

EFFECTIVENESS OF TYPE COOPERATIVE LEARNING MODEL STUDENT TEAMS ACHIEVEMENT DIVISION (STAD) ON STUDENT MATHEMATICS LEARNING OUTCOMES CLASS XI MIPA 1 SMA NEGERI 1 NOSU

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ABSTRACT

This study aimed at finding out the effectiveness of Cooperative Learning Type *Student Teams Achievement Division* (STAD) for the mathematics learning outcome at class XI MIPA 1 of SMA Negeri 1 Nosu. This type of research is quantitative research in the form of a *pre-experimental* design with one group pretest posttest. The population of this study was all class XI SMA Negeri 1 Nosu where the sample was class XI MIPA 1. The data analysis technique used in this study was descriptive analysis, gain test and inferential statistics at a significant level of 0.05 through the SPSS program version 25. Based on the results of the descriptive analysis, the mean score of pretest was 42.41 with a standard deviation of 8.0158 and the mean score of posttest was 80.14 with a standard deviation of 7.7723. Based on the normality test after treatment, it was found $\chi^2_{\text{count}} = 9.909$ and $\chi^2_{\text{table}} = 21.026$. Because the value of $\chi^2_{\text{count}} < \chi^2_{\text{table}}$ means that the scores of students' mathematics learning outcomes are normally distributed. While the t- test obtained was $t_{\text{count}} = 7.324$ and $t_{\text{table}} = 1.72$. Since, $t_{\text{count}} > t_{\text{table}}$ is obtained, H_0 is rejected and H_1 is accepted. It means that students' mathematics learning outcome is higher than the KKM. Likewise, by using the gain test formula, the gain value is 0.66 and is in the medium category. Thus, it can be concluded that the cooperative learning type *Student Teams Achievement Division* (STAD) is effective on students' mathematics learning outcomes at class XI MIPA 1 of SMANegeri 1 Nosu.

Keywords: Effectiveness, Cooperative Learning, STAD, Mathematics Learning Outcome

1. Introduction

Education is an important part of human life and survival. Education is a very important activity, because education is a tool that aims to make the nation smarter. National education aims to educate the life of the nation and develop the whole Indonesian human being, namely human beings who believe in and are devoted to God Almighty and have noble character, have knowledge and skills, physical and spiritual health, a strong and independent personality and a sense of social responsibility and nationality (Sirate et al., 2020:194). Furthermore, (Sukarni et al., 2022:41) states that education is programmed learning

experiences in the form of formal, non-formal and informal education at school and outside school, which last a lifetime with the aim of optimizing individual abilities, so that in the future they can play their life roles appropriately.

In addition, the school is a place where the teaching and learning process takes place. (Nurfirdaus & Hodiya, 2018:116) defines school as an educational environment that is expected to be able to give birth to a complete human being who has intellectual intelligence, emotional intelligence, and spiritual intelligence.

In the teaching and learning process, of course there are materials that are taught, one of which is learning mathematics which is also one of the subjects that must be learned in school. James said that mathematics is the science of logic regarding shape, arrangement, quantity, and concepts related to one another in large numbers and divided into three fields, namely algebra, analysis, and geometry (Ovan, 2019:15). Mathematics is a subject that is taught to students since elementary school, even before formal school a child is introduced to simple counting mathematics. Mathematics is one of the disciplines taught at every level of education from elementary school (SD) to high school (SMA), even college.(Asrawati & Mulyati, 2018:27). Mathematics is really needed by students as a basis for understanding the concept of counting and makes it easier to learn other lessons.

The importance of mathematics for students is not in line with the success of mathematics in learning. Based on the results of an interview with one of the mathematics teachers at SMA Negeri 1 Nosu who stated that there are still many difficulties that are often encountered in learning mathematics. Among them are that there are still many students who are less interested during the learning process, there is a lack of student activity in learning mathematics, because students consider mathematics to be a scary subject because of its level of difficulty, which has an impact on low student learning outcomes. In addition, in the process of learning mathematics at SMA Negeri 1 Nosu, they still use the direct learning model. The direct learning model is a more teacher-centered learning model where the teacher is more active than the students (Hawa et al., 2020:78). So that the teacher plays an active role in learning while students only receive the material taught by the teacher. Therefore, in learning some students are less enthusiastic and feel bored. Students who do not understand the material are indifferent to their lack of understanding and lack of learning. They are reluctant to ask the teacher if there is material that they do not understand. As a result, students' ignorance of learning material has an impact on low learning outcomes.

