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Improving Mathematical Problem Solving Ability Through Think Pair Share for Junior High School Students

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ABSTRAK

Dalam pembelajaran matematika, kemampuan pemecahan masalah sangatlah penting. Kemampuan pemecahan masalah akan membantu keberhasilan orang tersebut dalam kehidupan sehari-hari. Penelitian ini bertujuan untuk menganalisis peningkatan kemampuan pemecahan masalah matematik (KPMM) siswa yang pembelajarannya menggunakan strategi kooperatif tipe Think-Pair Share (TPS). Penelitian ini merupakan penelitian tindakan kelas tindakan kelas ini yang terdiri dari tiga siklus. Subjek dalam penelitian ini adalah siswa kelas VIII-A yang terdiri dari 34 siswa. Instrumen yang digunakan berupa tes kemampuan pemecahan masalah matematik (KPMM). Analisis data dilakukan dengan uji peningkatan (gain ternormalisasi), ketuntasan belajar dan rata-rata tingkat penguasaan. Berdasarkan hasil tes KPMM diperoleh informasi bahwa terdapat perbedaan ketuntasan belajar klasikal pada aspek kemampuan pemecahan masalah matematik pada siklus I, II, dan III. Hasil temuan ini didukung oleh banyaknya siswa yang tuntas pada tiap siklus. Untuk KKM 65, pada siklus I banyaknya siswa yang tuntas ada 13 siswa (38,24% dari 34 siswa), pada siklus II banyaknya siswa yang tuntas ada 23 siswa (67,65% dari 34 siswa), dan pada siklus III banyaknya siswa yang tuntas ada 28 siswa (82,35% dari 34 siswa). Dapat disimpulkan bahwa pembelajaran TPS dengan cara siswa secara berkelompok mengerjakan LKS dan dibimbing guru cara mengubah soal cerita ke dalam bentuk model matematika dapat meningkatkan KPMM siswa dengan kriteria tinggi. Banyaknya siswa yang tuntas pada siklus III lebih banyak dibandingkan dengan banyaknya siswa yang tuntas pada siklus I dan II.

ABSTRACT

In learning mathematics, problem-solving skills are very important. Problem-solving skills will help the person succeed in everyday life. This study aims to analyze the increase in mathematical problem-solving abilities (KPMM) of students whose learning uses the Think-Pair-Share (TPS) cooperative strategy. This research is a class action research that consists of three cycles. The subjects in this study were students of class VIII-A, consisting of 34 students. The instrument used is a mathematical problem-solving ability test (KPMM). Data analysis was carried out with an increased test (normalized gain), learning completeness, and the average level of mastery. Based on the KPMM test results, information was obtained that there were differences in classical learning mastery in aspects of mathematical problem-solving ability in cycles I, II, and III. These findings are supported by the number of students who complete each cycle. For KKM 65, in cycle I, the number of students who completed was 13 students (38.24% of 34 students). In cycle II the number of students who completed was 23 students (67.65% of 34 students), and in cycle III, the number of students who completed there was 28 students (82.35% of 34 students). It can be concluded that TPS learning using students working on worksheets in groups and being guided by the teacher on changing word problems into a mathematical model can increase the KPMM of students with high criteria. The number of students who complete cycle III is more than those who complete cycles I and II.

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1. INTRODUCTION

Problem-solving is one of the skills needed in the 21st century. Through this skill, it is hoped that all life problems can be resolved (Effendi et al., 2021; Pristiwanto, 2016). Problem-solving ability is crucial in learning mathematics (Elita et al., 2019; Irwanti & Zetriuslita, 2021). Problem-solving ability can be a way for students to build ideas about mathematics and be responsible (Moma, 2017; Utomo et al., 2021). Mathematical problem-solving abilities for a person will help people succeed in everyday life (Primayanti et al., 2019). The importance of problem-solving ability is a general goal of learning mathematics. The problem-solving ability of each student is different and depends on the level of intelligence possessed by the student (Effendi et al., 2021; Hanifah & Indarini, 2021). The goal of problem-solving in mathematics is to increase students' willingness to improve their problem-solving skills and to make them aware of problem-solving strategies. Problem-solving can include methods, procedures, and strategies, or the methods used are the core and main processes in the mathematics curriculum (Dinda et al., 2021; Gunantara et al., 2019). Problem-solving is a basic ability in learning mathematics, so problem-solving ability in mathematics is very important for a student and is also one-factor determining student learning outcomes in mathematics.

