Think Pair Share with Formative Assessment for Junior High School Student

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Abstract. Geometry is a science related to abstract thinking ability so that not many students are able to understand this material well. In this case, the learning model plays a crucial role in improving student achievement. This means that a less precise learning model will cause difficulties for students. Therefore, this study provides a quantitative explanation of the Think Pair Share learning model combined with the formative assessment. This study aims to test the Think Pair Share with the formative assessment on junior high school students. This research uses a quantitative approach of Pretest-Posttest in control group and experiment group. ANOVA test and Scheffe test used to analyse the effectiveness this learning. Findings in this study are student achievement on the material geometry with Think Pair Share using formative assessment has increased significantly. This happens probably because this learning makes students become more active during learning. Hope in the future, Think Pair Share with formative assessment be a useful learning for teachers and this learning applied by the teacher around the world especially on the material geometry.

1. Introduction

Currently, Indonesia's junior secondary school education uses the 2013 curriculum. In this curriculum, geometry gets the most space from other materials. Geometry is a mathematical science that speaks of points, lines, planes, spaces and their relation to each other [1]. From here, it can be concluded that the problem of geometry always involves something abstract. Based on the results of interviews with some middle school students in a city in Indonesia, on average 7 out of 10 students have difficulties when studying geometry. Therefore, a solution was needed to solve this problem. It is important for students to be competent in their mathematics learning process because their level of thinking is still low and is procedural in nature [2]. The learning model makes a difference in the students learning process result [3]. If the teacher's learning quality meets the student's expectations, then the student will be more interested in being active during the lesson. Has a lot of research about the learning model. Most findings from the study suggest a positive relationship between cooperative learning and academic achievement [4]. These findings support the fact that cooperative learning is a good learning method for achieving high academic achievement. In addition, Assessment is probably the most important thing we can do to help students while learning [5]. Meaning that the assessment function is not only used to assess students with scores after students complete theirs learning process, but also used to repair learning. Therefore, teachers need to use assessments that emphasize feedback to improve their learning quality. Such an assessment is nothing but a formative assessment.
From the description above, a new learning was offered. A cooperative learning model of think pair share based on formative assessment that can include students in learning geometry. Has much research on think pair share. For example, Burhan Mustaqim has conducted a study on the impact of cooperative learning of junior high school students in Indonesia using Think Pair Share method. They reported that the cooperative learning method of Think Pair Share was more effective in improving achievement [6] but in his study did not use assessment in learning. Therefore, it is very interesting to use formative assessment on the model. Cooperative learning represents a shift in educational paradigm from teacher-centered approach to a more student-centered learning in the small group [7].

Changing the way students work together can make a real difference in improving mathematics understanding [8]. Formative assessment (Assessment for learning) is the process of seeking and interpreting evidence for use by learners and their teachers to decide where to learn and how to get there [9]. This assessment can improve learning more effective because the purpose of this assessment is to give feedback.

In summary, this learning application is as follows (Table 1): in the Think step, students think of a problem that the teacher gives to individually. The students who successfully solve the problem entitled to a sign of success from the teacher. Teacher gives the success criteria to the students for use in the next learning stage. In the Pair step, students who have not succeeded in pairing and discuss. The student who previously received a mark of success from the teacher, assigned to each group for guide the discussion and entitled to also give a sign of success for the group if successfully solved the problem. It is in this process uses strategies of assessment that is students used as learning resources. It exists in the process that students play the role of coaching other students in one group during the discussion so that students who previously passive become active and information was be obtained from the student mentors. Another advantage, it can give the feedback process and help students in conveying ideas. In the Share stage, one of them shows their answers in front of the class. There was a large discussion process that facilitated feedback from other students as well as from teachers in class.

| Stages  | Activity                                                                 |
|---------|---------------------------------------------------------------------------|
| Preliminary | This stage begins with the teacher performing apperception, explaining the purpose of the lesson, conveying the material, and linking the earlier material with the material will be studied. |
| Think   | Students think about teachers’ questions individually. Then, students who successfully solve the problem entitled to get a sign of success from the teacher. |
| Pair    | Unsuccessful students pair with friends and discuss. Furthermore, each student who previously received a mark of success from the teacher assigned to each group to guide the discussion and entitled to also give a sign of success for the group if successfully solved the problem. |
| Share   | The representatives of the students presented their answer in front of the class. Furthermore, both other students and teachers give a classical feedback on the answer. |
| Closing | Teachers with learners do reflection. Teachers give feedback on learning processes and outcomes. The teacher gives home work and informs the learning materials for the next meeting. |

