and logic, and exhibit great strength to solve problems. Their ability to make connections between pieces of information is outstanding [16]. Hence, every student can possibly have different mathematical-logical intelligence whereas teachers shall give an optimal learning service. Mathematical-logical intelligence may influence learning achievement and mathematical disposition of students.

This research aims to discover several matters; which model is more effective to advance students' learning achievement between TPS using RME approach and direct learning; which students will
accomplish best learning achievement among students with high, average, and low mathematical-logical intelligence; any possible interaction between learning model and mathematical-logical intelligence level of students to result in learning achievement.

2. Method
Method applied in this research is quasi experimental using factorial design of $2 \times 3$. There are two independent variables in this research, first independent variable is Think Pair Share (TPS) learning model using Realistic Mathematics Education (RME) approach as experimented class and direct learning model as control class, and the second independent variable is mathematical-logical intelligence which consists of three categories which are high, average, and low. The dependent variable in this research is students’ mathematics achievement.

The population in this research is all students of State Junior High School throughout Karanganyar Residence year 2016/2017. The sample of this research is obtained by taking 3 Junior High Schools using stratified cluster random sampling technique. The sampling process is established by placing all 45 Junior High Schools throughout Karanganyar Residence in order based on the mean of mathematics score in National Examination year 2016/2017. Afterwards, the order is divided into three groups which are high group, average group, and low group.

Data in this research is collected by using documentation, test, and questionnaire methods. The respondents of documentation method are schools and teachers. Schools give research data sample which include students’ initial intelligence data taken from final test result and from the observation sheets in which whether or not students are able to follow learning stages appropriately established by teachers as observers. The respondents of test method are the students, it aims to obtain student’s mathematics achievement data and students’ logical-mathematical intelligence test. The type of test which is used is multiple choice test with 25 question and 4 multiple choice.

The used technique to analyze data in this research is two way analysis of variance with different cell. Before analyzing data using is two way analysis of variance, prerequisite tests which include normality and homogeneity tests are carried out previously.

3. Result and Discussion
The data in this research is processed by using two way analysis of variance. Before the data is analyzed by using two way analysis of variance, prerequisite tests which include normality and homogeneity tests are carried out previously. The result of univariate prerequisite tests shows that normality and homogeneity tests are fulfilled.

The result of two way analysis of variance with significance level of 5% can be seen in Table 1.

### Table 1. Summary Analysis Test of Two Ways Analysis of Variance

| Source                  | Sum of Squares | Degree of freedom | Mean square | F_{obs} | F_{table} | Decision Test |
|-------------------------|----------------|------------------|-------------|---------|-----------|---------------|
| Model (A)               | 943,876        | 1                | 943,876     | 6,641   | 3,893     | H_0 Rejected  |
| Mathematical Logical Intelligence (B) | 11843,773 | 2                | 5921,886   | 41,666  | 3,046     | H_0 Rejected  |
| Interaction (AB)        | 298,891        | 2                | 149,445     | 1,051   | 3,046     | H_0 Accepted  |
| Galat                   | 25867,507      | 182              | 142,129     |         |           |               |
| Total                   | 38954,047      | 187              |             |         |           |               |

### Table 2. The Marginal Average of Mathematics Achievement and Mathematical Disposition

| Learning Model | Mathematical Logical Intelligence | Marginal Average |
|----------------|----------------------------------|------------------|
| TPS model with RME approach | High 70,105 | Low 59,600 | Average 72,085 |
| Langsung        | High 69,073 | Low 53,150 | Average 62,957 |
| Marginal Average| High 69,570 | Low 55,300 |
Based on Table 2, it can be seen that in dependent variable learning achievement the result of furthered test on learning model factor effect shows that $F_A = 6.641 > F_{0.05;1.182} = 3.893$, it means $H_{0A}$ is rejected. This shows that there is a different mathematics achievement between students applied TPS learning model using RME approach and students applied direct learning model. Based on the marginal average, it can be concluded that TPS learning model using RME approach gives better mathematics achievement effect than direct learning model. This is because learning process applying TPS using RME approach begin with think stage which is reading or solving contextual problems individually, then discussing individual thinking result in pair (pair), giving suggestions and completing given problems simultaneously, and eventually presenting discussion result in front of the class (share) [17]. TPS learning model is an effective learning model to increase students’ learning activities. TPS gives students chances to work individually and cooperatively. In the other hand, through RME approach, students are able to build their own understanding from their reality knowledge and then construct it into mathematics model. The philosophy underpinning Realistic Mathematics Education (RME) is that students should develop their mathematical understanding by working from context that make sense to them [13]. In RME approach, learning starts from contextual problems, thus it enables students to make use of their previous experiences directly. Therefore, learning process which applies TPS learning model will give positive influence toward students to comprehend given materials.