However, the low ability to solve mathematical problems is due to ineffective learning, especially the lack of study hours (Fransiska et al., 2019; Gunantara et al., 2019). Difficulties are still encountered in understanding and interpreting information on given problems, as well as difficulties in determining appropriate problem-solving strategies. Problems were also found in the eighth grade of SMP Negeri 1 Garut. From year to year, the authors found that 85% of students from one class had difficulty solving mathematical problems. Based on the results of discussions with other mathematics teachers at SMP Negeri 1 Garut, it turned out that they experienced the same thing regarding students' weaknesses in solving mathematical problems. The results of empirical observations at school show that, in general, students have difficulty solving mathematical problems, especially for circle material. Weak students in solving mathematical problems caused by the learning model are inappropriate. The learning model tends to be conventional, teacher-centered learning and prioritizes using the expository method. Students experience difficulties solving mathematical problems in the form of word problems caused by difficulty compiling a mathematical model. Students seem to need help understanding the meaning of the story in the problem, so students are unable to formulate an appropriate mathematical model. The weak condition of students solving word problems must be balanced with the practice of learning mathematics that the teacher has been doing so far. It is possible because only some of the steps in the learning syntax the teacher has carried out have contributed positively to students' ability to solve word problems. So, the learning steps that the teacher has carried out need to contribute more to students' abilities to find their mathematical models.

The solution to these problems is to apply a learning model that can improve students' ability to solve problems while involving students' activeness in learning. The applied learning model should be through innovative, challenging, and fun learning experiences (Dewi et al., 2021; Suantara et al., 2019). One learning model that can be applied is the cooperative learning model (cooperative learning). This learning model can accommodate students' social development. Cooperative learning is learning together (cooperative learning) to achieve goals (Halawa et al., 2022; Putu Wulandari et al., 2018). One of the cooperative learning models that can be applied is the think pair share (TPS) cooperative model (Dewi et al., 2021; Meilana et al., 2020). The cooperative learning model of the think pair share type can build good interactions and social processes in the teaching and learning process and increase student motivation to learn by discussing in class (Halawa et al., 2022; Santra et al., 2018). The TPS learning model is a learning model that can help motivate students in the learning process (Ramadhani, 2017). This learning model aims to facilitate the management of information and communication and develop students' way of thinking in participating in learning (Meilana et al., 2020). The think pair share (TPS) model is a learning model that provides opportunities for students to be more flexible in responding to the knowledge and questions given (Suantara et al., 2019). Previous research findings stated that the think pair share learning model based on portfolio assessment affected science knowledge competence (Putu Wulandari et al., 2018). The think pair share (TPS) learning model assisted by concrete media can improve science learning outcomes (Siregar et al., 2017; Sutama et al., 2017). Cooperative model type think pair share elementary school students' motivation and mathematical communication skills (Septiningtyas et al., 2018; Zain & Ahmad, 2021). The cooperative learning model of the think pair share (TPS) type assisted by an investigative approach affects mathematical communication skills (Fahrullisa et al., 2018). The application of TPS learning aims to improve students' ability to solve mathematical problems. This needs to be followed up so that the problem of solving mathematical problems at each subsequent level of education can be overcome. This study aimed to analyze TPS learning to improve the mathematical problem-solving skills of eighth-grade students at SMP Negeri 1 Garut.

2. METHOD

This type of research is classroom action research. The subjects of this study were class VIII-A students of SMP Negeri 1 Garut consisting of 34 students. The second researcher himself is a Class VIII-A math teacher at SMP Negeri 1 Garut. Research data collection uses two types of instruments, tests, and non-tests. The instrument in the form of a test consists of questions on the prior knowledge test on mathematics and the KPMM test. While the non-test form instruments consist of an attitude scale and observation sheets of teacher and student activities. Tests for early knowledge of mathematics are in the form of knowledge, skills, or abilities possessed by students and brought into the learning process before learning occurs. This initial knowledge of mathematics is measured using test questions adopted from practice questions for each subject in textbooks for odd-semester eighth-grade junior high school mathematics and following the education unit-level curriculum—selecting questions based on the material that students have studied. The selected questions are modified only to the editorial and terms adapted to the students' situation, while the others are by the original. There are several considerations for adopting questions from textbooks, including questions prepared by expert math textbook writers who are accompanied by math textbook editors and have obtained ISBNs. Hence, there is no doubt about their validity. Students received the scope for the test material in the eighth grade, odd semester. 3) The difficulty level varies, and the abilities involved follow the Kurikulum Tingkat Satuan Pendidikan (KTSP) expectations. The initial knowledge test in mathematics was given to students of SMP Negeri 1 Garut Class VIII-A in an even semester, which were used as research subjects to know students' knowledge before learning took place.

