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The influence of the STAD learning model towards improving mathematics learning outcomes

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ABSTRACT

Mathematics is still a difficult and tedious subject for elementary school students, which leads to low learning outcomes. Many factors influence students' mathematics learning outcomes. Analyzing the influence of the Student Teams Achievement Division (STAD) learning model on the mathematics learning outcomes of grade 5 elementary school students is the aim of this research. This study adopted a quasi-experimental design by comparing two unequal groups of students. Data is collected through various methods, including tests and observations. Data analysis was carried out statistically to test research hypotheses and determine the effectiveness of a particular treatment. There is a very statistically significant difference between the experimental and control groups' average post-test scores. These results support the hypothesis that the STAD learning model effectively increases learning achievement. Apart from that, cooperative learning in STAD can increase student interaction, learning motivation, and a deeper understanding of mathematical concepts. The implications of this research indicate that STAD can be an alternative learning strategy teachers implement to improve student learning outcomes.

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ABSTRAK

Pelajaran matematika masih menjadi pelajaran sulit dan menjenuhkan bagi peserta didik SD, yang berujung pada hasil belajar rendah. Banyak faktor memengaruhi hasil belajar matematika peserta didik. Menganalisis pengaruh model pembelajaran Student Teams Achievement Division (STAD) terhadap hasil belajar matematika peserta didik kelas 5 SD adalah tujuan penelitian ini. Penelitian ini mengadopsi desain kuasi-eksperimental dengan membandingkan dua kelompok peserta didik yang tidak setara. Data dikumpulkan melalui berbagai metode, termasuk tes dan observasi. Analisis data dilakukan secara statistik untuk menguji hipotesis penelitian guna mengetahui efektivitas suatu perlakuan tertentu. Terdapat perbedaan sangat signifikan secara statistik antara rata-rata nilai post-test kelompok eksperimen dan kelompok kontrol. Hasil ini mendukung hipotesis bahwa model pembelajaran STAD efektif meningkatkan prestasi belajar. Selain itu, pembelajaran kooperatif dalam STAD mampu meningkatkan interaksi antar peserta didik, motivasi belajar, serta pemahaman konsep matematika secara lebih mendalam. Implikasi penelitian ini menunjukkan bahwa STAD dapat menjadi alternatif strategi pembelajaran yang diterapkan guru untuk meningkatkan hasil belajar peserta didik.

Kata Kunci: *hasil belajar; matematika peserta didik SD; STAD*

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INTRODUCTION

Education, especially at the elementary school level, efforts to improve student learning outcomes, especially in mathematics, are still a major concern. Math subjects are still considered difficult by some students; they need a practical and fun learning approach. This is one of the causes of students' low mathematics learning outcomes, as research revealed that the analysis results were that 57.8% of students scored below the KKM (Maduratna & Setyawan, 2020). Several factors can cause low student learning outcomes, especially for mathematics subjects. Two factors affect students' math learning outcomes: internal and external. Internal factors exist in the students themselves, namely health factors, interests, talents, and motivation.

Meanwhile, external factors exist outside students, including family, school, and community (Nabillah & Abadi, 2019). The thing that affects students' learning outcomes is related to the development of teaching media that is not in accordance with the students' learning style (Helma & Edizon, 2017). Determinants of student learning outcomes are inhibiting factors and supporting factors (Sudirman et al., 2024). When viewed from a school point of view, the inhibiting factor is that teachers too often give questions that are Low Order Thinking Skills (LOTS), so that when students are given problem-solving, they cannot do it. It results in small student learning outcomes. At the same time, the supporting factor comes from the students' interest. If these students are willing to repeat the material they learn at school, then when the teacher gives practice questions, the students get satisfactory learning results (Wibowo *et al*., 2021).

Through preliminary studies at SDN 3 Sukaratu, it is known that most teachers apply learning using conventional methods. This causes not only the results of learning mathematics, which always get low scores, but also students' passions for mathematics in particular have decreased. Teachers usually tell students to take notes and do problems for material understanding activities. Students feel that lessons are tricky and tedious without being given stimulants or games to avoid boredom. The game approach in learning mathematics improves the meaning of mathematical concepts and increases students' interest and motivation in understanding the lesson. In addition, using game techniques in learning mathematics can also increase students' participation in the learning process, create a fun learning environment, and improve social communication between students (Wijayanti & Yanto, 2023). Reviewing some research results, researchers will examine students' math learning outcomes based on the learning methods used. Learning methods are one of the external factors that determine student learning outcomes.

