



Development of Mathematic Teaching Materials Through Think-Pair-Share Learning to Improve Students' Mathematic Problem Solving Ability

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Abstract

This study aims to (1) produce mathematics teaching materials through Think-Pair-Share learning for students who fulfilled the valid, practical, and effective criteria and (2) determine the increasing of students' mathematical problem solving abilities using the developed teaching materials. This research is a development research that uses the Thiagarajan 4D development model. The validity of the product can be seen from the results of expert validation and reaches the valid criteria for teacher books and student books. The practicality of the product achieves the practical category in terms of the results of teacher practicality assessments and observations of the learning implementation. The effectiveness of criteria can be seen through out the 4 indicators, namely: the level of student learning achievement, the achievement of learning objectives, the achievement of a good learning time and a positive response to the learning process. This research produces valid, practical, and effective mathematics teaching materials. In addition, the use of mathematics teaching materials developed through Think-Pair-Share learning can improve students' mathematical solving abilities.

Keywords: Development; Mathematics Teaching Materials; Think-Pair-Share Learning; Mathematical Problem Solving Ability.

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1. Introduction

Education is a very important sector in improving the quality of Indonesia's human resources. Learning mathematics is part of the educational process in schools, and it has an important role in developing reasoning and shaping student attitudes. Reference [1] says that learning mathematics is learn to solve problems where this condition is feasible because mathematics is an activity of human life. Mathematical activities can make an important contribution to the development of reasoning needed in an effort to equip students who be able to think logically, critically and carefully, and to be objective and open in facing problems, especially in solving problems related to mathematics. But in fact, many students do not like learning mathematics. Reference [2] said that students have difficulty in solving these problems because they are not used to work on problem solving abilities. One thing that must be prepared and plays an important role in learning mathematics is the teaching material. In learning activities, the teacher's job is to provide learning convenience to students, by providing adequate learning facilities and resources. The teacher must prepare well-structured learning so that learning can be carried out and student-centered. As stated by [3] that teachers are trying to improve the quality of education, including teachers have to use media as a means of supporting the teaching and learning process, therefore it is necessary to have teaching materials. Teaching materials can a form of textbooks which are used in learning activities. According to [4] the good textbooks are: (1) accurate (accuracy); (2) appropriate (relevance); (3) communicative; (4) complete and systematic; (5) oriented student centered; (6) siding with the ideology of the nation and state, (7) rules of correct language, textbooks written using proper spelling, terms and sentence structures; (8) legible, textbooks with high readability contain sentence length and sentence structure according to the reader's understanding. But in fact there are still many teachers who have not been able to design the teaching materials to be used in learning and the existing teaching materials are not oriented towards the real world problems. Existing teaching materials have not been developed according to student needs. In line with [5], the use of printed books in mathematics learning is sometimes not optimal. Reciprocally, Reference [6] states that the teaching materials used by teachers do not facilitate teachers in implementing the learning process. One of the mathematical materials that must be mastered is algebraic operations. However, in its implementation, according to [7], the ability of students to solve problems in calculating the algebraic form is still relatively low, the material for calculating operations in algebraic forms is still considered difficult. In line with [8] said that students have major obstacles in understanding algebra and students also face difficulties in working on algebraic problems. Students have difficulty identifying, simplifying and solving problems related to algebra. Therefore, there must be teaching materials that contain good algebraic operation material in mathematics learning that can be used by teachers and students. In addition, a teacher must be able to choose a learning model or strategy that is in accordance with the conditions of students' abilities in the classroom, including the suitability of developing teaching materials / materials to support these learning activities. Teachers need to have the ability to use varied learning methods that involve more students in learning activities and teachers are more required to act as facilitators who help students take advantage of available learning resources. One method that can be used is the Think-Pair-Share learning model. Reference [9] argues that one of the efforts that can be made to overcome the weaknesses of mathematics learning is the selection of appropriate teaching methods and approaches in accordance with classroom conditions, so as to be able to actively involve students both physically, emotionally and socially. However, in reality the implementation of learning in schools