A set of questions adopted, selected, and modified from math textbook questions prepared by experts, is appropriate to be used as a tool for measuring initial knowledge of mathematics in grade eight junior high school even semester. This early knowledge test tool places students in study groups by considering the average daily score. Giving a preliminary knowledge test in mathematics, besides aiming to find out students' knowledge before learning takes place, is also intended to form study group members according to the demands of the TPS learning approach. The test scores of students' prior knowledge of mathematics were converted into grades from 0–100. There are a total of 6 questions tested. Each item has a maximum score of 4. Determining the classification of students' prior knowledge of mathematics, the test score of the prior knowledge of mathematics is added to the average daily odd semester grade eighth grade, and the result is divided by two. The daily average score determines the classification of students' prior knowledge of mathematics to obtain prior knowledge of mathematics close to the truth. The student's daily average score was obtained by students based on several test results conducted by the mathematics teacher before the grouping test was carried out. The score of prior knowledge of mathematics and the average daily score is used as the basis for grouping students in TPS learning. The score of prior knowledge of mathematics and the daily score of students for each group is arranged so that the average is not too different or almost the same.

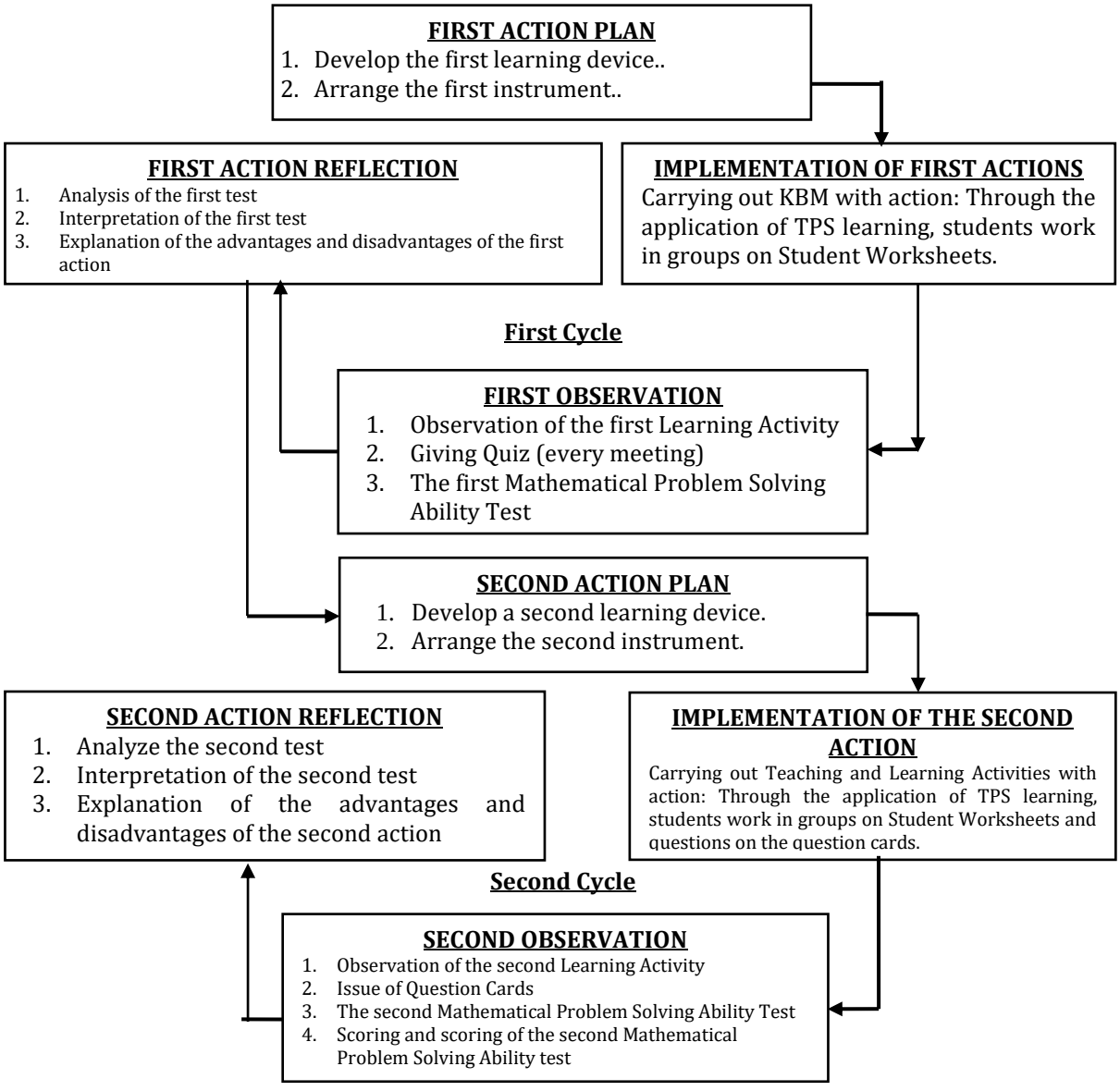
Mathematical problem-solving ability test. The purpose of compiling mathematical problem-solving ability test questions mathematical problem-solving abilities is to measure students' ability to solve mathematical problems, which consist of four aspects of mathematical problem solving, aspects of understanding the problem, making plans, completing calculations, and re-checking the results of calculations. This problem-solving ability test is composed of three sets for three cycles. The material tested includes the circumference of a circle (first cycle), the area of a circle (second cycle), the relationship between the central angle, the length of the arc, and the area of the sector (third cycle). The questions for this problem-solving ability test are all in the form of descriptions. Data on mathematical problem-solving ability is scored on student answers for each item. The scoring criteria are guided by the references put forward by Cai, Lane, and Jacobesin through the "Holistic Scoring Rubrics" in Table 1.