Based on this, it is necessary to apply a learning model that can support the learning process to be more effective and able to increase student interest and activity so as to enable

students to achieve better learning outcomes in learning mathematics. In addition, it is able to make students the main actors of learning and the teacher acts as a facilitator who holds full conditions in the learning space. One learning model that is considered appropriate to use in the mathematics learning process is the cooperative learning model. Rusman defines cooperative learning as a form of learning where students learn and work cooperatively in small groups consisting of four to six people with heterogeneous group structures.(Hawa et al., 2020:79).

One of the cooperative learning models is the Student Teams Achievement Division (STAD) type cooperative learning model. The syntax in the STAD type cooperative learning model places students at the center of the learning process (Student Centered). The STAD model emphasizes activities and interactions between students to help each other master the subject matter. To achieve the expected goals, students are divided into study groups, which together with these groups complete the tasks given by the teacher. Through group work, students become more interested, participate more actively and together improve understanding of concepts. By creating good group collaboration, students can better understand existing concepts with the help of their friends (Syamsu et al., 2019:346).

In line with this, (Durrotunisa et al., 2020:144) states that learning with the STAD type cooperative learning model is able to equip students with active, innovative, creative, and fun learning during the learning process. Such learning will be able to arouse students' enthusiasm and interest in learning so that it will influence the achievement of optimal student learning outcomes.

The aim of this research is to determine the effectiveness of the Student Teams Achievement Division (STAD) Cooperative learning model on the mathematics learning outcomes of class XI MIPA 1 SMA Negeri 1 Nosu students.

2. Research Methods

This research is a type of pre-experimental research. The design used in this research was one group pretest-posttest (*one group pretest-posttest design*). This research consisted of one group without a comparison

group. The One Group Pretest-Posttest design is as follows:

Table 1. One group pretest posttest model research design

O₁	X	O₂
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(Sugiyono, 2018)

Information:

X = Treatment

O₁= Pretest (results obtained before implementing the learning model).

O₂= Posttest (results obtained after applying the learning model).

Data collection techniques in this research consisted of 4, namely:

- a) Mathematics learning outcomes are the results of a student following the mathematics teaching and learning process which is measured by the student's ability to solve problems. Data collection techniques through test techniques are carried out by providing a test instrument consisting of a set of questions/questions to obtain data regarding students' abilities, especially in cognitive aspects.(Lestari & Yudhanegara, 2018:232). The test instrument given was in the form of a learning achievement test made by the researcher based on the problem grid. The learning outcomes test is in the form of an essay consisting of 5 numbers for the test before being given treatment (pretest) and 5 number questions for the test after being given treatment (posttest), provided that the level of difficulty of the two tests is relatively the same/identical.
- b) Student activities are student behavior or actions during learning. The student activity sheet is an illustration used by researchers to find out how much student participation occurred during the implementation of the STAD model.
- c) The implementation of learning is data that includes managing the class, so that learning activities are carried out according to expectations with existing processes and conditions. The implementation of the learning syntax describes the researcher's achievements in managing the class.
- d) Student response is a response to a behavior or situation that is received. Student responses are in the form of student opinions

regarding the STAD model being implemented.

Data which are learning outcomes are analyzed quantitatively using descriptive statistics, gain tests and inferential statistics.

A. Descriptive statistics

Descriptive statistics include student learning outcomes, student activities, learning implementation and student responses.

1) Student learning outcomes

After carrying out the learning, each student is given an essay test. The test results are processed using descriptive statistical analysis.

Guidelines for categorizing learning outcomes can be seen in the following table:

Table 2. Categorization of Learning Outcomes.

