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Improving Underachiever Students' Mathematics Learning Outcomes: The Effectiveness of the STAD Model

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Abstract
This study aims to obtain an objective picture of the effect of the Student Team Achievement Division (STAD) type cooperative learning model on mathematics learning outcomes in underachievers. This research is an actual experiment with a randomized pretest-posttest control group design. The sample of this study consisted of two classes, namely the experimental class and the control class, with a total of 30 people, each determined by random sampling technique. The data analysis technique used is the t-test. The results of this study indicate that the mathematics learning outcome obtained on average in the experimental group is 39.633, while in the control group is 27.267. This means that learning outcomes using the STAD method are better than mathematics learning outcomes using conventional models. The high average score in the experimental group positively affected the testing of hypotheses performed using the t-test.

Keywords: **STAD; cooperative learning model; learning outcomes; mathematics**

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1. INTRODUCTION

Internationally, students' mathematics achievement in Indonesia is still low, as reported in the Program for International Student Assessment (PISA) (Fenanlampir, 2019). This is also seen in the Trends in International Mathematics and Science Study (TIMSS) (Mullis I. V., Martin, Foy, Kelly, & Fishbein, 2020). However, Indonesian students have a fairly good attitude toward mathematics (Mullis, Martin, Foy, & Hooper, 2015).

According to NRC (1989) the objectives of learning mathematics are (1) numeracy skills, (2) geometric abilities, (3) measurement abilities, (4) data analysis abilities, (5) variable quantification abilities, (6) observing patterns, (7) the ability to distinguish between relevances, (8) the ability to make data predictions, (9) the ability to reason logically, (10) the ability to think and act consistently, (11) the ability to think and act independently, and (12) the ability to think creatively.

Many studies have discussed the effectiveness of the Student Team Achievement Division (STAD) method in improving student achievement. However, there still needs to be research examining its effectiveness in increasing the mathematics achievement of underachiever students. Sulaeman and Choiriah (2020) explain that there are many problems faced by underachiever students in mathematics, which is due to: (1) the nature of mathematics learning itself, (2) language problems, (3) the inability to process information, (4) motivational problems and math anxiety.

According to Pratiwi and Farozin (2019) and Sutriningsih (2017), the cause of underachievers among students is a combination of home and school factors. This phenomenon arises because students experience problems that interfere with their learning process from parents, school or teacher, and personality factors. Meanwhile, Akintunde and Olukemi (2014) explain that the cause of underachievers is due to the boredom experienced by students in the lesson, bad strategies used by the teacher in the learning process, the environment, and the personalities of students and peers.

The Underachieving Gifted (Bennett-Rappell, 2016), Coasting underachiever ('Aturrahmi & Zikra, 2019), and Gifted Children with Less Achievement (Wahab, 2005) are designations for students who have a difference between potential and performance or achievement (Supendi, 2020). In other words, student learning outcomes at school are not in accordance with their intellectual level (Asri, Setyowati, Hitipeuw, & Chusniyah, 2017). Students are in a situation where there is a gap between expected performance measured by standardized tests and actual performance measured by grades and records in class

performance and teacher assessment (Reis & McCoach, 2000). Meanwhile, Muhid (2019) defines low-achieving students as students whose actual achievement is lower than predicted, which can be measured based on the correlation of IQ, creativity, motivation, and achievement.

Characteristics of underachieving students (Muhid, 2019) are having poor skills in doing school work, poor study habits, having problems with peer acceptance, poor concentration in school activities, unable to organize themselves well at home or school, bored, leave class easily, have good spoken language skills but poor writing, easily distracted and impatient, preoccupied with their own thoughts, dishonest, often self-critical, has poor friendships, likes to joke in class.

Akintunde & Olukemi (2014) found that underachiever was caused by students' boredom in the lesson, bad strategies by the teacher, the environment, and students' personality. Learning is a lasting behavior change resulting from practice or experience (Sutriningsih, 2017) and is a system consisting of various interconnected components. These components include objectives, materials, methods, and evaluation. Teachers must consider the four learning components in choosing and determining what learning model to use in learning activities (Rusman, 2012). Bad strategies in the learning process will affect learning outcomes (Akintunde & Olukemi, 2014).