Learning outcomes are a branch of evaluation in learning. The high and low learning outcomes obtained by students are not necessarily only seen in the evaluation process, but also from the beginning of learning, the learning process, and the learning evaluation process. Of the three flows, the most influential is in the learning process, how the teacher processes the learning process so that the concept of understanding is achieved without ignoring the sense of comfort and fun felt by students. Learning methods for elementary school children must be oriented towards a fun approach because elementary school children still like to play. The nature of learning for students must consider the nature of nature and the nature of their times. The nature of learners is to play, so learning does not eliminate their pleasure in playing, which is integrated into the learning process. One approach that can be considered is the use of cooperative learning models. The cooperative learning model effectively creates an active, collaborative, and fun learning environment. In groups, learners can work together, share ideas and build a better understanding of the subject matter. One of the cooperative learning models that is often applied is Student Teams Achievement Division (STAD).

The Student Teams Achievement Division (STAD) model is one of the popular cooperative learning approaches. In this model, learners are grouped heterogeneously to learn together. Heterogeneous here

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is not only in terms of gender but also heterogeneous regarding the learners' initial abilities. Each group is given a task that must be completed collaboratively. After that, each learner will be assessed individually through a written test (Eviliyanida, 2011).

The STAD type learning model is an alternative to overcome students' learning weaknesses. By emphasizing interest, motivation, and communication relationships in students, one of the characteristics of the STAD type learning model (Adnyana, 2020). Using the STAD type learning model also improves student learning outcomes (Junistira, 2022). STAD is considered one of the innovative steps that can improve elementary school students' mathematics learning outcomes (Suriat, 2022). By looking at the success of previous studies, researchers added innovations in the syntax, namely in group selection. Researchers used several games that added to the atmosphere of enthusiasm and excitement. Likewise, in implementing the quiz, children are given challenges so that their adrenaline rushes. Researchers hope that this research can be used as a reference for educators to apply this learning model, which has been tested and found to be fun for students and to improve student learning outcomes. This study aimed to analyze the effect of the Student Teams Achievement Division (STAD) learning model on mathematics learning outcomes.

LITERATURE REVIEW

STAD Learning Method

The STAD learning model is one of the simplest cooperative learning methods and is the best learning method for beginners for teachers new to the cooperative approach (Safitri & Sholehuddin, 2024). It is a cooperative learning innovation from Slavin that encourages students to collaborate and motivate each other in the learning process. This is expected to optimize students' academic achievement.

According to Slavin, there are five main aspects in STAD learning, namely (Misbah & Rasyid, 2022):

1. Class achievement. This activity is done immediately after the teacher understands the material. This presentation will help students with the quiz.
2. Teamwork. Teams or small groups of 4-5 learners are heterogeneous regarding ability, gender, or ethnicity. This team will determine the level of learner success. The team is expected to work together and motivate each other to do the quiz.
3. Quiz. Although in groups, learners still work on quizzes independently.
4. Independence score. In doing quizzes, the points earned by each learner become their excitement for them in competing to collect the most points. On the other hand, learners show an increase in their abilities in the academic field.
5. Team awards. The teacher automatically awards the team with the highest score. The score is calculated based on the percentage of their test score exceeding the previous test.

Hasil Belajar Matematika

Fundamentally, learning is a natural change in students from not knowing to knowing, from not understanding to understanding. Moreover, one of the indicators to determine that the process is to conduct an assessment or evaluation to know the students' learning outcomes. According to Dimyati and Mudjiono, learning outcome evaluation determines students' learning achievements through assessment and/or measurement activities (Firmansyah, 2015). Meanwhile, according to Gagne and Briggs, learning outcomes are a person's ability after a specific learning process (Nurrita, 2018). Sudjana also said that learning outcomes or achievement are the realization or expansion of a person's potential abilities or capacities (Saputri *et al*., 2020). The learning outcomes that a person has can be seen from their

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behavior. Based on Bloom's Taxonomy theory, learning outcomes are achieved through 3 aspects of the domain: the cognitive domain, affective domain, and psychomotor domain. The learning outcomes obtained by students become the initial data for a teacher to analyze and reflect on the learning process that has taken place and whether it is appropriate or must be changed or modified. Learning outcomes are the students' final learning process and a self-control tool to determine how students understand their learning. In the implementation of learning outcomes, students are the main subject. However, in determining how to determine learning outcomes, teachers have a big enough share to package the evaluation material so that children can do it in a fun way.

Learning outcomes result from a series of learning processes obtained by students in the form of an assessment of the three aspects: cognitive, affective, and psychomotor. In determining the learning outcomes of each learner, various factors, both internal and external, can be involved. In this study, researchers highlighted the learning methods teachers use. Based on the experience of researchers, if the teacher is right in using learning methods so that students are comfortable and enjoy learning, inhibiting factors in determining learning outcomes can be minimized.