Table 1. Scoring Criteria for Testing Mathematical Problem Solving Ability

Aspects	Score	Criteria
Understanding the problem	0	Misinterpretation of questions or no answers at all.
	1	Misinterpreted some of the questions or ignored the condition of the questions.
	2	Complete understanding of the problem or question.
Making plans	0	Strategy is irrelevant or no strategy at all.
	1	The strategy used is less able to be implemented and cannot be continued.
	2	The strategy used is correct but leads to wrong answers or does not try other strategies.

Aspects	Score	Criteria
Completing calculations	3	Using several procedures that lead to the correct answer.
	0	No answer at all.
	1	Using several procedures that lead to the correct answer.
	2	The wrong result or part of the result is only a miscalculation.
	3	The results and procedures are correct.
Checking the calculation results again	0	There is no inspection or no information whatsoever.
	1	There is an examination, but it is incomplete or incomplete.
	2	The examination is carried out fully to see the truth of the results and processes.

The learning process activities in this study were carried out with TPS learning as a treatment in the class that was used as the research subject. The steps for teacher and student learning activities at the first meeting are guided by lesson plan 1 for circle and circle definitions and getting to know the elements of circles through TPS learning. Data obtained from research results using all research instruments. The principles include researching data originating from sources, analyzing the data based on each data source, and looking at the relationship of one fact to another. Furthermore, the writer tries to make conclusions about students' mathematical problem-solving skills in learning mathematics due to TPS learning. The math problem-solving ability test results in the first, second, and third cycles show the increase using normalized gain, the percentage of classical learning completeness, and the average level of mastery of the material being taught. Stages of the action flow are carried out for each cycle. The entire cycle in this study consists of three cycles, presented in Figure 1.



