

Improving Learning Outcomes of Pythagorean Theorem using STAD Cooperative Learning Type for 8th Grade Students at SMPN 1 Rindingallo

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Abstract

The objective of this research is to improve the learning outcomes of the Pythagorean Theorem using the STAD Cooperative Learning Type for 8th grade students at SMPN 1 Rindingallo. The research method employed in this study is Action Research, consisting of two cycles, with each cycle comprising Planning, Implementation, Observation, and Reflection. Based on the action research findings, it is concluded that the STAD Cooperative Learning Type can enhance the learning outcomes of the Pythagorean Theorem for 8th grade students at SMPN 1 Rindingallo. Furthermore, the researcher recommends that (1) teachers facing similar difficulties should implement the STAD Cooperative Learning Type to improve learning outcomes, and (2) for optimal results, teachers are encouraged to create more engaging and varied STAD Cooperative Learning activities.

Keywords: Learning Outcomes, STAD Cooperative Learning.

Introduction

Education as an effort to enlighten the nation's life and to develop individuals who embody the Pancasila ideology. In the Republic of Indonesia Law No. 20 of 2003 on the National Education System, it is stated as follows:

"National education functions to develop the capabilities and shape the character and civilization of the nation in order to enlighten the life of the nation. Its aims are the development of the potential of learners to become individuals who are faithful and devoted to God Almighty, have noble character, are healthy, knowledgeable, capable, creative, independent, and responsible citizens."

Furthermore, education is also the most effective and efficient means to enhance human resources in achieving the desired dynamics. Based on the results of daily tests conducted in Class VIII a at SMPN 1 Rindingallo, North Toraja Regency, it was found that students' learning outcomes in the Pythagorean theorem were below the minimum passing standard, which is below 70.

Factors contributing to this situation include:

1. Students' cognitive abilities in understanding concepts in Mathematics education are still low.
2. The learning process tends to be monotonous and boring.
3. Students lack motivation to learn Mathematics.

By learning through rote memorization, the received mathematical concepts become easily forgotten. This is a challenge that teachers must face and overcome. Teachers are expected to be more creative in preparing their lessons. One way to address this is through the selection of appropriate learning models as part of teaching strategies. The teacher's readiness in managing the learning process will have a positive impact on students, such as improved learning outcomes that align with the desired indicators. One applicable learning model for teaching the Pythagorean theorem is the Student Teams Achievement Divisions (STAD) cooperative learning, as it actively

involves students by assigning them individual roles and responsibilities, thus increasing student engagement during the learning process.

STAD cooperative learning is a teaching method where students are given question sheets and answer sheets with multiple answer options. Students are expected to find the answers and problem-solving methods for the given questions.

Based on the above description, as a researcher, it is deemed important to conduct a study on the aforementioned issue. Therefore, a Classroom Action Research titled "Efforts to Improve Learning Outcomes in the Pythagorean Theorem through STAD Cooperative Learning for Class VIII a Students at SMPN 1 Rindingallo" will be conducted.

Method

The Classroom Action Research was conducted at SMPN 1 Rindingallo, North Toraja Regency, South Sulawesi Province, which is located approximately 24 km outside the district's main city. SMPN 1 Rindingallo, North Toraja Regency, South Sulawesi Province has almost complete facilities including a well-equipped library, science laboratory, computer laboratory, and others. The school has a total of 27 permanent teachers, consisting of 17 male teachers and 10 female teachers, as well as 3 administrative staff.

The research object of this study is the students of Class VIII a at SMPN 1 Rindingallo, North Toraja Regency, South Sulawesi Province, with a total of 23 students, comprising 12 male students and 11 female students.

The Classroom Action Research was conducted for a period of 3 months, from September to November 2021. The research focused on the Pythagorean theorem. The study was planned to have 2 cycles, with each cycle consisting of 1 meeting. The research design used was the Classroom Action Research with Cycles.

Cycle I

This cycle focused on the sub-concepts of the Pythagorean theorem.

- a. Planning Phase: In this phase, preparations were made for planning the action, including creating a syllabus, lesson plans, teacher and student observation sheets, student worksheets, and developing a written test as an evaluation tool using multiple-choice models.
- b. Implementation Phase: In this phase, the following activities took place:
The teacher explained the Pythagorean theorem to the students in a whole-class setting. Students were organized into 5 groups, with each group consisting of 4-5 students. They were provided with worksheets and were instructed to study them. During the learning activities, students followed the steps outlined in the worksheets, engaged in group discussions, intergroup discussions, and answered questions. Students worked collaboratively, assisting and sharing tasks within their groups. Each member was responsible for their group.
- c. Observation Phase: During this phase, the implementation of the action was observed, focusing on student and teacher engagement during the learning process using observation sheets for student activities and responses, as well as teacher observations. The improvement in student learning outcomes was determined through the test results.
- d. Reflection Phase: In this phase, the evaluation of the learning process in Cycle I took place, which served as a consideration for planning the next cycle. If any of the following components were not met, considerations were made:
Individual mastery by students $\geq 70\%$.