Mark	Information
90 – 100	Very high
79 – 89	Tall
68 – 78	Currently
57 – 68	Low
0 – 56	Very low

(Nosu 1 Public High School)

Furthermore, the minimum completeness is adjusted to the KKM for mathematics subjects at SMA Negeri 1 Nosu, which can be seen in the following table:

Table 3. Minimum Completeness Criteria

Criteria	Intervals	Category
< 68	0 – 67	Not Completed
≥ 68	68 – 100	Complete

(Nosu 1 Public High School)

2) Student activity

Data from observations of student activities were analyzed quantitatively and qualitatively. Quantitative analysis by determining the percentage of frequency.

The steps for analyzing student activities are as follows:

- a) Determine the frequency of student observations for each activity in one meeting.

- b) Find the percentage of student activity frequency by dividing the total score obtained by the maximum score, then multiplying by 100%.

$$\text{Gained} = \frac{\text{Number of response scores}}{\text{maximum score}} \times 100\%$$

Guidelines for categorizing student activity in learning can be seen in the table below:

Table 4. Categories of Student Activity

Percentage (%)	Category
91 – 100	Very active
81 – 90	Active
71–80	Moderately Active
60 – 70	Less Active
< 60	Not active

Kunandar(Helwina, 2019)

3) Implementation of learning

Observation of learning implementation is used to obtain data about the researcher's achievements in implementing the learning model. The steps in analyzing learning implementation are:

- Count the number of learning implementation categories carried out by the teacher in each meeting.
- Find the frequency percentage of each category, namely the number of categories implemented divided by the total number of learning implementation categories then multiplied by 100%

$$\text{Percentage: } \frac{\text{Total score obtained}}{\text{maximum score}} \times 100\%$$

The criteria used to determine the learning implementation category are based on the learning implementation percentage category technique, namely:

Table 5. Categories of Learning Implementation

Percentage (%)	Criteria
$90 > x \leq 100$	Very good
$75 < x \leq 91$	Good
$50 < x \leq 75$	Currently
$25 < x \leq 50$	Not enough
$0 < x \leq 25$	Very less

(Ramadhana & Hadi, 2022)

4) Student response

Based on students' responses to the questionnaire given, they were analyzed

quantitatively and qualitatively. The steps to analyze students are:

- Determining the frequency of student responses.
- Determine the percentage of responses by dividing the number of response scores by the maximum score of all questions and multiplying by 100%.

$$\text{Gained} = \frac{\text{Number of response scores}}{\text{maximum score}} \times 100\%$$

Guidelines for categorizing student responses to learning can be seen in the table below:

Table 6. Categorization of Responses

Percentage (%)	Category
91 – 100	Very positive
71 – 90	Positive
61 – 70	Less positive
< 61	Very less positive

Kunandar(Helwina, 2019:38)

B. Gain Test

The use of the N-gain test to prove an increase in student achievement. The N-gain value is determined by the formula:

$$\text{N-gain} = \frac{\text{Posttest score} - \text{pretest score}}{\text{ideal score} - \text{pretest score}}$$

The criteria for the N-gain value are based on the following:

Table 7. N-gain value criteria

Mark	Category
$\text{N-Gains} \geq 0.70$	Tall
$0.30 < \text{N-Gain} < 0.70$	Currently
$\text{N-Gains} \leq 0.30$	Low

(Lestari & Yudhanegara, 2018)

C. Inferential Statistics

1) Data normality test

The data normality test is intended to show that the data obtained is normally distributed. The technique used to test is chi squared.

The formula used is:

$$\chi^2 = \sum_i^n \frac{(O_i - E_i)^2}{E_i} \text{ Nazir (Helwina, 2019:40)}$$

Information :

χ^2 = calculated chi square value

O_i = Frequency of observation

E_i = Expected frequency

k = Number of interval classes

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Test criteria, if $\chi^2_{hit} \leq \chi^2_{tab}$ "then the data is normally distributed, then $\chi^2_{tab} = \chi^2 (dk)$ where the significant level (α) = 0.05 with degrees of freedom (dk) = k-1. α

2) Hypothesis testing

To test the hypothesis after the cooperative application of the STAD type to student learning outcomes reaching KKM, it can be used. The thit formula according to(Lestari & Yudhanegara, 2018:257)as follows:

$$t_{count} = \frac{\bar{x} - \mu_0}{\frac{s}{\sqrt{n}}}$$

Information :