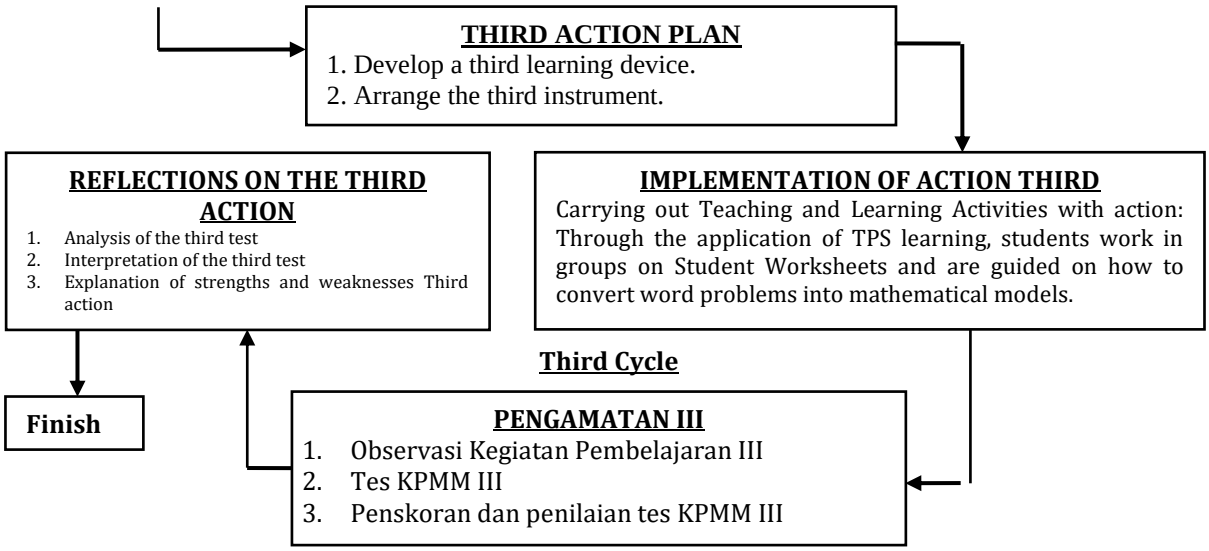


Figure 1. Stages of the Action Flow

3. RESULT AND DISCUSSION

Result

This research is classroom action research. Students' initial knowledge of mathematics in this study was measured using a test kit of 6 questions. The questions are arranged based on a grid by the subject matter taught in the odd semester of eighth grade. Before being used, the test tool for prior knowledge of mathematics was validated by five mathematics teachers at SMP Negeri 1 Garut. In addition to being used as a basis for grouping students who are used as research subjects, students' prior knowledge of mathematics. In addition, it is used as a basis for seeing an increase in student learning outcomes in the first, second, and third cycles. Based on an analysis of data on the score of students' prior knowledge of mathematics, information was obtained regarding the average Mastery of Classical Learning with a Minimum Mastery Criterion of 65 and the Average Level of Mastery presented in Table 2.

Table 2. KBK dan RTP

	The score of early knowledge of mathematics	Criteria
KBK Average	8.09	Not Completed
RTP	0,49	Very low

Table 2 shows that the score of the students' initial knowledge of mathematics in terms of KBK still needs to be completed (none of the students have completed or achieved the Minimum Completeness Criterion of 65), apart from going through the KBK analysis to find out the average level of mastery, an analysis of the average level of mastery was also carried out. The average level of student mastery based on the score of prior knowledge of mathematics still needs to be higher. It shows that the students' initial knowledge of mathematics on the material taught in the previous semester, the odd semester of Grade 8, was low. This fact shows that students' memory of the subject matter taught some time ago is low. Students' mathematical problem-solving abilities in the first cycle and research data relating to mathematical problem-solving abilities in the first cycle were obtained through tests of mathematical problem-solving abilities on the topic Circumference. The results of a summary of mathematical problem-solving abilities in the first cycle based on the Think Paire Share (TPS) approach are presented in Table 3. Table 3 illustrate that the average score of students' mathematical problem-solving abilities in the first cycle is higher than that of students' prior knowledge of mathematics. Likewise, the number of students who complete the first cycle is more than the initial knowledge of mathematics. It shows an increase in the number of students who complete the test results of mathematical problem-solving abilities in the first cycle. Based on the score of prior knowledge of mathematics, none of the students completed or achieved the Minimum Completeness Criteria with a score of 65. The improvement criteria were moderate based on the normalized gain from prior knowledge of mathematics to mathematical problem-solving abilities in the first cycle. Research data relating to the ability to solve mathematical problems in the second cycle

was obtained through a test of the ability to solve mathematical problems in the second cycle on the topic of Circle Area. The results of a summary of mathematical problem-solving abilities in the second cycle based on the Think Paire Share (TPS) approach using Student Worksheets and Question Cards are presented in Table 4.