Class mastery if $\geq 85\%$ of the students achieved individual mastery, based on the test results.

Cycle II:

The reflection and analysis of data from Cycle I were used as a reference for planning Cycle II, with improvements made to address any weaknesses and deficiencies identified in Cycle I. The stages followed were the same as in Cycle I.

Several data collection techniques were employed in this action research, including:

- a. Observation conducted by the teacher and a collaborator to record the behavior and activities of both the teacher and students during the learning process, using observation sheets.
- b. Test results to assess the level of student understanding.
 - i. The instruments used in this Classroom Action Research consisted of:
 - ii. Test sheets/daily quizzes to assess student learning outcomes.
 - iii. Student observation sheets to assess student motivation.
 - iv. Teacher observation sheets to document teaching activities.

The research data were analyzed descriptively, as follows: Test results were used to determine the level of student mastery or success in learning the Pythagorean theorem using STAD Cooperative Learning. Individual mastery was achieved if a student obtained a score of 70 or above. Class mastery was determined if approximately 85% of the students achieved individual mastery, calculated using the formula provided by Arikunto (2012: 24):

$$F P = N \times 100\%$$

Where: P = Percentage

F = Frequency of each activity

N = Total number of activities

Result and Discussion

Initial Condition Description:

1. Planning

In the planning phase, the teacher prepared the action by creating a Lesson Implementation Plan (RPP) that aligned with the STAD Cooperative Learning Method for the Pythagorean Theorem, subtopic (1) Pythagorean Theorem. Additionally, the teacher developed Student Worksheets (LKS) and prepared observation sheets for both teacher and student activities. The teacher also created a test for assessing learning outcomes. Before implementing the action in the classroom, the teacher and observer discussed the observation sheets.

2. Implementation

The action was carried out on Thursday, September 11, 2021, from 07:00 to 08:20 AM. The learning activities consisted of three phases: introduction, core activities, and closing. The allocated time for the introduction phase was 10 minutes, while the core activities were given 50 minutes, and the closing activities were allocated 20 minutes.

During the introduction phase, the teacher conducted three activities: (1) Greeting and checking attendance, (2) Icebreaking through singing, (3) Engaging students in a discussion to connect their prior knowledge to the upcoming lesson. Icebreaking activities were conducted by the teacher.

In the core activities, the teacher designed the activities to allow students to experience the process of discovering, naming, and presenting. To facilitate discovery in line with STAD Cooperative Learning, the teacher divided the students into 5 groups, with each group consisting of 4-5 students. The teacher explained the tasks to the students before assigning them to avoid confusion. During the group discussions, the teacher circulated among the groups to supervise their work and occasionally provided comments on their work. Representatives from each group then presented the results of their group discussions. Students from other groups were asked to provide their opinions on the presented answers. If there were any mistakes, the teacher asked other students to provide corrections. Students who had correct findings and presented them well received praise from the teacher, while those who didn't perform optimally were motivated and given reinforcement.

The closing activities included evaluating student achievements after implementing the STAD Cooperative Learning strategy, having students reflect on the newly learned content, and celebrating the learning success with applause.

c. Observation

The participation of Class VIII a students at SMPN 1 Rindingallo improved in the learning activities during the initial condition after implementing the STAD Cooperative Learning model. This can be seen from the learning outcomes and students' responses to the learning activities, although some minor issues arose during the learning process. With the challenges identified in the initial condition, the observer and I reflected on these issues with the aim of addressing them in Cycle I, hoping that all students would be able to improve their learning outcomes.

The participation of Class VIII a students at SMPN 1 Rindingallo in mathematics teaching and learning activities is evident from the initial condition. The learning outcomes of the students in the initial condition, without the application of STAD Cooperative Learning, showed that out of 23 students, 17 students (74%) achieved satisfactory results, while 6 students (26%) did not meet the satisfactory criteria. The average score was 71.5. The data can be seen in the table below.

d. Reflection

The main objective of this research was to determine the improvement in learning outcomes in the Pythagorean Theorem Multicultural content through the application of STAD Cooperative Learning. However, the average score obtained was 71.5, which is still below expectations. Therefore, the reflection focused on improving student learning outcomes in the Pythagorean Theorem.