In the effect of mathematical-logical intelligence factor, it is obtained that $F_B = 41.666 > F_{0.05;2.182} = 3.046$, which means $H_{0B}$ is rejected. It shows that there is a different mathematics achievement amongst students who have high mathematical-logical intelligence, average, and low ones. To determine effect difference in each category, furthered post anava test is conducted applying scheffe test by inter-column double comparison. The result of inter-column double comparison test is served in Table 4.

### Table 3. Summary of Double Comparison Between Line

| $H_0$        | $F_{obs}$ | $2F_{0.05;2.182}$ | Decision Test |
|--------------|-----------|------------------|---------------|
| $\mu_1 = \mu_2$ | 19,667    | 6,089            | $H_0$ Rejected |
| $\mu_2 = \mu_3$ | 108,253   | 6,089            | $H_0$ Rejected |
| $\mu_1 = \mu_3$ | 48,855    | 6,089            | $H_0$ Rejected |

As seen in Table 4, it is known that those three $H_0$ are rejected. Hence, it can be concluded that each variable level of different mathematical-logical intelligence affect differently, therefore according to Table 3, mathematics achievement of students with high mathematical-logical intelligence is better than students with average and low mathematical-logical intelligence, meanwhile mathematics achievement of students with average mathematical-logical intelligence is better than students with low mathematical-logical intelligence, one of internal factors which influences toward students’ mathematical achievement is mathematical-logical intelligence. This ability covers mathematical-logical intelligence: the capacity to understand the underlying principle of some kind of casual system, the way a scientist or a logician does, or to manipulate numbers, quantities, and operation, the way mathematician does [18]. Students who have mathematical-logical intelligence will be skilled in thinking inductively/deductively, have the ability of solving problems and will not give up on difficult problems.

In interaction effect between learning model and mathematical-logical intelligence, it is obtained that $F_{AB} = 1,051 < F_{0.05;2.182} = 3.046$, which means $H_{0AB}$ is accepted. It can be concluded that there is no interaction between learning model and students’ mathematical-logical intelligence toward their mathematics achievement. It proves that there is no interaction between learning model and level of students’ mathematical-logical intelligence toward students’ mathematics achievement. It means each learning model and learning achievement gaps amongst students with high, average, and low mathematical-logical intelligence follow common conclusion in which mathematics achievement of students with high mathematical-logical intelligence is better than those with average and low ones, while students with average mathematical-logical intelligence gets better mathematics learning achievement than those with low one. In TPS model applying RME, students with high mathematical-logical intelligence tend to learn more actively than others, they are able to lead discussions and give
direction to those with average and low mathematical-logical intelligence. Similar circumstance occurs as well in direct learning model where students with high mathematical-logical intelligence are able to understand given mathematics material better than those with average and low ones.

4. Conclusion
Based on the explanation on result and discussion, it can be concluded that mathematics achievement which applied TPS model using RME approach is better than direct learning model; students with high mathematical-logical intelligence achieve better mathematics achievement than students with average and low mathematical-logical intelligence; while students with average mathematical-logical intelligence achieve better mathematics achievement than students with low mathematical-logical intelligence; there is no interaction between learning model and level of students’ mathematical-logical intelligence in mathematics achievement.

The impact of application of TPS learning model using RME approach affect the increase of students’ activeness in learning activity and students’ comprehension toward geometry learning. It also increases awareness of students that mathematics application is used as well as beneficial in daily life aspects. In spite of external factors such as learning model and learning approach, it is important as well to consider internal factors, for example, mathematical-logical intelligence of students.

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