Table 3. Completeness and Improvement of the First Cycle of Prior Knowledge of Mathematics

	First Cycle Score	The score of early knowledge of mathematics	Improvement	Criteria
Average	17,38	8,09	0.55	Moderate
Completed Subject	13	0		
Incomplete Subject	21	34		

Table 4. Completeness and Improvement of the Second Cycle of Prior Knowledge of Mathematics

	Second cycle score	The score of early knowledge of mathematics	improvement	Criteria
Average	68.82	8,09	0,66	Moderate
Completed Subject	23	0		
Incomplete Subject	11	34		

Table 4 show that the average score of students' mathematical problem-solving ability in the second cycle is higher than that of students' initial knowledge of mathematics. Likewise, the number of students who complete the second cycle is more than the initial knowledge of mathematics. It shows an increase in the number of students who complete the test results of mathematical problem-solving skills in the second cycle. Based on the score of prior knowledge of mathematics, none of the students completed or achieved the minimum completeness criterion with a score of 65. The improvement criteria were moderate based on the normalized gain from prior knowledge of mathematics to mathematical problem-solving abilities in the second cycle. Students' mathematical problem-solving abilities in the third cycle and research data relating to mathematical problem-solving abilities in the third cycle were obtained through tests of mathematical problem-solving abilities on the topic of the relationship between central angles, arc length, and cross-section area. The results of a summary of mathematical problem-solving abilities in the third cycle based on the Think Paire Share (TPS) approach and in groups, students worked on student worksheets. They were guided on how to change story questions into the form of mathematical models presented in Table 5.

Table 5. Completeness and Improvement of the Third Cycle of Prior Knowledge of Mathematics

	Third Cycle Score	The score of early knowledge of mathematics	Improvement	Criteria
Average	76,57	8,09	0,74	High
Completed Subject	28	0		
Incomplete Subject	6	34		

Table 5 show that the average score of students' mathematical problem-solving ability in the third cycle is higher than that of students' prior knowledge of mathematics. Likewise, the number of students who complete the third cycle is more than the initial knowledge of mathematics. It shows an increase in the number of students who complete the test results of mathematical problem-solving skills in the third cycle. Based on the score of prior knowledge of mathematics, none of the students completed or achieved the minimum completeness criterion with a score of 65. The improvement criteria were high based on the normalized gain from prior knowledge of mathematics and the ability to solve mathematical problems in the third cycle. This study produced several findings about the mathematical problem-solving ability of students' attitudes towards mathematics in TPS learning which were analyzed based on cycles and prior knowledge of mathematics. The score of students' prior knowledge of mathematics was greater than or equal to 15.76. There were only seven students belonging to the upper group (20.59% of 34 students), while students belonging to the middle group were 18 students (52.94% of There were 34

students, and the remaining nine students in the lower group (26.47% of 34 students) This indicated that students who were used as research subjects generally had low prior knowledge of mathematics before learning TPS.

The results showed that based on the mathematical problem-solving ability tests for each cycle, the students' mathematical problem-solving abilities in the second and third cycles were significantly different or better than in the first cycle. At the same time, the students' mathematical problem-solving abilities in the second cycle were not significantly different or better than the students' mathematical problem-solving abilities in the third cycle. However, the average score of students' mathematical problem-solving abilities in the third cycle was greater than in the second. The findings above are supported by the acquisition of a normalized average gain score, in the third cycle of 0.74 (the increase in the initial knowledge of mathematics is quite high), in the second cycle of 0.66 (the increase in the initial knowledge of mathematics is moderate), and in the first cycle of 0.55 (an increase from prior knowledge of mathematics including moderate). In addition, it is also supported by the results of a comparison of learning completeness. Based on the mathematical problem-solving ability test results, information was obtained that there were differences in classical learning completeness in the aspect of mathematical problem-solving ability in the first, second, and third cycles. These findings are supported by the number of students who complete each cycle. For the minimum completeness criterion of 65, in the first cycle, the number of students who passed was 13 (38.24% of 34 students). In the second cycle, the number of students who completed there was 23 students (67.65% of 34 students), and in the third cycle, the number of students who completed there was 28 students (82.35% of 34 students). In the third cycle, classical mastery (85% of students achieve mastery) is almost achieved.