In the initial condition, there was a lack of student understanding in the Pythagorean Theorem Multicultural content. According to the observer, there were several factors contributing to this issue. Firstly, students were not focused on completing the LKS, resulting in incomplete sections. Secondly, students engaged in activities unrelated to the lesson, such as playing with their groupmates. Lastly, some groups were unable to answer questions posed by the teacher during the evaluation at the end of the lesson.

Based on these identified shortcomings, I devised new strategies to address these issues in Cycle I. For the first issue, I assigned three students from

each group to ensure that all LKS were completed. This approach aimed to collect complete data and enhance student understanding of the new grouping methods, reducing students' tendency to play with their peers. Regarding the third issue, I provided more detailed explanations of the Pythagorean Theorem, especially for difficult questions or those that the group struggled to answer during discussions. Additionally, the explanations were supported by the observer.

Description of Cycle 1 Results

1. Planning

In the planning phase, the teacher prepared the action by creating a Lesson Implementation Plan (RPP) that aligned with the STAD Cooperative Learning Method for the Pythagorean Theorem. Additionally, the teacher developed Student Worksheets (LKS) and prepared observation sheets for both teacher and student activities. The teacher also created a test for assessing learning outcomes. Before implementing the action in the classroom, the teacher and observer discussed the observation sheets.

2. Implementation

The implementation of Cycle 1 action took place on Thursday, September 25, 2021, from 07:00 to 08:20 AM. The learning activities consisted of three phases: introduction, core activities, and closing. The allocated time for the introduction phase was 10 minutes, while the core activities were given 50 minutes, and the closing activities were allocated 20 minutes.

During the introduction phase, the teacher conducted three activities: (1) Greeting and checking attendance, (2) Icebreaking through singing, (3) Engaging students in a discussion to connect their prior knowledge to the upcoming lesson. The icebreaking activity was conducted by the teacher.

In the core activities, the teacher designed the activities to allow students to experience the process of discovering, naming, and presenting. To facilitate discovery in line with STAD Cooperative Learning, the teacher divided the students into 6 groups, with each group consisting of 3-4 students. The teacher explained the tasks to the students before assigning them to avoid confusion. During the group discussions, the teacher circulated among the groups to supervise the students' work and occasionally provided comments on their work. Representatives from each group then presented the results of their group discussions. Students from other groups were asked to provide their opinions on the presented answers. If there were any mistakes, the teacher asked other students to provide corrections. Students who had correct findings and presented them well received praise from the teacher, while those who didn't perform optimally were motivated and given reinforcement.

The closing activities of Cycle 1 included evaluating student achievements after implementing the STAD Cooperative Learning, having students reflect on the newly learned content, and celebrating the learning success with applause.

3. Observation:

Student Learning Outcomes: There was an improvement in student participation in the learning activities during Cycle 1 after implementing the STAD Cooperative Learning model. This can be seen from the learning outcomes and students' responses to the learning activities, although some minor issues arose during the learning process. With the challenges identified in Cycle 1, the observer

and I reflected on these issues to make improvements in Cycle 2, with the hope that all students would be able to improve their learning outcomes.

The participation of Class VIII a students at SMPN 1 Rindingallo in mathematics teaching and learning activities was evident in Cycle 1. The learning outcomes of the students in Cycle 1, with the implementation of the STAD Cooperative Learning model, showed that out of 23 students, 19 students (82.6%) achieved satisfactory results, while 3 students (17.4%) did not meet the satisfactory criteria. The data can be seen in the table below.

Student Activities

The research findings on student activities during the learning activities that implemented the STAD Cooperative Learning model for the Pythagorean Theorem in Cycle 1 showed an average score of 3.04, indicating good performance. Further data can be found in the appendix.

To assess students' responses to the learning activities conducted using the STAD Cooperative Learning, a questionnaire was given to the students after completing the entire learning process. The results of the questionnaire on students' responses to the STAD Cooperative Learning model are shown in the table below. It summarizes the responses of 23 students to the STAD Cooperative Learning model implemented during the Pythagorean Theorem learning activities. In general, students provided positive feedback during the learning activities, expressing their enjoyment of the learning process, satisfaction with the use of worksheets, the classroom atmosphere, the teacher's presentation style, and the new learning model they received. During the learning activities, students also expressed their joy in being able to express their opinions and felt that they benefited from the STAD Cooperative Learning model.