Experts organize learning models based on various educational principles, theories, sociology, psychology, systems analysis, or other theories (Schunk, 2012). This learning model includes Instructional System Development Procedures, contextual learning models, cooperative learning models, problem-based learning models, thematic learning models, computer-based learning models, PACEF (Participative, Active, Creative, Effective and Fun), and independent learning models (Rusman, 2012).

According to Slavin (2012), one of the essential principles of educational psychology is that teachers do not only impart knowledge to students. Students must also construct their knowledge in their own minds. Teachers can facilitate this process by making information meaningful and relevant to students, giving students opportunities to discover and apply their own ideas, and teaching students to become aware of and consciously use their own learning strategies. According to Slavin (2012), teachers can only provide ladders to students toward a higher understanding, but students themselves have to climb the ladder.

The purpose of the approach/teaching method is to assist student learning achievement, namely: (1) students learn independently, (2) students are actively involved in

learning activities, (3) students have a comprehensive cognitive, affective, and conative understanding of task material, (4) students participate in learning activities, feel interested and can take meaning in these activities (Hanurawan, 2016).

One of these learning models is cooperative learning. While the learning principles according to Roger and David Johnson (in Lie, 2008) are: (1) the principle of dependency (positive interdependence), namely cooperative learning, which means success in completing tasks depends on the work done by the group. The performance of each group member determines the success of group work; (2) individual responsibility (individual accountability), namely, the group's success, is highly dependent on each group member. Therefore, each group member has duties and responsibilities that must be carried out in a group; (3) face-to-face promotion (face-to-face interaction), namely providing broad opportunities for each group member to meet face to face and discuss and give and receive information from members of other groups; (4) participation and education (participatory communication), namely training students to be able to actively participate and communicate in activities; (5) evaluation of group processes, namely scheduling a certain time for groups to evaluate group work processes as a result of their collaboration, so they can work together more effectively later.

One model of cooperative learning is Student Team Achievement Division (STAD). The theory underlying cooperative learning is the theory of constructivism, where more emphasis is placed on exposing complex problems to finding solutions; the teacher only acts as a facilitator and builds knowledge in students' minds (Muhid, 2019). Constructivist approaches to teaching usually use cooperative learning on a large scale, based on the theory that students will discover and understand more complex concepts if they can talk to each other about a particular problem (Slavin, 2012).

STAD cooperative learning steps are (1) delivery of goals and motivation, (2) division of groups, (3) presentations from the teacher, (4) learning activities in teams (teamwork), and (5) quizzes or evaluations (Slavin, 2012). This model is used to teach students new conceptual material through verbal and written presentations. In the STAD model, students are placed in a study team of four or five people who are mixed according to their level of achievement, gender, and ethnicity. The teacher presents the lesson while students work in teams and ensure that all team members have mastered the lesson and all students are asked questions about the material being discussed (Hanurawan, 2016).

2. METHODOLOGY

This research was conducted on underachiever students at SMA Negeri 5 Surabaya, East Java Province, Indonesia. The research was carried out in the odd semester of the 2019/2020 academic year from 15 to 30 October 2019. This research is a True Experimental study that examines causal relationships by manipulating one or more variables in one or more experimental groups. To determine the research sample random sampling technique was used. The research instrument used aims to measure student learning outcomes in both the control and experimental classes. The research design used was the Randomize pretest-posttest control group design. Each group was selected randomly or randomly. The first group was given treatment using the STAD-type learning model, and the other group was given conventional learning methods.

To avoid deviation from predetermined dimensions and indicators, arranging a grid of instruments is necessary. The instrument, in the form of an essay, measures the student learning outcomes. It was prepared based on basic competency standards and indicators contained in the mathematics subject syllabus on statistics topics determined in the 2013 curriculum. Before the test is used, validity and reliability tests are first carried out on the test instrument. To test the validity of the items, the moment product correlation formula was used. Meanwhile, the Alpha Cronbach formula was used to test the reliability of the test. The calculations using SPSS series 25 show that all of the 11 questions tested are valid with a corrected total correction index of 0.573 to 0.789.