Factors Affecting Learning Outcomes

Two factors affect student learning outcomes, namely: 1) Internal factors, in which there is physical health (the main factor), psychology concerning intelligence, learner talent, interest and creativity, motivation to increase enthusiasm in achieving goals, and finally a stable psychoemotional condition; and 2) External factors in which there is a physical environment, namely an environment that meets the facilities and infrastructure of students in learning, as well as a classroom social environment that affects the psychological and social atmosphere that occurs during the learning process in a conducive manner (Saputri *et al*., 2020). Classroom management is more dominant in terms of teacher competence. Passive classroom management makes students experience difficulties in learning. The cause of low student learning outcomes is students' difficulty in understanding learning, so that students are not motivated to learn, and the ineffectiveness of teachers in using learning methods (Nabillah & Abadi, 2019). Learners consider Mathematics lessons difficult; lack of learner interest, lack of learner concentration, low understanding of learner concepts, lack of learner discipline, busy school hours, and learner perceptions of teaching teachers can affect learning outcomes. For specific findings, it is stated that students lack interest in mathematics lessons, do not concentrate during learning, have a low understanding of fundamental mathematics concepts, and lack discipline that affects learning outcomes (Ardilla & Hartanto, 2017).

Factors that influence student learning outcomes lie with the teacher and the students. Students who experience difficulties in understanding and learning, combined with a teacher who cannot facilitate their needs, will tend to have low learning outcomes. Similarly, when students who experience learning difficulties and lack discipline meet an innovative teacher who can manage the class, making the learning environment comfortable and enjoyable, it will become one of the motivations for the students to learn, ultimately leading to improved learning outcomes.

Relevant Learning Theories

1. Theory of Constructivism
   The STAD learning model is one of the learning models based on the constructivism approach. One type of this approach is the grouping of students who are prepared to work together, and it is one of the approaches that helps students with low abilities increase their confidence in learning because there is cooperation and togetherness in learning. It is also one of the keys to improving student

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learning outcomes with learning that uses the constructivist approach. Omrod proposes the center of concepts and principles in constructivism theory that humans can use their mental functions to improve learning, memory, and logical reasoning (Suryandari, 2023). According to Vygotsky's view, the basis of human mental functions is biologically built, and to develop these mental functions, humans need the role of society and culture. The important ideas in his theory are:

a. Informal and formal interactions between adults and children will give children an understanding of how children develop.
b. Every culture has meaning to improve children's cognitive abilities; the meaningfulness of culture for children aims to guide children in living their lives productively and efficiently.
c. Thinking and language skills develop in the early years of a child's development.
d. The development of complex mental processes occurs after children perform social activities. These processes gradually become internalized in children's cognition and can be used freely. Complex thought processes are highly dependent on the child's social interactions.
e. Children can do challenging tasks if given more challenging tasks by competent individuals.

Related to that theory, it aligns with the STAD learning model, which uses groups to interact socially with their peers as a developmental process.

2. Social Cognitive Theory
Social cognitive theory is a theory that emphasizes the idea that most human learning occurs in a social environment. By observing others, humans acquire knowledge, rules, skills, strategies, beliefs, and attitudes (Dewi et al., 2024). Individuals also look at models or examples to learn the usefulness and suitability of behaviors resulting from modeled behavior. Then they act according to beliefs about their abilities and the expected results of their actions. Another distinctive characteristic of social cognitive theory is the leading role given to self-regulatory functions when a person behaves not just to conform to their tendencies. Most of their behavior is motivated and regulated by internal standards and reactions to their actions (Yanuardianto, 2019). This theory aligns with the STAD learning model, which states that the groups created are heterogeneous so students can have social relationships with their friends.

3. Motivation Theory
Abraham Maslow's theory of motivation is often called the needs theory, which states that humans have basic needs. The five levels of needs are known as Maslow's hierarchy of needs, namely: (1) physiological needs (hunger, thirst, and so on), (2) security needs (feeling safe and secure, away from danger), (3) needs for a sense of love and belonging (affiliating with others), (4) needs for appreciation (achieving, competing, and getting support and recognition), (5) self-actualization needs (cognitive needs; knowing, understanding, and exploring; aesthetic needs; harmony, order, and beauty; self-actualization needs: getting self-satisfaction and realizing their potential).