Teacher Activities:

The data from the observation of the teacher's ability to manage the STAD Cooperative Learning activities is shown in Table 4, indicating a score of 2.93, which falls under the "good" category.

4. Reflection:

The main objective of this research is to determine the improvement of learning outcomes in the Pythagorean Theorem by implementing the STAD Cooperative Learning model. Therefore, the reflection will focus on improving student learning outcomes in the Pythagorean Theorem.

In Cycle 1, there were shortcomings in students' understanding of the Pythagorean Theorem. According to the observer, several factors contributed to this. Firstly, students were not focused on completing the LKS, resulting in incomplete sections of the worksheet. Secondly, students engaged in activities outside the learning context, such as playing with their groupmates. Thirdly, one or two groups were unable to answer the teacher's questions effectively during the evaluation at the end of the lesson.

Based on these findings, the researcher devised new strategies to address these issues in Cycle 2. To address the first problem, the researcher assigned three students in each group to ensure that all LKS were completed. By doing so, the collected data would be complete, and students would have a better understanding of the grouping material. To reduce students' engagement in unrelated activities, the researcher emphasized detailed explanations about the

Pythagorean Theorem, especially for difficult questions that the groups were unable to answer during discussions. Additionally, the observer provided assistance in explaining the third problem.

Description of Cycle II Results:

1. Planning

In the planning phase, the teacher prepared the action by creating a Lesson Implementation Plan (RPP) that addressed the shortcomings identified in Cycle 1 for the Pythagorean Theorem. Additionally, the teacher developed Student Worksheets (LKS) and prepared observation sheets for both teacher and student activities. The teacher also created a test for assessing learning outcomes. Before implementing the action in the classroom, the teacher and observer discussed the observation sheets.

2. Implementation

The implementation of Cycle II action took place on Thursday, October 9, 2021, from 07:00 to 08:20 AM. The learning activities consisted of three phases: introduction, core activities, and closing. The allocated time for the introduction phase was 10 minutes, while the core activities were given 50 minutes, and the closing activities were allocated 20 minutes.

During the introduction phase, the teacher conducted three activities: (1) Greeting and checking attendance, (2) Icebreaking through singing, (3) Engaging students in a discussion to connect their prior knowledge to the upcoming lesson. The icebreaking activity was conducted by the teacher.

In the core activities, the teacher designed the activities to allow students to experience the process of discovering, naming, and presenting. To facilitate discovery in line with STAD Cooperative Learning, the teacher divided the students into 7 groups, with each group consisting of 3-4 students. The teacher explained the tasks to the students before assigning them to avoid confusion. During the group discussions, the teacher circulated among the groups to supervise the students' work and occasionally provided comments on their work. Representatives from each group then presented the results of their group discussions. Students from other groups were asked to provide their opinions on the presented answers. If there were any mistakes, the teacher asked other students to provide corrections. Students who had correct findings and presented them well received praise from the teacher, while those who didn't perform optimally were motivated and given reinforcement. The closing activities of Cycle II included evaluating student achievements after implementing the STAD Cooperative Learning, having students reflect on the newly learned content, and celebrating the learning success with applause.

3. Observation:

Student Learning Outcomes:

There was an improvement in student participation in the learning activities during Cycle II after implementing the STAD Cooperative Learning model. This can be seen from the learning outcomes and students' responses to the learning activities, although some minor issues arose during the learning process.

The participation of Class VIII a students at SMPN 1 Rindingallo in mathematics teaching and learning activities was evident in Cycle II. The learning outcomes of the students in Cycle II, with the implementation of the STAD Cooperative Learning model, showed that out of 23 students, 21 students (91%)

achieved satisfactory results, while 2 students (9%) did not meet the satisfactory criteria. The average score was 80.4.

Teacher Activities

The data from observing the teachers' abilities in managing cooperative learning activities using the STAD (Student Teams Achievement Divisions) Cooperative Learning Type is shown in Table 4, indicating that the management of learning with the implementation of STAD Cooperative Learning Type in the Pythagorean theorem subject in Cycle I is 2.93, which falls into the good category.

4. Reflection

The main objective of this research is to determine the improvement of learning outcomes in the Pythagorean theorem subject by implementing a teaching model using the STAD Cooperative Learning Type. Therefore, the reflection presented will focus on the improvement of students' learning outcomes in the Pythagorean theorem subject.

In Cycle 1, there were shortcomings in students' understanding of the Pythagorean theorem. According to the observer, there were several factors contributing to this. First, students were not focused on filling out the worksheets completely, resulting in incomplete sections. Second, students engaged in activities outside the learning context, such as playing with their groupmates. Third, one or two groups were unable to answer the teacher's questions effectively during the end-of-lesson evaluation.