2. Experimental Method
This study was a comparative study that uses a quantitative approach of Pretest and Posttest. This research form is quasi-experimental design. In this study use control group and experiment group. The
control group is a group with conventional learning and experimental group is a group with Think Pair Share using formative assessment and only Think Pair Share. Each model was tested for 1 month on geometry material. Pretest is used to see normality and class balance (homogeneity) test. Pretest and Posttest made in the form of 25 multiple choice test. The instrument has tested for validity, reliability, distinguishing power, and difficulty level. This research population is all junior high school students academic year 2016-2017 in one city of Indonesia. Students in this city mostly taught using conventional learning (direct learning). This research uses simple random sampling to select three of all Junior high school and select three class (Grade 8) of every school as sample. The control group consisted of 30 male and 32 female student. The experiment group that uses Think Pair Share with assessment formative consisted of 26 male and 37 female students. In other hand, the experiment group that uses Think Pair Share consisted of 23 male and 36 female students. ANOVA test and Scheffe test used to analyse the effectiveness this learning. For follow-up conducted a qualitative analysis of the way students do the questions.

3. Result and Discussion
Based on the pretest data was be obtained the normality test conclusion that the sample comes from a population that is normally distributed with \( L_{obs} = 0.043 \) and \( L_{0.05;184} = 0.065 \) so \( H_0 \) is accepted because of \( L_{obs} \leq L_{0.05;184} \). It is mean, the sample comes from a population that is normally distributed. The results of homogeneity test show that the comparable population has the same variance with \( X_{2obs} = 4.287 \) and \( X_{20.05;2} = 5.991 \) so \( H_0 \) is accepted because of \( X_{2obs} \leq X_{20.05;2} \). It is mean, the comparable population has the same variance.

The results of this study illustrate student achievement in the geometric material. Description of achievement data in the form of pretest and posttest averages based on the learning model with a scale of 0-100. In summary, data description was be presented in table 2.

| Learning model                                      | Pretest       | Posttest      |
|----------------------------------------------------|---------------|---------------|
|                                                    | Min | Max | Ave | Var | Min | Max | Ave | Var |
| Think Pair Share with formative assessment         | 51.44 | 89.01 | 60.82 | 25.76 | 60.03 | 92.11 | 80.41 | 21.67 |
| Think Pair Share                                   | 55.67 | 90.67 | 63.33 | 30.52 | 59.08 | 91.03 | 75.34 | 16.77 |
| Conventional                                       | 56.06 | 87.98 | 64.55 | 31.21 | 57.34 | 89.23 | 72.81 | 9.86  |

Table 2 shows the mean score of students with Think Pair Share using formative assessment had significant improvement (from 60.82 to 80.41) compared to mean of student score with other learning model and at posttest had a variance that was not too big that is 21.67. This means, the distribution of collecting values on the number 80. In other hands, the other models also have a variance that is not large so the value collects on the number 75 for the Think Pair Share and 72 for the conventional.

| Sum of Square | Df | Mean Square | \( F_{obs} \) | \( F_{table} \) |
|---------------|----|-------------|----------------|----------------|
| SSb           | 4070.92 | 2 | 1257.32 | 3.328 | 3.05 |
| SSw           | 11233.64 | 182 | 354.58 | | |
| Total         | 15304.56 | 184 | | | |

Table 3 shows \( F_{obs} > F_{table} \) so \( H_0 \) is rejected it means there is a difference between the three learning models. Because it gives a different result, sceffe test is necessary to know which learning model is better. Sceffe test results can be seen in table 4.
Table 4. Result of Scheffe’ test

| Comparison | $F_{obs}$  | $F_{table}$ | Decision | information |
|------------|------------|-------------|----------|-------------|
| $\mu_1$ vs $\mu_2$ | 6.9010 | 6.656 | $H_0$ is rejected | Two models give a different result |
| $\mu_1$ vs $\mu_3$ | 6.8814 | 6.656 | $H_0$ is rejected | Two models give a different result |
| $\mu_2$ vs $\mu_3$ | 7.1253 | 6.656 | $H_0$ is rejected | Two models give a different result |