Discussion

This study produced several findings about the mathematical problem-solving abilities of students' attitudes towards mathematics in TPS learning which were analyzed based on cycles and prior knowledge of mathematics. The first finding shows that the prior knowledge of mathematics of the students involved in this research is relatively low. It is reinforced by the average percentage of initial knowledge of mathematics which is still below the minimum classical completeness criteria. It shows that the material students have not mastered prior knowledge of mathematics on average. Students have yet to achieve minimal mastery. Such a situation will certainly affect the readiness of students to accept new subject matter, especially the circle material delivered by TPS learning. The results showed that based on the mathematical problem-solving ability tests for each cycle, the students' mathematical problem-solving abilities in the second and third cycles were significantly different or better than in the first cycle. At the same time, the students' mathematical problem-solving abilities in the second cycle were not significantly different or better than the students' mathematical problem-solving abilities in the third cycle. However, the average score of students' mathematical problem-solving abilities in the third cycle was greater than in the second. The cooperative learning model is a model that places more emphasis on common interests so that smart students can share with students who are classified as mediocre and vice versa (Dewi et al., 2021; Meilana et al., 2020). The second finding, the application of TPS learning alone has not improved students' mathematical problem-solving abilities. However, TPS learning is accompanied by students working on student worksheets in groups and guided by the teacher on converting word problems into mathematical models. In that case, it has the potential to improve students' mathematical problem-solving abilities or achieve mastery in learning classically, even though the results could be more optimal. It is due to the actions in the third cycle. In addition to implementing TPS learning using student worksheets, the teacher guides students to change story questions into mathematical models. So that the third cycle of action gives more opportunities for students to evaluate a situation or problem by identifying needed things, conducting investigations, exploring, solving problems, reflecting, and the teacher actively asking questions if there are students or study groups experiencing deadlock. In solving problems to arrive at the correct final solution. All of that trains students to be more skilled in solving math problems. The TPS learning model is a cooperative learning model designed to teach students how to interact (Arki et al., 2017; Sutama et al., 2017). This learning model is a model that encourages students to play an active role together with their group mates by discussing to solve a problem given by the teacher (Septiningtyas et al., 2018; P Wulandari et al., 2018). This finding is reinforced by previous research that the think pair share (TPS) learning model assisted by concrete media can improve science learning outcomes (Siregar et al., 2017; Sutama et al., 2017). Cooperative model type think pair share elementary school students' motivation and mathematical communication skills (Septiningtyas et al., 2018; Zain & Ahmad, 2021). The cooperative learning model of the think pair share (TPS) type assisted by an investigative approach affects mathematical communication skills (Fahrullisa et al., 2018). Applying TPS learning can create a more conducive learning atmosphere, increase student activity in learning, and become student-centered. This

research implies that the TPS learning process can increase students' sensitivity to mathematical problems. It is expected to improve students' problem-solving abilities inside and outside school.

4. CONCLUSION

The application of TPS learning in mathematics learning in the eighth grade of Garut 1 Public Middle School has had a positive influence. The mathematical problem-solving abilities of students in learning mathematics who obtained TPS with the teacher's help in changing story questions into mathematical models were better than students who received TPS by using question cards or TPS only. In this regard, hopes have been opened for SMP Negeri 1 Garut, especially for mathematics teachers, to improve the ability of their students to carry out mathematical activities that lead to students' mathematical problem-solving abilities. Students' prior knowledge of mathematics improves the quality of the relationship between mathematical problem-solving abilities in each cycle. This means that the higher the students' prior knowledge of mathematics, the higher the students' mathematical problem-solving abilities. This indicates that prior knowledge of mathematics is crucial in explaining the relationship between students' mathematical problem-solving abilities in each cycle. Thus, in applying a learning approach in mathematics lessons, it is necessary to pay attention to the student's initial knowledge of mathematics.

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