Table 1. The validity of the test instrument items for student learning outcomes

	Scale Mean if Item Deleted	Scale variance if Item Deleted	Corrected Item-Total Correlation	Cronbac's Alpha if Item Deleted
A1	38.44	958.638	.789	.893
A2	39.51	980.867	.753	.895
A3	40.59	1046.053	.577	.905
A4	38.03	1005.451	.612	.904
A5	36.08	1091.494	.614	.904
A6	41.21	1060.424	.573	.905
A7	38.59	972.827	.738	.896
A8	40.51	1037.641	.604	.904
A9	39.03	993.838	.653	.901
A10	41.21	1060.424	.573	.905
A11	39.51	980.867	.753	.895

Based on Table 1 results, all items met the criteria with a corrected index value of > 0.3. The analysis results of 11 test items with a Cronbach Alpha coefficient price of 0.909 (> 0.9) mean the math test is reliable. It is indicated by the value of A > 0.3, which means that the test is considered reliable in measuring students' mathematical abilities.

Table 2. Statistical Reliability

Cronbach's Alpha	N of Item
.909	11

The difficulty level test of the items using SPSS version 25 showed a difficulty level of 0.371 to 0.618, which indicated that the difficulty level is in the medium criteria (0.30 to 0.69).

The dependent variable is the results of students' mathematics learning after being given treatment. The results of students' mathematics learning are in the form of test scores obtained from the posttest. Meanwhile, the independent variable is the STAD-type learning model. The data obtained were analyzed quantitatively, namely looking for the average price, mode, median, standard deviation, and standard deviation of each variable studied, looking for variance, looking for analysis requirements tests, and testing the hypothesis using the T-test.

3. FINDINGS

In this study, the variable measured is the effect of the STAD-type cooperative learning model on mathematics learning outcomes. Based on the score calculation, the score range is from 0 to 100.

Table 3. Categories of Mathematics Learning Outcomes Value

Interval	Category
81-100	Very high
61-80	High
41-60	Fair
21-40	Low
0-20	Very low

The measurement results of the experimental group based on the results of the math test before and after treatment obtained the following results:

Table 4. The experimental group measurement results based on the results of the mathematical tests before and after treatment

	Pretest	***Post-test***	**Number**	**Difference**
Number	1419	2608	4027	1189
Average	47	87	134	40
Minimum	25	50	75	25
Maximum	57	100	175	43

In table 4, it can be seen that the total pretest score is 1419, the posttest score is 2608, and the difference in the total score between the pretest-posttest is 1189. So, it can be interpreted that there is an increase in the number of math test scores after being given treatment. For the average total score, on the pretest, the value obtained is 47; on the posttest, the mean value obtained is 87; and the difference in the average score obtained is 40 points. Students' pretest scores in the experimental group are in the Fair category. On average, the students' posttest scores are in the Very High category. Thus, there is an increase in the average total score after being given treatment. For the minimum score, the pretest score is 25; in the posttest, the score is 50, so the difference in the minimum score is 25 points. So there is an increase in the minimum value of the total score after being given treatment. For the maximum score, the pretest score is 57; in the posttest, the score is 100, so the difference in the maximum score is 43 points. Thus, there is an increase in the maximum value of the total score after being given treatment.

The measurement results of the control group based on the results of the math test before and after treatment obtained the following results on Table 5:

Table 5. The results of the control group's measurements based on the math test results before and after the treatment

	Pretest	***Post-test***	**Number**	**Difference**
Number	1320	2136	3456	816
Average	44	71.2	115.2	27.2
Minimum	25	43	68	18
Maximum	80	98	178	18

From the measurement results in table 5, it can be seen that the total score of the pretest is 1320 and the total score of the posttest is 2136, and the difference in the total score between the pretest-posttest is 816. Thus, there is an increase in the number of math test scores after being given treatment. The average total score on the pretest is 44; on the posttest, it is 71.2, so the difference in the average score is 27.2 points. The pretest scores of students in the control group are in the Fair category. In the posttest scores, the average student is in the high category. Thus, there is an increase in the average total score after being given treatment. For the minimum total score, on the pretest, the minimum score is 25; on the posttest, the score is 43, so the difference in the minimum score is 18 points. So it can be interpreted that there is an increase in the minimum value of the total score after being given treatment. For the maximum total score, on the pretest, the maximum score is 80; on the posttest the score is 98, so the difference in the minimum score is 18 points. So there is an increase in the maximum score after being given treatment.

Table 6 shows the results of prerequisite analysis assumption test in the form of normality test and homogeneity test.