- t_{count} = Calculated t value
- $\bar{x}$ = Average
- μ_0 = Hypothesized value
- s = Standard deviation
- n = Total number of samples

The test criterion is "if thit $\leq$ ttab" then H0 is accepted and Ht is rejected, and if thit $>$ ttab then H0 is rejected and H1 is accepted. Then $\chi^2_{table} = \chi^2 (dk)$ where dk = n-1 and the significance level is $d= 0.05.\alpha\alpha$

Because effectiveness is the level of achievement of goals set according to plan, efficiency requirements must be established. According to Jeranah (Syafuruddin & Jeranah, 2020:228) important indicators so that research can be said to be effective, namely:

- a) Student learning outcomes meet the minimum completeness criteria (KKM) determined by the school concerned and classical completeness is achieved at least 80%.

The criteria set in this study are: The average score of students' mathematics learning outcomes by applying the cooperative learning model of the Student Teams Achievement Division (STAD) type is higher than the KKM SMA Negeri 1 Nosu, namely 68 and 80% complete classically. There is an increase in student learning outcomes from before to after applying the Student Teams Achievement Division (STAD) type cooperative model (the interpreted gain value is classified as moderate minimum or $g < 0.30$.

- b) Student activity

In this study, student activity during learning using the cooperative learning model type Student Teams Achievement Division (STAD) was in the active minimal category with a percentage of 81%.

- c) Implementation of learning

In this study the implementation of learning through the application of the cooperative learning model type Student Teams Achievement Division (STAD) is at least good with a percentage of 75%.

- d) Student response

In this research, students' responses after implementing the Student Teams Achievement Division (STAD) type cooperative learning model were in the minimum positive category with a percentage of 71%.

3. Results and Discussion

A. Description of Research Results

Table 8. Students' Mathematics Learning Outcomes Before and After Applying the Cooperative Learning Model STAD type.

Statistics	Statistical Value	
	<i>Pret-test</i>	<i>Post-test</i>
Sample size	22	22
Ideal Score	100	100
Maximum score	58	95
Minimum score	25	60
Reach	33	35
Average score	42,41	80.14
Variance	64,253	60,409
Standard Deviation	8.01581	7.77233
Median	41.50	82
Mode	43	83

Based on Table 8 of the 22 students who were given a pretest with the subject matter of the matrix, an average score of 42.41 was obtained with a standard deviation of 8.01581 indicating that the distribution of student learning outcomes was still below the KKM that had been set at 68. The scores achieved by students are spread between a minimum score of 25 and a maximum score of 58 from a score range of 0-100 with a range of 33 which is the difference between the highest and lowest scores. The median value is 41.50, which means that 50% of the students score above 41.50 and 50% of students score below 41.50. The mode value of 43 means that out of 22 students, learning results were obtained with a score of 25-58. The most frequently occurring value was 43, 4 people. Meanwhile, the learning outcomes test (Posttest) showed that the average score obtained from 22 students on the learning outcomes test (posttest) on matrix material was 80.14. The standard deviation value

is 7.77233, indicating that the distribution of students' mathematics learning outcomes is above the established KKM standard, namely 68, with the lowest score being 60 and the highest score being 95. The range is 35 which is the difference between the maximum and minimum scores. The median is 82, which means that 50% of students' scores are above 82 and 50% of students' scores are below 82. The mode score of 83 means that out of 22 students, learning results with a score of 60 - 95 were obtained, the most frequently occurring score was 83, 5 people. 77233 shows the distribution of students' mathematics learning outcomes above the KKM standard that has been set, namely 68, with the lowest score being 60 and the highest score being 95. The range is 35 which is the difference between the maximum and minimum scores. The median is 82, which means that 50% of students' scores are above 82 and 50% of students' scores are below 82. The mode score of 83 means that out of 22 students, learning results with a score of 60 - 95 were obtained, the most frequently occurring score was 83, 5 people. 77233 shows the distribution of students' mathematics learning outcomes above the KKM standard that has been set, namely 68, with the lowest score being 60 and the highest score being 95. The range is 35 which is the difference between the maximum and minimum scores. The median is 82, which means that 50% of students' scores are above 82 and 50% of students' scores are below 82. The mode score of 83 means that out of 22 students, learning results with a score of 60 - 95 were obtained, the most frequently occurring score was 83, 5 people.

