The quality of mathematics learning material using a modification of Think Pair Share (TPS) model

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Abstract. Think Pair Share (TPS) modification learning model is expected to strengthen TPS model syntax by changing the number of member in a group, a group of two into a group of three. The researcher has developed learning materials for TPS modification model using Plomp model. This study focuses on the practicability of the learning materials on the assessment phase of Plomp model. The practicality of the learning materials was evaluated by experts and teachers. The data was obtained from the pilot test involving 19 students in grade 9 of a junior high school in Aceh. The research instrument used was an observation sheet to examine the learning implementation. The results show that learning materials using TPS modification model met the practicality criteria. The finding implies that the learning materials using TPS modification model could be applied in the classroom.

1. Introduction
Think Pair Share (TPS) modification model refers to the TPS model by changing one of the learning phases in the TPS model. That is, changing the number of member in a group, group of two into a group of three by considering the third students as a mediator in the group. The group of three students gives many opportunities for each member to share ideas so that the dominance of one person in a group could be avoided [1]. This condition encourages the interaction among the students.

TPS modification phases are oriented on thinking, discussion with the group mates, and sharing activities. The small group discussion in the TPS modification model means that the students discuss in a small group consisting of three students to solve mathematics problems. The group on the TPS modification model consists of students with various capabilities [1].

TPS modification model is expected to give better impacts than TPS model. TPS modification is considered more effective in changing the discussion pattern situation in the classroom; that is, the discussion can provide more time for students to think, respond, and help each other [2]. Moreover, TPS modification also supports students to think about the problem individually then share to other students as in the original TPS model [3]. Similar to the original TPS, TPS modification allows students to think independently, respond to problems given by teachers to find the solution and help other students who have difficulty in solving the problems [4]. Students construct their knowledge to find the solutions to the problems, both individually and in a group.

This paper examines the practicability of mathematics learning materials using TPS modification model. The practicability of the materials is evaluated based on the recommendations of experts and teachers.
2. Method
This study was part of development research on learning materials using TPS modification model. This study used Plomp development model that consists of three phases: the preliminary research, prototyping, and evaluation phases [5]. This paper focuses on the evaluation phase for the practicality aspect. The data to measure the practicability aspect were obtained from a pilot study on the learning materials. The pilot study was conducted for 19 Year 9 students in one of the junior high schools in Aceh, Indonesia. Experts and teachers were asked to assess the practicality of the learning implementation [6].

3. Result and discussion
The pilot study to evaluate the practicability of learning materials with TPS modification model focuses on the topic of solid geometry with the curved surface (non-polyhedrons). The learning implementation consists of four sessions. The first session discussed net and surface area of cylinders. The second session focused on net and surface area of cones. The third session was about the surface area of spheres, and the fourth session was about the volume of solid geometry objects with the curved surface (cylinders, cones, and spheres). Those subtopics were required to learn by junior high school students in grade 9 as mentioned in the basic competencies in Curriculum 2013. That is, generalizing the surface area and volume of solid geometry objects with the curved surface (cylinders, cones, and spheres) and solving a contextual problem related to the surface area and volume of the objects, and the combination of some solid geometry objects with curved surface [7].

The first step of the TPS modification model is giving problems related to solid geometry with the curved surface (non-polyhedrons). The problem given was about net and surface area of cylinders shown in Figure 1.

Aisyah got a cylinder pencil holder from her father. The holder has a hollow surface. Aisyah wants to use it to save her money and put it on her table. However, Aisyah doesn’t want the money can be seen from the outside. What should Aisyah do?

![Figure 1. The pencil holder problem.](image)

The students were given the opportunity to understand and think about the problem solving strategy individually. The result of a student’s individual work is shown in Figure 2. Then, the students discussed the problems in a group of three. In the second phase of the TPS modification model, the students discussed the problem solving with the other members. Every member in a group had the different abilities that consist of high, medium and low. Then, the learning activity was continued to group presentation.
Penyelesaian:
1. Apa yang dapat dilakukan Aisyah agar uang dalam celengannya tidak terlihat dari luar? 
   Melapisi alat tulis dengan menggunakan kertas pada samping bagian.
2. Berbentuk apa lapisan yang perlu disiapkan Aisyah? 
   Lingkaran, persegi panjang, dan 2 lingkaran.
3. Gambarkan bentuk kertas yang dibutuhkan Aisyah untuk melapisi wadah alat tulis tersebut!

Solution:
1. What can Aisyah do to make the money in the pencil holder not visible from the outside? 
   Covering the pencil holder with paper.
2. What shape of the layer does Aisyah need to prepare? 
   Rectangular/parallelogram, and 2 circles.
3. Draw the layer’s shape Aisyah needs to cover the pencil holder!

