TPS Type Cooperative Learning Model Based on PBL: Implementation and Influence on Mathematics Learning

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Abstrak

Kemampuan pemecahan masalah siswa dalam menyelesaikan soal cerita matematika sangatlah rendah. Dibutuhkan inovasi dan studi khusus terkait pemanfaatan model pembelajaran yang dapat meningkatkan kemampuan pemecaham masalah. Penelitian ini bertujuan untuk mengetahui perbedaan Hasil Tes kemampuan pemecahan Masalah matematika siswa dalam menyelesaikan soal cerita yang diajarkan dengan model pembelajaran kooperatif tipe think pair share dengan pendekatan problem-based learning dan hasil tes kemampuan pemecahan masalah matematika siswa yang diajarkan dengan model konvensional pada materi kubus dan balok. Subjek penelitian ini yaitu kelas VIIIA yang diajarkan dengan model pembelajaran kooperatif tipe *think pair share* dengan pendekatan *problem-based learning* dan kelas VIIIB menggunakan model pembelajaran konvensional. Kedua kelas tersebut homogen atau setara. Data pada penelitian ini diambil dari hasil *Pretest dan Posttest* dari kedua kelas. Nilai rata-rata *Pretest* untuk kelas eksperimen adalah 59,562 dan untuk kelas kontrol 49,409. Sedangkan untuk nilai rata-rata *Posttest* kelas eksperimen yaitu 86,093 dan kelas kontrol yaitu 69,818. Hasil penelitian yang didapat pada kedua kelas dengan menggunakan uji hipotesis yaitu uji-t dengan taraf signifikan 5% diperoleh bahwa nilai $t_{hitung} = 3{,}496 > t_{tabel} = 2{,}006$ ini berarti H_0 ditolak dan terima H_1. Dengan demikian dapat disimpulkan bahwa hasil tes kemampuan siswa dalam pemecahan masalah matematika menyelesaikan soal cerita lebih baik menggunakan model pembelajaran kooperatif tipe *think pair share* dengan pendekatan *problem-based learning* dari pada model pembelajaran konvensional pada materi kubus dan balok.

Kata Kunci: *Model Pembelajaran, Think Pair Share, Problem Based Learning, Kubus, Balok*

Abstract

Students' problem-solving abilities in solving mathematics story problems could be much higher. Innovation and special studies are needed regarding learning models that can improve problem-solving abilities. This research aims to determine the differences in the test results of students' mathematical problem-solving abilities in solving story problems taught using the think pair share type cooperative learning model with the problem-based learning approach and the results of tests of students' mathematical problem-solving abilities taught using the conventional model on cube and block material. The subjects of this research are class VIIIA, which is taught using a think pair share type cooperative learning model with a problem-based learning approach, and class VIIIB, which uses a conventional learning model. The two classes are homogeneous or equal. The data in this study were taken from the pre-test and post-test results from both classes. The average pre-test score for the experimental class was 59.562, and for the control class, 49.409. Meanwhile, the average post-test score for the experimental class was 86.093, and the control class was 69.818. The research results obtained in both classes using hypothesis testing, namely the t-test with a significance level of 5%, showed that the value of t_{count}=3.496 > t_{tabel}=2.006 means that H_0 is rejected and H_1 is accepted. Thus, the test results of students' ability to solve mathematical problems to solve story problems are better using the think pair share type cooperative learning model with a problem-based learning approach than the conventional learning model using cube and block material.

Keywords: *Learning Model, Think Pair Share, Problem-Based Learning, Cubes, Blocks*

INTRODUCTION

Mathematics is a science that requires higher thinking abilities. Apart from that, mathematics is also a field of science that is a tool for thinking, communicating, a tool for solving various practical problems, and can provide convenience in responding to a problem [49], [2], [12], [13]. In other words, mathematics can hone students' thinking skills [36], [3], [15], [21]. Mathematics itself is a science that is considered difficult for students, but mathematics actually brings perfect changes, especially at the education level [35], [11], [22], [24]. The difficulties experienced by students in learning mathematics are due to students' need for understanding and interest in mathematics lessons [4], [43], [9], [25]. One of the factors causing this is a passive class condition, where students are less involved in learning, and some students already think that mathematics is a complex subject. Hence, the class tends to become tense, and students become reluctant to learn mathematics [26], [46], [42], [38].