In a study conducted by Yanuardianto (2019), it was stated that Abraham Maslow's Motivation Theory can improve, influence, or optimize the mathematics learning process, mathematics learning outcomes, and mathematics learning achievement, so it is essential to apply Abraham Maslow's Motivation Theory in mathematics learning activities. One of the theories is about the need for security. The sense of security in question is the sense of security of students in learning with their teachers, where students feel safe even when they do not understand in learning mathematics, students can still ask until they understand, none other than because of the sense of security provided by their teachers (Yanuardianto, 2019). This condition is in line with the STAD learning model, which facilitates the needs of students in addition to learning and provides a place to keep playing while learning. This is one of the conditions in which students are motivated to learn.

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Herzberg's motivation theory states that two types of factors encourage a person to try to achieve satisfaction and stay away from dissatisfaction. The two factors are (1) Hygiene Factors: motivate a person to get out of dissatisfaction, including environmental conditions (extrinsic factors), (2) Motivator Factors: motivate a person to try to achieve satisfaction, which includes achievement, recognition, etc. (intrinsic factors). Furthermore, Mc Clelland's motivation theory states that there are three important things become human needs, namely a) Need for achievement, b) Need for affiliation (need for social relationships/almost the same as Maslow's social need) and c) Need for Power (drive to organize) (Prihartanta, 2015).

METHODS

The research took place at SDN 3 Sukaratu Kecamatan Banyuresmi Kabupaten Garut. The researcher used a quasi-experimental method of comparing two unequal groups to determine the effect of one variable on another. To determine the relationship, a comparison class is needed, so the researcher also used the Pre-Test and Post-Test with Non-Equivalent Control-Group Design (Abraham & Supriyati, 2022).

Table 1. Research Design

Group	Pre-test	Treatment	Post-test
Experiment	O_1	X	O_2
Control	O_3		O_4

Source : Sugiyono in his book "Metode Penelitian Kuantitatif Kualitatif dan RnD"

Information:

O1 and O3:
Initial measurement of students' abilities before they participate in learning with the STAD model.
O2 and O4:
Final assessment of students' abilities after learning with the STAD model.
X:
Applying the STAD learning model as an independent variable in the research.

The population researchers use is all grade 5, including classes 5A and 5B, totaling 47 students. Where the sample of class 5A is the control class, while class 5B is the control class. To measure the effect of applying the learning syntax [STAD learning model] on students' learning outcomes, this study used a combination of data collection methods: observation, documentation, and tests. Quantitative data from multiple-choice test questions were analyzed using simple linear regression with SPSS to test the research hypothesis. This research uses the parametric descriptive statistical analysis method. Hypothesis testing was carried out with the Independent T-test with the help of SPSS 29.0 for Windows. Before conducting data analysis and hypothesis testing, the data obtained needs to be tested for assumptions first, which is done by testing the normality and homogeneity of variance. The normality test was conducted using the Kolmogorov-Smirnov test, while the homogeneity test was conducted using Levene's Test.

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RESULTS AND DISCUSSION

All 20 objective items were declared valid based on the results of the content validity test with an item-total correlation coefficient above 0.3 at the 5% significance level. In addition, the pre-test and post-test data of the experimental group have met the normality assumption, as tested using the Kolmogorov-Smirnov test.

Table 2. SPSS Output Normality Test Experimental Class

Tests of Normality

	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
pretest	,124	23	,200*	,956	23	,388
posttest	,152	23	,180	,929	23	,107

Source: Data processed by researchers (2024)

The results of the normality test using the Kolmogorov-Smirnov test with a significance level of 5% indicate that the pre-test data of the experimental group are normally distributed (p = 0.388), as well as the post-test data (p = 0.107).

Table 3. SPSS Output Normality Test Control Class

Tests of Normality

	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
pretest	,127	24	,200*	,948	24	,242
posttest	,202	24	,012	,931	24	,102

Source : Data processed by researchers (2024)

The test results show that the pre-test and post-test data in the control group are normally distributed. This is indicated by the significance values greater than 0.05, namely 0.242 for the pre-test and 0.102 for the post-test.

Table 4. Output SPSS Homogeneity Test

Tests of Homogeneity of Variances

		Levene Statistic	df1	df2	Sig.
Hasil_Belajar	Based on Mean	,163	1	45	,689
	Based on Median	,157	1	45	,694
	Based on Median and with adjusted df	,157	1	37,736	,694
	Based on trimmed mean	,149	1	45	,701

Source: Data processed by researchers (2024)

The researchers also conducted a homogeneity test on the learning outcome scores. In that data, the significance value is >0.689, where the value is >0.005, which proves that the data is homogeneous.

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Using the STADodel has proven effective in improving the understanding of fractions among fifth-grade students. The results of the t-test) The group that used STAD showed better outcomes than the group that did not use STAD.