is still dominated by teacher-centered learning so that student activity is reduced. These results in a lack of reciprocal relationship between teachers and students as well as interactions between students which in turn leads to low quality of the learning process, so that learning objectives are not maximally achieved. Therefore, a teacher must be able to choose a learning model or strategy in accordance with the conditions of the students' abilities in the classroom. One method that can be used is the Think-Pair-Share (TPS) learning model. Think-Pair-Share is a teaching and learning technique that provides opportunities for students to work alone and work together. Reference [10] says that the general idea of Think-Pair-Share is that students think independently to solve a problem calmly. Then pair up and share thoughts or solutions with friends nearby. Each student collaborates on activities, works with partners, brainstorms ideas and shares thoughts with collaborators about problem solutions. With the existence of thinking in pairs in learning mathematics, it will have a positive effect, in particular it can improve students' mathematics learning ability. One of these abilities is the ability of students to solve mathematical problems. Reference [11] said that mathematical problem solving skills are a very important part of learning mathematics. According to [12] students' problem solving abilities are emphasized on thinking about how to solve problems and process mathematical information. Mathematical problem solving abilities provide great benefits to students. As [13] argued that problem-solving abilities will provide students with the ability to continue their education and to face life in society. But in reality, students' mathematical problem solving abilities are still low. This is in line with [14] who said that the problem solving ability of Indonesian students is still low. Thus it is necessary to design teaching materials that focus on students' mathematical solving abilities by using appropriate learning models or strategies. Reference [15] said that the Think Pair Share (TPS) type of cooperative learning model is an effective learning model to improve students' mathematical problem solving abilities because students are required to do more activities while learning. TPS provides opportunities for students to work alone and collaborate with others. In line with [16], the Think Pair Share (TPS) type of cooperative learning model is suitable for use in junior high schools because the condition of junior high school students who are still in their teens makes them like new things and are more open with peers in solving the problems they face. Reference [17] argues that teaching students to solve problems will allow these students to be more analytical in making decisions in life. The statements above are the background for researchers to conduct research related to the development of teaching materials to improve students' mathematical problem-solving abilities through Think-Pair-Share cooperative learning.

2. Research Method

This research is a development research or often referred as Research & Development (R&D) research by adapting the 4-D development model, namely Define, Design, Develop, and Disseminate. The products that will be developed in this research are teaching materials in the form of teacher books, student books and the mathematical problem solving ability test instrument. This research was conducted at SMP Negeri 1 Pangkalan Susu. The subjects of this study were eight grade students of SMP Negeri 1 Pangkalan Susu. The research was conducted from August to September 2020. The teaching material is stated to be valid for use in trials if the validity score of each teaching material has a minimum valid category. The results of data analysis that do not meet the minimum valid category in this study will be taken into consideration for revising the product before being tested. Teaching materials are stated to be practical if the teacher's assessment in learning are in the practical category, and the results of the analysis of the implementation of teaching materials into the high

category. Teaching materials are said to be effective if they fulfill 4 indicators, namely: the level of student learning achievement, namely at least 85%, the achievement of learning objectives with criteria $\geq 75\%$, the achievement of a good learning time and a positive response to the learning process at least 80%. The schemes in this study are:

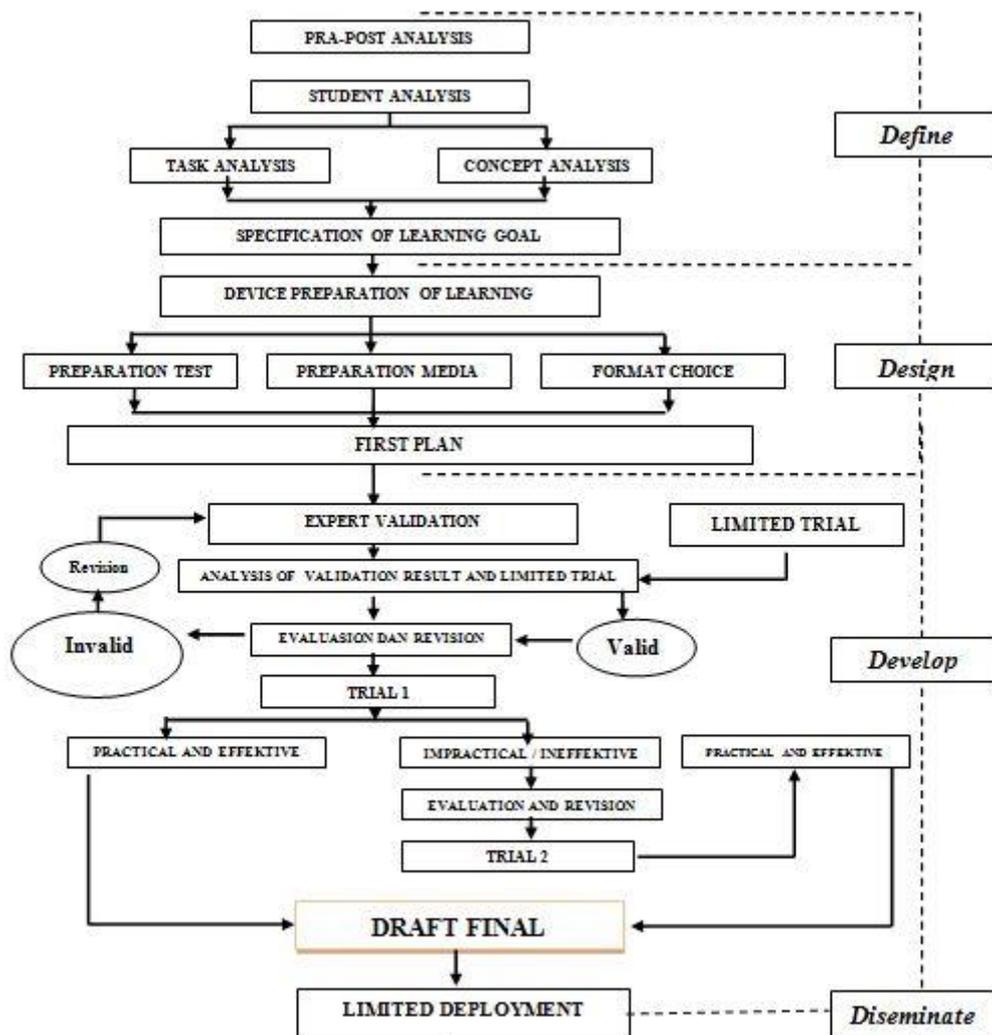


Figure 1: 4-D Model Learning Material Development Chart (Modified from [18])

3. Results and Discussions

In developing learning tools using the 4-D development model Thiagarajan, Semmel and Semmel, namely define, design, develop and disseminate. Where in this research disseminate was carried out limitedly. Trials in this study were conducted 2 times.

3.1. Validity of Teaching Materials

The validity of the teaching materials that have been prepared is tested first. The following will be presented in Table 1, a summary of the results of the validation assessment from the expert team.

Table 1: Scores of Teaching Materials Validation Results

Validator	Validated Product Score		
	Lesson Plan	Teacher Book	Student Book
I	4,5	4,5	4,8
II	4	4	4
III	4,1	4,5	4,8
IV	4,5	4,4	4,5
V	5	5	4,9
Total Score	4,4	4,7	4,6
Criteria	Valid	Valid	Valid

Based on this Table, it can be seen that the teaching materials and mathematical problem solving ability test instruments developed have a valid category in terms of expert judgment, so that they meet the validity criteria and can then be used in trials. In addition to providing an assessment of teaching materials, the validator also provides input as material for improvement. The research instrument in the form of a test has a valid and reliable score. Furthermore, it can be used in trials after being repaired according to the advice of experts. This is in line with [19] which states that the mathematics module set TPS type of cooperative learning that has been developed. The learning implementation plan, mathematics learning module, learning outcomes test) has all met the validity criteria, where previously several minor revisions had been made according to the suggestions given by the validator.

3.2. Practicality Data of Teaching Materials

After being validated, the product is revised. The next step is to do trial run to assess its practicality and effectiveness. Practicality data were obtained from teacher assessments of teaching materials as well as from observations of the implementation of teaching materials. From the teacher's assessment of the teaching materials, the average score was 3.4 in the first trial and an average score of 3.6 in the second trial. Based on the results obtained from the teacher's assessment of teaching materials, it is included in the very good category. The data from the observation of the implementation of teaching materials with Think-Pair-Share learning showsdown below.

Table 2: Percentage of Teaching Materials Implementation

Meetings	Materialize Averages
	Average
Trial I	3,66
Trial II	3,71
Description	High

From the data above, from the results of the analysis of the implementation of teaching materials, the

mathematics teaching materials developed into the high category. From the results of teacher assessments of teaching materials and observations of the implementation of teaching materials, this shows that the teaching materials developed are in the practical category. This is in line with the research of [20] which states that the think pair share type cooperative learning device falls into the practical category and is feasible to implement.

3.3. Data on The Effectiveness of Teaching Materials

In addition to the analysis carried out on the validity and practicality of the teaching materials, an analysis was also carried out on the effectiveness of the teaching materials. Analysis of the effectiveness of teaching materials in terms of achieving the level of student learning completeness, the achievement of learning objectives, the achievement of a good learning time and a positive response to learning. It can be seen from the Table below:

Trial I

Table 3: Trial Results I

No	Indicator	Description
1	Student learning completeness	Not achieved
2	Achievement of Learning Objectives	Not achieved
3	Time of Learning Activity	Effective
4	Student Response	Positive

From the table above, based on the criteria for the effectiveness of learning mathematics with mathematics teaching materials using Think-Pair-Share learning does not fulfill the effectiveness criteria because the indicators of student learning completeness and the achievements of the learning objectives are not fulfilled. Therefore, he conducted trial II.

Trial II

After conducting the first trial on draft II, furthermore the improvements are made to produce teaching materials that fulfill the good effectiveness. The achievement of the effectiveness of learning mathematics with mathematics teaching materials using Think-Pair-Share learning which determined based on classical student learning and the achievement of completeness of learning objectives, learning time and student responses to the learning materials developed can be seen in the following Table.