Based on this, teachers must implement a learning model to improve students' mathematical problem-solving abilities. In reality, the learning model that has been used so far is the conventional learning model [16], [27], [14], [15]. Where the teacher explains the material and mathematical concepts while the students only take notes and do some practice questions, then the teacher discusses and so on [28], [17], [5], [1]. This learning tends to be monotonous and makes students passive.

Therefore, students need to be taught in an exciting way that students can understand. There is also a need for innovation in learning models to achieve learning objectives. A learning model is a learning design pattern that systematically describes step-by-step learning to help students construct information and ideas and build thought patterns to achieve learning goals [28], [20], [44], [10]. Mistakes in choosing a learning model influence whether learning is achieved [40], [47], [23], [29], [30]. Finding out whether the learning objectives have been completed can be seen from the results of tests on students' problem-solving abilities in solving story problems [19], [39], [50], [31]. The results of students' problem-solving ability tests describe the level of student success after participating in learning activities for a certain period [45], [18], [32], [43].

Based on the results of interviews and observations that I conducted at SMP N 3 Tondano, some problems occur in class, namely: the learning process is monotonous, students' learning patterns are still dominated by conventional learning, students do not participate enough and only play around, telling stories with fellow students in learning so that the teaching and learning process seems passive. There many students still need help with the teaching and learning process. Especially the level of understanding and ability of students to solve problems. Including problems related to cube and block material that have not achieved the desired goals because their learning outcomes in this material are still low and have yet to reach the KKM, namely 70.

Apart from that, the daily test scores on cubes and blocks in the even semester from 54 students show that most students still got scores below the KKM, namely 70. This indicates that of the 54 students, only nine achieved the KKM with an average of 70.111 and a percentage of 17%, while 45 students still need to reach the KKM with an average of 39,866 and 83%. Even though the school has used the 2013 curriculum, the learning outcomes have yet to get the KKM. While learning mathematics in class, students feel bored and still need help understanding and working on the questions given, one of which is on cubes and blocks.

Based on the problems above, what teachers must pay attention to when teaching a subject is choosing models and methods appropriate to the learning material so that students appear active in learning. So, one learning model that can be used as an alternative in mathematics is the think pair share (TPS) learning model. According to Trianto [48], one of the advantages of the TPS learning model is responding to and helping students to work together. Aqib [8] suggests that the think pair share learning model or think, pair, share is a type of cooperative learning designed to influence student interaction patterns. Then, the application of the TPS learning model is still lacking; they have never used any learning approach. Therefore, the author uses the Think Pair Share learning model with a Problem-Based Learning (PBL) approach.

The Problem-based Learning (PBL) approach is a learning approach that uses problems as the first step in gaining new knowledge from students. In addition, the PBL approach is a learning process where the starting point of learning begins based on problems in real life. Students are stimulated to study problems based on the knowledge and experience they have previously (prior knowledge) to form new knowledge and experience [6], [41], [7], [33], [34].

Research related to problem-based learning has been carried out by various researchers [7][18][19][13]. However, there are fundamental differences between several previous studies and this research as related to the focus and learning materials that are the object of research. This research focuses on TPS-type cooperative learning based on problem-based learning on cube and block material.

METHODS

The type of research applied is a quasi-experimental research with a pretest-posttest control group design, namely researching the application of the think pair share (TPS) type cooperative learning model with problem-based learning (PBL) approach to improve students' abilities in problem-solving. Mathematics solves problems in the form of stories on cubes and blocks. This research will be conducted at SMP N 3 Tondano in the 2022/2023 academic year, namely in the even semester. The application of the research schedule will be adjusted to the schedule applicable at the school. The material provided in the research determines the surface area and volume of cubes and blocks. Based on the type of research, the research design for this research is Pretest and Posttest Control Group Design with a Two-Group Pretest-Posttest Design research design.

Tabel 1. Two-group Pretest-Postest Design

Class	*Pretest*	Treatment	*Posttest*
Experiment	R_1	A	R_2
Control	T_1	B	T_2

The research instruments used consisted of learning tools in lesson plans, LKPD, and written tests in the form of descriptions. This type of test measures students' problem-solving abilities to solve questions in story form, as seen from the students' cognitive aspects in the Cubes and Blocks material. According to Polya, the mathematical problem-solving ability test consists of four stages, namely: (1) Understanding the problem, (2) making a solution plan, (3) Implementing the Solution plan, and (4) rechecking the final results. Researchers design the mathematical problem-solving ability test questions to identify indicators of the learning objectives to be achieved. Before the research instrument is used, a validity test is first carried out. This validity test was consulted with supervisors, expert validators, and mathematics subject teachers to determine whether the test was suitable for use in research.