Table 9. Distribution of Frequency and Percentage of Scores on Students' Mathematics Learning Outcomes Before and After Implementing the STAD Type Cooperative Learning Model

Score	Category	Frequency		Percentage (%)	
		<i>Pretest</i>	<i>Posttest</i>	<i>Pretest</i>	<i>Posttest</i>
90 – 100	Very high	0	2	0	9.09
79 – 89	Tall	0	15	0	68.18
68 – 78	Currently	0	3	0	13.63
57 – 67	Low	1	2	5	9.09
0 – 56	Very low	21	0	95	100

Based on Table 9, it shows that before the Student Teams Achievement Division (STAD) type cooperative learning model was implemented, students' mathematics learning outcomes had a percentage of 95% in the very low category. Then, after applying the Student Teams Achievement Division (STAD) type cooperative learning model, students' mathematics learning outcomes had a percentage of 9.09% in the very high category, 68.18% in the high category, and 13.63% in the medium and low categories. 9.09% are in the low category. This shows that the range of categories obtained has increased.

The results of observations regarding student activities during learning were carried out in three meetings. Assessment is carried out in groups by applying the Student Teams Achievement Division (STAD) type cooperative learning model. Based on the results of the descriptive analysis, the average percentage of student activity is 84% and referring to Table 4 shows that student activity during learning takes place in the active category. So it can be concluded that students play an active role in the learning process.

The learning implementation observation sheet is used to determine the percentage of the teacher's ability to apply the learning model. Based on the results of descriptive analysis, an average of 90.9% was obtained and referring to Table 5, it shows that the implementation of learning during learning was in the very good category.

Student response questionnaires were used to find out how students responded or reacted to learning by applying the cooperative learning model of the Student Teams Achievement Division (STAD) type and then analyzed. The percentage of student response questionnaire data during learning by applying the cooperative learning model type Student Teams Achievement Division (STAD) is 85.35%. By referring to Table 6, it can be seen that students' responses during learning were in the positive category.

The gain test was used to determine the magnitude of the increase in learning outcomes for class Based on testing using normal gain analysis, an N-Gain of 0.66 was obtained, indicating that the increase in student mathematics learning outcomes before and after

implementing the Student Teams Achievement Division (STAD) type cooperative learning model was in the medium category.

B. Discussion

The application of the Student Teams Achievement Division (STAD) type cooperative learning model has provided positive results by increasing student mathematics learning outcomes. And through the application of the Student Teams Achievement Division (STAD) type cooperative learning model, it helps students to be active during the learning process. This is based on the results of analysis of learning outcomes data, it was found that the average mathematics learning outcomes of class achieve the KKM score) which is in the very low category. The KKM value set by the school is 68. Meanwhile, the average score for students' mathematics learning outcomes after implementing the Student Teams Achievement Division (STAD) type cooperative learning model is 80.14 with a standard deviation of 7.772 which is in the high category. This shows that there was an increase in the average score of students' mathematics learning outcomes after implementing the Student Teams Achievement Division (STAD) type cooperative learning model and completed it with a percentage of 90.9%. Furthermore, based on the gain calculation, a gain value of 0.66 is obtained and is in the medium category. This shows that there was an increase in the average score of students' mathematics learning outcomes after implementing the Student Teams Achievement Division (STAD) type cooperative learning model and completed it with a percentage of 90.9%. Furthermore, based on the gain calculation, a gain value of 0.66 is obtained and is in the medium category.

Based on the results of the analysis, it can be said that the application of the Student Teams Achievement Division (STAD) type cooperative learning model is very good in improving students' mathematics learning outcomes. The

increase in student learning outcomes after being taught by implementing the Student Teams Achievement Division (STAD) type cooperative learning model occurred because students felt happy working together with their group friends, and did not hesitate to ask their friends if they did not understand the material. In group learning, students are more active in discussing and helping each other in understanding the material.