Table 5. Output SPSS T-Test Post-test

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means							
						Significance		Mean	Std. Error	95% Confidence Interval of the Difference	
		F	Sig.	t	df	One-Sided p	Two-Sided p	Difference	Difference	Lower	Upper
Hasil_Belajar	Equal variances assumed	,163	,689	-13,574	45	<,001	<,001	-36,245	2,670	-41,623	-30,867
	Equal variances not assumed			-13,655	42,693	<,001	<,001	-36,245	2,654	-41,599	-30,891

Source: Data processed by researchers (2024)

Based on the output results above, the two-sided p-value is <0.001, much smaller than 0.005. This means that H0 is rejected, and it is concluded that there is a statistically significant difference between the means of the two groups.

Next, the table below presents the students' average pre-test and post-test learning outcomes.

Table 6. Average Learning Outcome Score

Group	Pre-test	Post-test	Particulars
Experiment	55,6	87,9	32,3
Control	48,8	50,1	1,3

Source: Data processed by researchers (2024)

The research results show a significant increase in the experimental class students' average score after learning with the STAD model, from 55.6 to 87.9. On the other hand, the increase in scores in the control class, which did not use the STAD model, was relatively small, only from 48.8 to 50.1. This proves that the STAD model effectively improves students' learning outcomes.

Learning Outcomes of Learners Who Apply the STAD Learning Model

The results showed significant differences in learning outcomes using the Student Teams Achievement Division (STAD) learning model compared to conventional learning. The learning outcome variable obtained significant results, where the STAD learning model could improve the math learning outcomes of 5th-grade students at SDN 3 Sukaratu. Following learning activities according to the syntax in the STAD learning model, students are also more motivated and enthusiastic in learning, improving their learning outcomes. STAD-type cooperative learning has a positive effect or can increase motivation, social attitudes, and student learning outcomes (Andrian et al., 2020). Likewise, according to Adnyana's research (2020), motivation and learning outcomes increased when implementing the STAD type learning model (Adnyana, 2020).

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The findings of this study also reinforce previous studies that have been conducted, that the STAD learning model can improve student learning outcomes in elementary schools (Yeni et al., 2023). By looking at the learning syntax in the STAD learning model, what distinguishes it from other cooperative learning models is the reward given by the teacher for the success of students. Giving rewards to elementary school children is still one of the drivers of students' enthusiasm for learning. Giving rewards based on the characteristics of students can improve student learning outcomes (Salamah et al., 2022).

This research is also supported by many relevant studies, including research that reveals that with increased learning outcomes in students, the STAD learning model can be applied to other subjects (Kadek et al., 2021). Penerapan model STAD mampu mendorong peserta didik untuk mencapai potensi belajar yang lebih optimal (Mujazi, 2020). The STAD type cooperative model can improve students' Mathematics learning outcomes (Sigalingging et al., 2022). This can be seen from the difference in student learning outcomes (Manjani et al., 2022).

Effect of STAD Learning Model on Students' Learning Outcomes

Data analysis shows that the STAD learning model strongly influences students' mathematics learning outcomes. The average final score of students taught with the STAD model (87.9) is much higher than that of students taught with the conventional method (50.1). The difference of 37.8 points is statistically significant and shows the effectiveness of the STAD model in improving students' understanding of mathematical concepts. The effect of the STAD learning model is very significant on students' learning achievement (Jannah, 2023; Putri & Sutriyono, 2018; Walijah et al., 2017).

CONCLUSION

Based on the results of the research and discussion, it can be concluded that this study proves that the STAD learning model is one of the practical learning approaches to improve the mathematics learning outcomes of grade 5 students in understanding and applying fraction concepts in the SDN 3 Sukaratu school environment. By looking at the research results, this study is designed to be used as a reference and to share information with teachers regarding the positive impact of using the STAD learning model on students' math learning outcomes. The suggestions researchers want to convey about this research show that the STAD learning model can improve student learning outcomes. However, several things must be considered, including: 1) teachers must master the syntax of the STAD learning model; 2) what distinguishes this research from other studies is that, in making groups, researchers use games. Although this activity adds a little time, the impact on students is quite significant, namely students are made comfortable from the beginning to the end of the activity; and c) teachers must be clear in giving directions to students and teachers must also focus on always being ready to facilitate students who fail to understand the implementation of the STAD learning model. This STAD learning method needs support from school leaders so that teachers and students are equally motivated and teachers can share good practices. So that the improvement of learning outcomes is not only felt in one class but in all classes, so that all teachers consistently innovate to use fun learning models, and one of them is the STAD learning model.

AUTHOR'S NOTE

The authors declare that there is no conflict of interest related to the publication of this article and emphasize that the data and content of the article are free from plagiarism.

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