Data collection in this research was carried out by providing research instruments in the form of tests of students' mathematical problem-solving abilities in solving story problems. The test is given before and after treatment. The results of the test are then used as data in the research. This research procedure was carried out as in diagram 1 below.

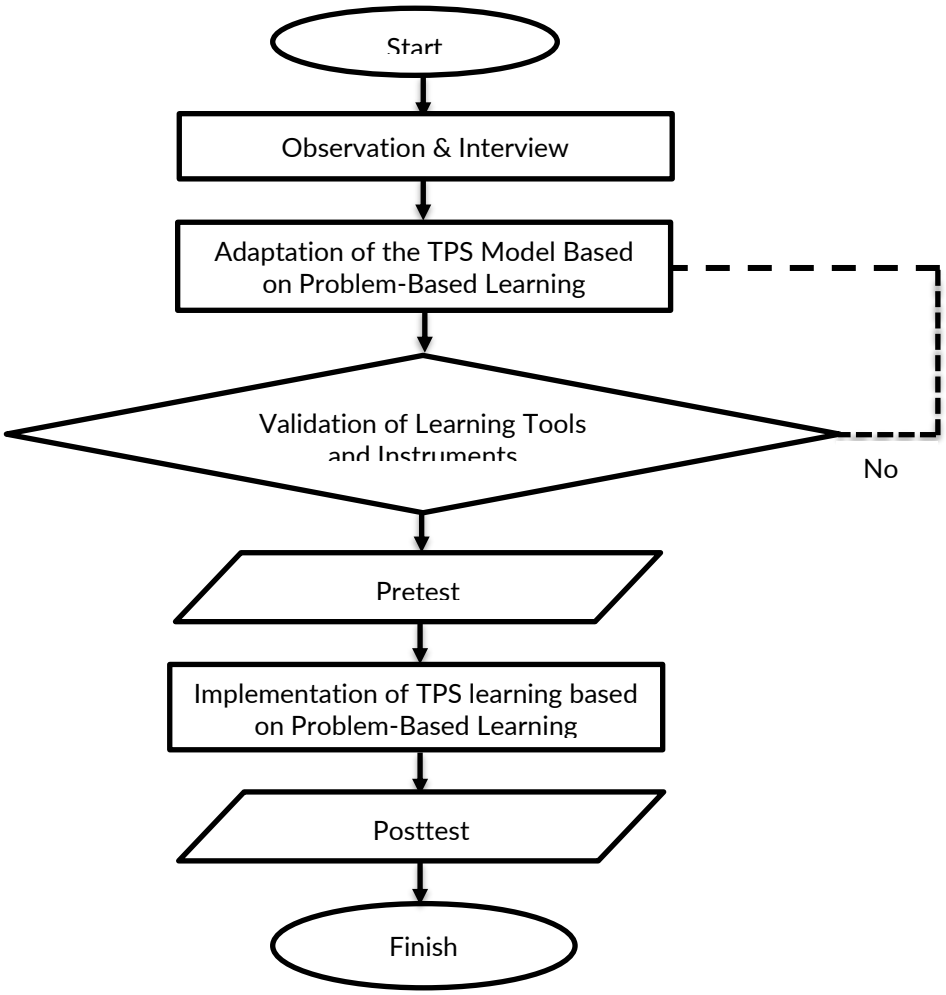

Diagram 1. Research Procedure

RESULT AND DISCUSSION

Result

This research was carried out at SMP N 3 Tondano in the even semester 2022/2023 in class VIIIA as an experimental class, namely a class that studied using a think pair share type cooperative learning model with a problem-based learning approach with a total of 32 students and class VIIIB as a control class, namely a class that is studying with conventional learning with a total of 22 students. The data taken are the results of tests on students' abilities in solving mathematical problems on cubes and blocks.

The results of this research can be described in Appendix 1 of the pretest and posttest results of students' abilities in solving mathematical problems taught using the TPS-type cooperative learning model with a PBL approach.