In addition, in this study the researchers used observations of student activity which were observed three times when implementing the cooperative learning model of the Student Teams Achievement Division (STAD) type. Observation of student activity was carried out to see the activeness of students in learning and in this study the researcher was assisted by a mathematics teacher. Through the application of the cooperative learning model type Student Teams Achievement Division (STAD) in learning is very influential seen from the way students work together in completing worksheets with their group mates. The observation results obtained show that the average percentage of student activity is 84% and according to the categorization by Kunandar in (Helwina, 2019:38) are in the active category. Active student activities certainly influence their learning outcomes. This is supported by research (Tampubolon & Sitompul, 2022) which states that student learning activities using the cooperative learning model type Student Teams Achievement Division (STAD) are in the active category.

Observation sheets on learning implementation were given during the learning process by implementing Student Teams Achievement Division (STAD) type cooperative learning during three meetings. The assessment carried out on the implementation of learning was the ability of the teacher (researcher) in managing mathematics learning activities in class and in this research the researcher was assisted by a friend. Based on the results of observations of learning implementation while implementing the Student Teams Achievement Division (STAD) type cooperative learning model, the results of descriptive analysis of learning implementation were obtained with a percentage of 90.9% and were in the very good category. The results of this study are supported by research (Helwina, 2019) where the research results show that teacher activities in teaching are in the good category.

From the results of the activities carried out to analyze student responses which aim to find out student responses during the learning process using the cooperative learning model type Student Teams Achievement Division (STAD). Based on the results of the descriptive analysis, the percentage of student responses was 85.35%, categorized according to Kunandar Dalam (Helwina, 2019:38) shows that student responses are in the positive category.

The results of this research are relevant to the results of research conducted by (Nurmilah & Rozak, 2016) related to the effectiveness of STAD type cooperative learning on comparative subject matter at SMP II Megaluh Jombang. In this study, it was argued that the application of cooperative learning type STAD was effective in the subject matter of comparisons for students, by meeting the criteria of learning completeness, effective student activity, teacher's ability to manage effective learning and positive student responses. Furthermore, the results of research by (Durrotunisa et al., 2020) with the title the effectiveness of the cooperative learning model type Student Teams Achievement Division (STAD) on the mathematics learning outcomes of class XI students of SMA Negeri 1 Wiradesa and by (Eve et al., 2020) with the title research on the effectiveness of the STAD type cooperative learning model on vocational school students' mathematics learning outcomes. The results of both studies stated that the STAD type cooperative learning model was more effective than the direct learning model for students' mathematics learning outcomes.

4. Conclusion

Based on the results of the research and discussion, the effectiveness of learning by applying the Student Teams Achievement Division (STAD) type cooperative learning model, the researcher can draw the conclusion that the application of the Student Teams Achievement Division (STAD) type cooperative learning model is effective on the mathematics learning outcomes of class XI MIPA students. 1 SMA Negeri 1 Nosu. This can be seen from the average student learning outcomes after implementing the Student Teams Achievement Division (STAD) type cooperative learning model, namely 80.14, indicating that student learning outcomes are higher than the specified KKM, namely 68 and completed with a percentage of 90.9%. There was an increase in

student learning outcomes from the Pretest to the Posttest where the gain value obtained was 0.66 and was interpreted as moderate. Student activities for learning by applying the cooperative learning model type Student Teams Achievement Division (STAD), with a percentage of 84% being in the active category. The implementation of learning through the application of the cooperative learning model type Student Teams Achievement Division (STAD), with a percentage of 90.9% is in the very good category. Student responses to learning which are students' views on the application of the Student Teams Achievement Division (STAD) model, with a percentage of 85.35% are in the positive category. 9% are in the very good category. Student responses to learning which are students' views on the application of the Student Teams Achievement Division (STAD) model, with a percentage of 85.35% are in the positive category. 9% are in the very good category. Student responses to learning which are students' views on the application of the Student Teams Achievement Division (STAD) model, with a percentage of 85.35% are in the positive category.

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