Table 6. Normality test values for Kolmogorov-Smirnov data distribution

Kolmogorov-Smirnov	**Sig.**	**Interpretation**
1.048	0.222	normal

In the Normality Test, the analytical technique used is the One-Sample Kolomogorov-Smirnov analysis technique. Drawing conclusions related to data distribution assumption is said to be normal if the probability results show more than 0.05 (sig > 0.05). From the results above, it can be seen that the probability of the normality test in the data population is 0.222 (sig 0.05). The entire data group has a probability value above 0.05; therefore, the distribution of all data in each group is said to be normal.

Table 7. Results of the Levene Homogeneity Test Analysis

Levene`s test	**Sig.**	**Interpretation**
15.646	0.000	Homogen

In the Normality Test, the analytical technique used to fulfill the prerequisites for the homogeneity test is Levene's Test analysis technique. The variance of the data between the experimental group and the control group is assumed similar if the significance results show a value smaller than 0.01 (sig. <0.01).

In this study, hypothesis testing was carried out using a different test of gain scores in the experimental and control groups. The following are the results of the Gain Score different test analysis using the Independent Sample t-test.

Table 8. Statistical results of Gain Scores difference test using the independent sample t-test

Independent sample t test	**Sig.**	**Interpretation**
7.380	0.00	There is a difference

Based on the Gain Score Difference Test using the Independent Sample t-test, it can be seen that the significance value of the difference in the gain score is 0.000, and this value is less than 0.05 (sig. <0.05). Thus, it can be concluded that there is a significant difference in the gain score data between the experimental group and the control group. It can be interpreted that the STAD learning method affects the mathematics test scores of the research subjects.

The results of the Independent t-test gain score obtained the following results showed on table 9:

Table 9. Statistical results of the Independent t Test Gain score

Group	**Group Gain Score**	**T**	**Sig**
Experiment	39.633	7.380	0.00
Control	27.267		

From the independent t-test results, the value of t = 7.380 is obtained with a significance value of 0.00 (p <0.01). These findings prove a significant difference in the score of the mathematics learning outcomes obtained by the experimental group using the STAD learning model and the control group not using the STAD learning model. The experimental group got an increase in the average value of mathematics learning outcomes (M=39.633) which is higher than the control group (M=27.267). Thus, the STAD-type cooperative learning model

has a significant effect on improving the mathematics learning outcomes of underachiever students.

4. DISCUSSION

The study results show that STAD effectively improves the mathematics learning outcomes of underachiever students. According to Purwanto (2014), there is an increase in learning outcomes because students get group assignments for a number of materials provided during the learning process. One of the positive results of applying the STAD method is a change in students' cognitive domains. In addition, students also become more active in participating in learning, primarily because of the rewards at the end of the learning session. According to Hamdayana (2015), the advantage of STAD-type cooperative learning is that students work together to achieve goals while still following group norms. Interaction between students is getting more intense as their ability to express opinions improves. These results are consistent with research conducted by Nugroho (2014), Sunilawati (2013), and Muharom (Muharom, 2014). In general, according to them, the STAD-type cooperative learning model, apart from having a significant effect on improving student learning outcomes, can also increase student activity.

The research results also show that the STAD model can improve students' problem-solving abilities. This increased ability is due to the learning process being carried out in an interactive and fun way, especially when carrying out group discussions, both within their own groups and when responding to other groups. This is in line with the opinion of Slavin (2012), which explains that the STAD-type cooperative learning model emphasizes the achievement of understanding the same material from each group member. The average increase in students' problem-solving abilities is also consistent with what Ormrod (2008) stated that several factors can influence the increase in students' mathematical problem-solving abilities.

5. CONCLUSION

The STAD (Student Team Achievement Division) learning model is a cooperative learning model that can significantly improve the mathematics learning outcomes of underachiever students. The initial average score proves this. Before being given the STAD (Student Team Achievement Division) treatment, the average score in the experimental group is 47. After being given the treatment, the average score is 87. In the control group, the pretest score is 47, while the post-test is 71.2.

The STAD (Student Team Achievement Division) learning model effectively improves the mathematics learning outcomes of gifted students with less achievement (underachiever students). It can be seen from the t = t = 7.380 with a sig = 0.00.

The STAD (Student Team Achievement Division) learning model provides opportunities for students to build information and collaboration to make learning more meaningful. It can be seen that during the learning process, students become more active.

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