1. Data from pretest and posttest results on students' abilities in solving mathematical problems in the experimental class

   The following table is a summary of the experimental class pretest and posttest data

Table 2. Pretest and Posttest Results for Experimental Class

No	Sttistic	Statistic Value	
		pretest	*posttest*
1	Total	1906	2755
2	Average	59,562	86,093
3	Minimum Score	47	75
4	Maximum Score	74	96
5	Range	27	21
6	Median	59,5	85,5
7	Variance	57,028	23,442
8	Standard Deviation	7,551	4,841

2. Data from pretest and posttest results on students' abilities in solving control/conventional class mathematics problems
   The following table is a summary of the control class Pretest and Posttest data

Table 3. Control Class Pretest and Posttest Results

No	Statistic	Statistic Value	
		pretest	*posttest*
1	Total	1087	1536
2	Average	49,409	69,818
3	Minimum Score	35	50
4	Maximum Score	70	85
5	Range	35	35
6	Median	47	70

Based on the table above, it can be described that in the experimental class, there are 32 students. Based on the results of pre-test calculations of students' mathematical problem-solving abilities, the average mathematical problem-solving ability of practical class students is 59.562, with a standard deviation = 7.551 and a variance of 57.028. In contrast, the post-test calculations are based on the calculation of the post-test results of the mathematical problem-solving ability of the experimental class, which was 86.093, with a standard deviation of 4.841 and a variance of 23.442. In the control class, there were also 22 students. Based on the results of the pre-test calculation of students' mathematical problem-solving ability, the average control class mathematical problem-solving ability was 49.409 with standard deviation = 9.540 and variance = 91.051, while the calculation of the post-test results of students' mathematical problem-solving skills shows that the average control class mathematical problem-solving ability is 69.818 with standard deviation = 8.133 and variance = 66.155.

3. Description of the Difference in Pretest and Post Test Data on Students' Ability to Solve Mathematical Problems in the Experimental and Control Classes
   a. Description of the difference between pretest and posttest data on students' abilities in solving mathematical problems in the experimental class
      Data presented on the difference between pretest and posttest results of students' abilities in solving mathematical problems taught using the TPS type cooperative learning model with the PBL approach in the experimental class. From the data above, it is known that the average difference between the pretest and posttest students' abilities in solving mathematical problems in solving story problems taught using the TPS type cooperative learning model with the PBL approach is 26.531.
   b. Description of the difference between pretest and posttest data on mathematical problem-solving abilities in the control class
      Data from the difference in pretest and posttest results of students' abilities in solving mathematical problems and completing story problems taught using direct learning, namely conventional in the control class. From the existing table, it can be seen that the average difference between the pretest and posttest students' abilities in solving mathematical problems in solving story problems taught using direct (conventional) learning is 20.409. Based on the table of differences in students' pretest and posttest results above, it can be seen that there is a difference in the average difference between the pretest and posttest in students' abilities to solve mathematical problems in completing story problems taught using the TPS type cooperative learning model with the PBL approach with the average difference between the pretest and posttest. Students' abilities in solving mathematical problems and completing story problems are taught using conventional learning models. The difference between the average pretest and posttest ability of students in solving mathematical problems in solving story problems taught using the TPS type cooperative learning model with a PBL approach is higher than the average difference between the pretest and posttest ability of students in solving mathematical problems solving story problems taught using the model—conventional learning.
   c. Analysis of research data and hypothesis testing
      Before testing the hypothesis using the t-test, a normality test and homogeneity test are first carried out as prerequisite test variances.
      1) Data Normality Test

The data normality test is intended to determine whether the data in the results of this research have a normal distribution of data. The sample is normally distributed if $L_{count}<L_{table}$ is fulfilled at the α = 0.05 level. Data was obtained using the Liliefors test which was completed using Microsoft Office Excel 2010 software.

The following is the hypothesis for the normality test:

H_0= normal distribution of data

H_1= data is not distributed normally

Based on the results of normality test calculations for all groups, the value $L_{count}<L_{table}$ is obtained at a significant level of α=0.05 so there is no reason to reject H_0. This shows that all groups of data in this study come from a normally distributed population.

Table 4. Summary of Data Normality Test

Class	n	L_{hit}	L_{tab}	Information
Experiment	32	0.120	0.154	Normal
Control	22	0.127	0.184	Normal

Thus, from table 4 above, it shows that the data from the two groups of students used as research samples had a result of $L_{count}<L_{tabel}$, namely in the experimental class 0.120 < 0.154 and in the control class, namely 0.127 < 0.184 at the α = 0.05 level, which means that the calculation results have a distribution. which is normally distributed.

2) Data Homogeneity Test

The intended test on homogeneity data is to determine whether the research sample data comes from a homogeneous population or can represent another population. The second test uses the same variance, namely F, in both samples to test homogeneity.