Table 4: Trial Results II

No	Indicator	Description
1	Student learning completeness	Achieved
2	Achievement of Learning Objectives	Achieved
3	Time of Learning Activity	Effective
4	Student Response	Positive

From the Table above, based on the criteria for achieving the effectiveness of mathematics teaching materials

developed using Think-Pair-Share learning, it can be concluded that the mathematics teaching materials are effectively used. From the explanation above, it can be said that the mathematics teaching materials developed through Think-Pair-Share learning meet the criteria of being valid, practical and effective. This is in line with the results of [9] research that the development of learning tools with the Think-Pair-Share type of cooperative learning model is valid, practical and effective.

3.4. Increasing Students' Mathematical Problem Solving Ability by Using Mathematics Teaching Materials Through Link-Pair-Share Learning

The improvement of the mathematical problem solving abilities in terms of the results of the students' mathematical problem solving abilities test. Based on the test results, it was found that the average score of the mathematical problem solving ability of the first trial was 73.125 and the second trial was 80. This means that the average score in the second trial increased. These results can be seen in the following Table.

Table 5: Score of Mathematical Problem Solving Ability Test Trial I and Trial II

Mathematical Problem Solving Ability	Average	
	Trial I	Trial II
	73,125	80

For more details, it can be seen in Figure 2:

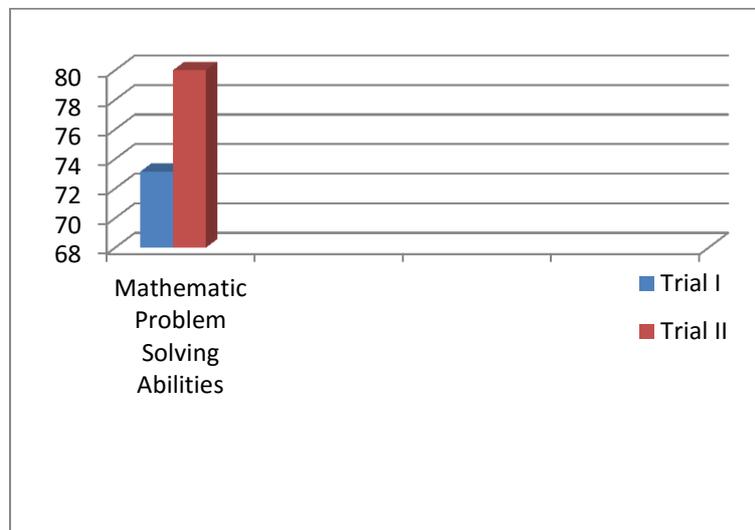


Figure 2: Results of the Improvement of Mathematical Problem Solving Ability

Based on the Tables and Figures above, it is known that the scores on trial II were better than trial I. This shows that the students' mathematical problem solving abilities using mathematics teaching materials developed through Think-Pair-Share learning have increased from trial I to trials. II. Based on the results above, it can be said that mathematics teaching materials developed through Think-Pair-Share learning can improve the students' mathematical problem solving abilities. This is in line with the results of research by [21] which states that the

Think-Pair-Share learning tool can improve student learning outcomes. Likewise, Reference [22] in their research found that student learning outcomes improved by using Think-Pair-Share cooperative learning. Through Think-Pair-Share learning, students can interact with each other in learning, be active and participated in learning activities. As [23] stated that the Think-Pair-Share type of cooperative learning can encourage students in learning activities to think, help each other, share and appreciate and encourage students to learn. This will affect students' mathematical learning abilities, especially students' mathematical problem solving abilities. It all will have an impact on students' mathematics learning achievement.

4. Conclusion

Based on the results of the research and discussion, can be concluded as:

1. Mathematics teaching materials developed through Think-Pair-Share learning is classified as valid category. The teaching material validation sheet, the lesson plan validation is 4.4; the teacher book validation was 4.7 in the very valid category, the student book validation was 4.6 in the very valid category, so the teaching material stated to be valid. Meanwhile the research instrument in the form of a test of mathematical problem solving abilities has a valid and reliable score.
2. Mathematics teaching materials developed through Think-Pair-Share learning are classified as practical categories. This can be seen from the results of the observation in the implementation of mathematics teaching materials through Think-Pair-Share learning, which shows that the Teacher's Assessment in the Teaching Materials shows an average of the first test is 3.4; the average in the second trial was 3.6. Both of them are in the very good categories and the average of all components of the observational implementation is 3.66 in trial I and 3.71 in trial II with the high category. This shows that in the practical category.
3. Mathematics teaching materials using Think-Pair-Share learning developed classified as effective category. Which is shown from the achievement of the level of student learning completeness, the achievement of learning objectives, the achievement of a good learning time and a positive response to learning.
4. There was an increase in students' mathematical problem-solving abilities using mathematics teaching materials developed through Think-Pair-Share learning, namely the average achievement of students' mathematical problem solving abilities in the first trial of 73.125 increased to 80 in the second trial.

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