4. Berapa luas kertas yang dibutuhkan Aisyah untuk melapisi bagian selimut wadah alat tulis?

   | Based on the figure di atas maka: |
   |----------------------------------|
   | a. Panjang selimut tabung (AB = CD) = Keling lingkaran (\(2\pi r\)) \[1\] |
   | b. Lebar selimut tabung (AD = BC) = tinggi tabung \[2\] |
   | c. Jadi, luas kertas yang dibutuhkan Aisyah untuk melapisi bagian selimut wadah alat tulis? |
   | \[ \text{Luas selimut tabung} = \text{Pxl} \] |
   | \[ = \frac{2\pi r x t}{2} \] |
   | \[ = \pi rt \] \[3\] |

   The lateral surface area = \(\text{pxl} = 2\pi r \times t = 2\pi rt\)

5. Berapa luas kertas yang dibutuhkan Aisyah untuk melapisi bagian alas dan tutup wadah alat tulis?

   \[ = \pi r^2 + \pi r^2 \]
   \[= 2\pi r^2 \]

   | What is the area of paper that Aisha needs to cover the base and the lid of the container? |
   |----------------------------------|
   | \(= \pi r^2 + \pi r^2\) |
   | \(= 2\pi r^2\) |

Figure 2. Example of a student's work on the pencil holder problem.
The practicality of the learning materials was evaluated by experts and teachers and based on the observation result of the learning implementation. Based on the evaluation from experts and teachers, the learning materials including a lesson plan, worksheet, and a test could be applied with minor revision. Overall, the quality of the lesson plan was good; only some parts need correction. Similarly, the experts and teachers recommended that the worksheet could be applied, but there was a minor revision. For the test, the errors found in the sentences that did not meet the Indonesian language requirement. Also, most of the typos found in the test were about missing words and ambiguous sentences without the figure explanation. Nevertheless, in general, the test was good enough and can be applied with a small revision.

The learning implementation for every session was evaluated through the observation by two observers, a teacher, and a colleague. Each session of learning has 21 aspects of learning activities. There were six aspects evaluated in the preliminary phase: opening, praying, checking students’ attendance list, checking students’ prior knowledge, motivating students, delivering the learning objectives, and explaining the learning activities. The observation result shows that all aspects in the preliminary phase were well conducted in the first, second and third sessions.

Moreover, there are 10 aspects evaluated in the core activity. The activities include students observe the problem given related cylinder radius and surface area, students ask questions related to the problems given, the teacher distributes a worksheet about cylinder radius and surface area, the students collect the information related to the problems in worksheet, students solve the worksheet, students are assigned a group, students discuss their solutions in a group, the teacher guides each group, group presentation, and whole class discussion. The finding shows that generally the aspects of the core activity from the first session to the fourth session could be implemented well. Out of the 10 aspects, only one aspect did not occur. That is the activity in the whole class discussion. The other groups did not respond to the presentation delivered by the presenter group because the answers of all groups were almost the same. Moreover, the students were still shy to deliver ideas publicly in the class. On the contrary, beyond the learning process, the students were more courageous to ask questions of the other students who were more capable and to teachers about the material that they did not understand.

Furthermore, in the final phase, there were five aspects evaluated that consists of guiding students to conclude the topic that had been learned, giving reinforcement about net and surface area of cylinder, having students reflect their learning process, evaluating students through a test, providing information about topics that will learn in the next session. All activities in the final phase could be applied well. In detail, the result of observation of the learning implementation is shown in Table 1.

| The measured aspect                                                                 | Implementation |
|------------------------------------------------------------------------------------|----------------|
| Greeting, praying, and checking the attendance list of the students, open the learning activities. | √              | √              |
| The teacher checks the prior knowledge of the students by asking some prerequisite materials. | √              | √              |
| The students answer the question and give response related to prerequisite materials | √              | √              |
| The teacher motivates the students about the importance to understand cylinder radius and surface area | √              | √              |
| The teacher delivers the learning objectives                                         | √              | √              |
| The teacher explains the learning objectives that the students will conduct          | √              | √              |
| The students observe the problem given in power point about cylinder radius and surface area | √              | √              |
The students ask about the problems given √ √
The teacher distributes a worksheet of cylinder radius and surface area √ √
The students collect the information to solve worksheet about cylinder radius and surface area √ √
The students complete the worksheet about cylinder radius and surface area √ √
The students are divided into several heterogeneous groups (3 members) √ √
The students are asked to discuss together with the group member to discuss the worksheet given in the previous phase. √ √
The teacher guides every group facing the problems in completing the worksheet. √ √
The group representative presents the discussion result in Pair Plus Phase to other groups √ √
Other groups give a response to the presenter group - -
The teacher guides the students to conclude the material learned √ √
The teacher strengthens the students in solving the problem of net and surface area cylinder √ √
The students reflect the learning process conducted √ √
The teacher asks the students to do the evaluation test/quiz √ √
The teacher gives information about the next topic. √ √

The findings show that the learning materials using TPS modification model met the requirements of the practicability criteria. Experts and teachers declared that the learning materials could be applied in the classroom, and the level of implementation of the learning materials is categorized very high [6]. TPS modification model encouraged students to be more active in the discussion and more confident in delivering their ideas. A small group discussion provided more opportunities to discuss the topic with their partners. Low-achieving students were more confident in discussing the topic with moderate-achieving students. Similarly, moderate-achieving students were motivated to talk with the high achieving students. The learning outputs from the implementation of TPS modification model have the same impact as the original TPS model. This is consistent with the results of some studies that found the TPS model encouraged the students in the classroom to discuss actively, and improve safety environment for students to construct their thoughts and ideas [8,9]. Also, cooperative models, e.g., TPS can provide the feedback to respond and help each other in the learning process [10]. The students who have difficulty in constructing their knowledge can be assisted by other group members to find a solution to their difficulty [10]. The interaction processes occurring in the group can help the students to develop thinking and the idea so that the learning process is more active.

4. Conclusion
Overall, the learning materials using TPS modification model met the criteria of practicality. Based on the pilot study on the mathematics learning materials using TPS modification model, it can be concluded that the experts and teachers generally recommended lesson plan, worksheet, and test developed can be applied in the classroom with minor revision. Also, based on the observation, all aspects were done well. Thus, the practicality of learning materials using TPS modification model was considered good.

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