The hypothesis to be tested is as follows:

$$H_0: \sigma_1^2 = \sigma_2^2$$
$$H_1: \sigma_1^2 \neq \sigma_2^2$$

For the experimental and control class results data, $F_{count} < F_{table}$ was obtained, namely 1,595 < 1,907 at the α = 0.05 level. Based on the calculation results, it can be concluded that the experimental and control classes came from a homogeneous population.

3) Hypothesis Testing

After knowing that the data on student's ability to solve mathematical problems to solve story problems for both samples had a normal and homogeneous distribution, we will carry out a hypothesis test. The researcher tested this hypothesis on post-test data using the t-test. The results of post-test data from the two samples, namely the experimental and control classes:

$H_0 : \mu_1 = \mu_2$

$H_1 : \mu_1 > \mu_2$

Information:

H_0 : The average test of students' problem-solving abilities using the TPS-type cooperative learning model with the PBL approach is not different from the average test of students' problem-solving abilities using conventional learning models.

H_1 : The average test of students' ability in problem-solving using the TPS type cooperative learning model with the PBL approach is higher than the intermediate student learning outcomes using the conventional learning model

Real level: α=0.05

- Critical area: $t_{count}>t_{table}$
- The test statistic used is the t statistical formula.

$$t = \frac{\bar{X}_1 - \bar{X}_2}{s\sqrt{\frac{1}{n_1}+\frac{1}{n_2}}} \quad with \quad s = \sqrt{\frac{(n_1-1)S_1^2 + (n_2-1)S_2^2}{n_1+n_2-2}}$$

- Hypothesis testing criteria:

H_0 is rejected if the critical region is: $t_{count} > t_{table}$

Table 5. Summary of Hypothesis Testing Calculation Results

Class	Average Difference	Var	T	$t_{0,05}$	H_0
Experiment	26,531	23,442	3,496	2,006	Rejected
Control	20,409	66,155			

Because $t_{count}=3.496>t_{table}=2.006$ then H_0 is rejected so H_1 is accepted. So it can be concluded that the average difference in students' abilities in problem solving taught using the thin pair share cooperative learning model with a problem based learning approach is higher than the average difference in students' abilities in problem solving taught using conventional learning.

Discussion

This research was conducted at SMP Negeri 3 Tondano in the even semester of the 2022/2023 academic year. The data from this research were taken from 2 classes, namely class VIIIA, an experimental class with 32 students, and class VIIIB, a control class with 22 students. This research is empirical.

Then, the learning given to the experimental class used a think pair share type cooperative learning model with a problem-based learning approach, and the control class used conventional learning. This section describes and interprets research data on students' abilities to solve mathematical problems for students taught using the TPS-type cooperative learning model with PBL and conventional approaches.

According to the data obtained, the average pretest score for students' ability to solve mathematical problems in solving story problems in the experimental and control classes had the same issues. The average pretest score for students' ability to solve mathematical problems in completing story problems for the practical class was 59.562, and for the control class, 49.409. Between the two pretest average scores, students' problem-solving abilities in solving story problems on cubes and blocks in the experimental and control classes have differences.

Furthermore, the average post-test score for students' ability to solve problems in solving story problems for the experimental class was 86,093, and for the control class was 69,818. The average post-test score for students' ability to solve mathematical problems to solve story problems was higher than that of the control class.

Thus, the Think Pair Share type cooperative learning model with a problem-based learning approach can improve students' abilities in solving students' mathematical problems with cube and block material. So, the results of research conducted using the TPS-type cooperative learning model with a PBL approach are better in helping the learning process, where students are actively involved in the learning process so that students can solve mathematical problems, especially story problems.

The results of this research are relevant to the research researched by Indah [19] entitled "The influence of the problem-based learning approach with the think pair share type cooperative learning model on increasing problem-solving abilities." It concludes that the mathematics learning outcomes of students taught using the TPS-type cooperative learning model with a PBL approach are better than those of conventional learning models.

CONCLUSION

Based on the results of data analysis, it can be concluded that the test results of students' ability in problem solving taught using the Thik Pair Share type cooperative learning model with the Problem Based Learning approach are higher than those taught using the conventional learning model on Cubes and Blocks material in class VIII SMP N 3 Tondano. Using the Think Pair Share type cooperative learning model with a Problem Based Learning approach can improve students' abilities in solving problems on Cubes and Blocks material. For this reason, teachers can make new changes, master the models or strategies contained in learning so as to create more interesting learning at school. Then by collaborating models and approaches so that students do not feel bored learning mathematics and can make it easier for students to understand each material.

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