Based on table 4, all the learning models give unequal results. In the table, $\mu_1$ is the average score of student achievement in Think Pair Share with formative assessment group, $\mu_2$ is the average score of student achievement in Think Pair Share group, and $\mu_3$ is the average score of student achievement in conventional group. Table 2 provides information on student achievement that varies in each model. Based on Table 2, it can be seen that the group using Think Pair Share with formative assessment has a higher average ($\mu_1 = 80.41$) than 2 other groups ($\mu_2 = 75.34$ and $\mu_3 = 72.81$) and Think Pair Share has a higher average than conventional. It means that Think Pair Share with formative assessment is more effective to teach geometry material. Cooperative learning model encourages students to work together in groups well so as to create meaningful learning process and improve student’s cognitive achievement. This process can help students develop academic performances because a student-centred approach would encourage students to actively participate in mathematics learning activities [10]. Based on the results of the analysis of the results of answers and interviews of participants who received the lowest score of each group, there are some differences in answering questions number 3. point 3 is a matter of moderate difficulty. Many students answered wrongly about this. The question is the volume of a beam is twice the volume of a cube. Long beam is 12 meters, 4 meters is high and 9 meters is wide. Student must calculate the length of the cube segment. The answer was be presented in Figures 1, 2, and 3.

According Figure 1, seen at the beginning of the work, students are wrong in the work. This shows that students do not understand what the purpose of the matter. Based on the interview results, it is true
that he does not know what that means. This happens because of in the conventional learning, student not much interaction and practice questions so that he is not working another questions. In other hands, when learning takes place, the teacher rarely asks students about similar problems and does not explain in detail due to limited time. So students are easy to forget and less accustomed to solve similar problems.

![Image 1](image1.png)

**Figure 2.** Student answer who have the lowest score in Think Pair Share group

From picture 2, it looks that he has done the first step of calculating the volume of the beam, but he does not know what to do next. Based on the results of the interview, he once completed the same problem but the result is wrong. His group did not know how to answer correctly. This is obvious because Think pair share does not give feedback so students do not know where the error lies.

![Image 2](image2.png)

**Figure 3.** Student answer who have the lowest score in Think Pair Share with formative assessment group

From the student's answer in Figure 3, we can see that he failed to find the final result, but 75% of the steps are correct. This shows that students' understanding of the geometric material that is the subject of Think Pair Share by using the assessment to learn better than students with other learning models. Based on the interview, he has learned to solve similar problems with his friends and he remembers his steps despite failing to find results. On the other hands, he was very helpful with his theme in solving this problem. His friend can help because he already knows the success criteria of his teacher. This is the benefit of an assessment for learning strategies that activate students as another learning resource for students. Such facilities not given on conventional learning models. Students with the Think Pair Share model give better answers. Students who experience Think Pair Share use the formative assessment to build the concept of deeper thinking or thinking at a higher order level in the face of problems. They trained to argue and explain the reasons for a problem. First, they will solve the problem individually and then discuss it in groups while communicating, sharing experiences with other students and solving common problems.

Think Pair Share learning does not give feedback facility from friends and teachers so that if they are wrong, then they will not know where their fault. On the other hands, students from conventional
groups were be exposed to memorize a concept from a textbook. They tend to interact a little with other students because they can not work together. Students are also motivated and begin to change their attitudes, increase attendance and appreciate the importance of concepts in mathematics. They are be involved in the completion of mathematical tasks and show readiness to participate in the task. Another advantage besides that is able to save the feedback process and can facilitate students in conveying ideas.

The current research findings are student achievement on the material geometry with Think Pair Share using formative assessment has increased significantly. Think Pair Share with the Formative assessment becomes the incredible learning for geometry materials. Cooperative learning methods will enable students to receive positive feedback through the process of inculcating thinking skills, problem solving and group interaction. Cooperative efforts among students can improve higher achievement by all participants[11]. Think pair share with formative assessment has shown that shared learning will result in a better understanding of mathematical concepts. Students will learn to sort and direct ideas toward complex mathematical problems and students will be able to give logical explanations. When students interact with their peers during the cooperative learning process, the emergence of conflicting opinions may be due to different levels of competence in the conceptual understanding of mathematics between them. Student involvement in the cooperative group activities had contributed towards an increase in student understanding of mathematical concepts [12].

4. Conclision
Think Pair Share with the formative assessment is able to improve students achievement in the geometric material because of this learning makes students involved while learning and provides facilitate feedback that used for learning. It can not be given by conventional and Think Pair Share without formative assessment. Communication is very important to understanding material. In enhancing the students understanding of mathematics, their competence in mathematics communication also need to be enhanced [13]. One way to improve communication is discussion. One of On the other hands, students are more active because not only interacting with teachers but also students interacting with their friends. Because his friend already knows the criteria of success, then he can help friends who have difficulty. Group dynamics were very important in student learning [14]. If this learning model was be applied by all teachers in the world, then it is likely that students will more easily understand the material geometry so that student achievement will increase.

For other researchers, we expected they apply this learning for other materials. If this learning succees to improving the achievement of other materials, then this learning is proper to be a solution for students and teachers. But if there is no improvement in performance, then another solution must be found.

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