Based on these findings, the researcher developed a new strategy to address the causes of the students' understanding deficiencies mentioned above, which will be implemented in Cycle II. For the first issue, the researcher assigned three students in each group to ensure that all worksheets were filled out completely. By doing so, the collected data would be complete, enabling students to better understand the new grouping material and reducing instances of students playing with their peers. As for the third issue, the researcher provided more detailed explanations about the Pythagorean theorem, particularly for difficult or unanswered questions during group discussions. In addition, an observer assisted in providing explanations for this third issue.

Discussion

Learning Outcomes

The research findings show that the learning outcomes of the 8th-grade students in SMPN 1 Rindingallo for the Pythagorean theorem subject using the STAD Cooperative Learning Type obtained an average score of 71.5 in the initial condition, with the highest score being 85 (1 student) and the lowest score being 60 (4 students), achieving a learning completeness rate of 74% and an incomplete rate of 26%. The research findings also indicate that the learning outcomes of the 8th-grade students in SMPN 1 Rindingallo in Cycle 1 for the Pythagorean theorem subject using the STAD Cooperative Learning Type obtained an average score of 77.2, with the highest score being 100 (1 student) and the lowest score being 65 (5 students), achieving a learning completeness rate of 82.6% and an incomplete rate of 17.4%. In Cycle II, for the subtopic "Collaboration in the Village/Community Environment" of the Pythagorean theorem, the average score in Cycle II was 80.4, with the highest score being 100 (2 students) and the lowest score being 65 (3 students), achieving a learning completeness rate of 91% and

an incomplete rate of 9%. The students who did not achieve completeness in both Cycle I and Cycle II were the same students, indicating that they lacked the intention to learn and often skipped school.

Based on the data of students' learning outcomes in Cycle I and Cycle II, there is an improvement in the learning outcomes of the 8th-grade students in SMPN 1 Rindingallo in the academic year 2021/2022, specifically in the Pythagorean theorem subject. This improvement can be attributed to the implementation of the STAD Cooperative Learning Type in both cycles.

Student Activities

During the implementation of the STAD Cooperative Learning Type for the Pythagorean theorem subject, students' activities during the learning process were assessed and considered good in all aspects by the observer. The activities assessed by the observer included: listening and paying attention to the teacher's explanations, cooperation within the group, working with manipulatives, active participation in discussions, presenting the results of discussions, summarizing the material, and the ability to answer questions from the teacher.

Based on the assessment results, the most dominant activities carried out by the students were working together on worksheets and engaging in discussions. This demonstrates that students collaborate and take responsibility to achieve good results. This is in line with Santoso's opinion (as cited in Anam, 2000:50) stating that cooperative learning encourages students in a group to work and take responsibility seriously until individual and group tasks are completed.

Implementation of the STAD Cooperative Learning Type

The teacher's ability to manage the STAD Cooperative Learning Type was assessed and considered good in all aspects. This indicates that overall, the teacher has a good ability to manage the STAD Cooperative Learning Type for the Pythagorean theorem subject. This is in line with Ibrahim's opinion (2000) that the teacher plays an important role in managing teaching activities, being creative and innovative in designing learning activities in the classroom to enhance students' interest and motivation in learning. Another supporting opinion is from Piter (as cited in Nur and Wikandari, 1998), stating that a teacher's ability is crucial in managing learning to ensure that it is effective and efficient.

Student Response to the STAD Cooperative Learning Type

Based on the questionnaire results regarding student response to the implementation of the STAD Cooperative Learning Type by the researcher, it is shown that students feel happy about the subject matter, worksheets, learning atmosphere, and the teacher's presentation of the material. According to the students, with the STAD Cooperative Learning Type, they find it easier to understand the subject matter, and interactions between the teacher and students, as well as among students, improve through discussions. However, some students expressed dissatisfaction with the slightly noisy classroom atmosphere during the cooperative learning activities.

All students (100%) stated that they were new to participating in learning using the STAD Cooperative Learning Type. The students expressed happiness, especially knowing that the next topic would also use the STAD Cooperative Learning Type, and they felt that the cooperative learning model using the STAD Cooperative Learning Type was beneficial because they could exchange ideas and easily remember the learning material.

Conclusion

Based on the research findings and the implementation of the STAD Cooperative Learning Type, the following conclusions can be drawn: The use of the STAD Cooperative Learning Type can improve the learning outcomes of the 8th-grade students in SMPN 1 Rindingallo in the Pythagorean theorem subject.

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