

## Math Learning Outcomes with Cooperative Learning Model (STAD) Reviewed from Students' Self Efficacy

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### ABSTRACT

This study aims to determine the effectiveness of the STAD cooperative learning model in terms of students' self-efficacy towards mathematics learning outcomes, particularly in the topics of Least Common Multiple (KPK) and Greatest Common Divisor (FPB), for fourth-grade students at SD Negeri Manyaran 02, divided into two learning groups: Class IV.A with 25 students and Class IV.B with 24 students. The research design employed in this study is quasi-experimental. Quasi-experimental research is conducted under conditions that do not allow for full control. Data collection utilized questionnaire and test techniques, followed by data analysis using a two-way ANOVA and further post hoc tests (multiple comparisons). Based on the tests, the test instrument was declared valid, with difficulty index reaching  $p < 0.30$  for difficult criteria and  $p > 0.70$  for easy criteria, as well as a reliability index of  $r_{11} > 0.70$ . The study findings indicate that there is no significant effect of the STAD cooperative learning model on mathematics learning outcomes when viewed from the self-efficacy of fourth-grade students. However, the relationship between the STAD model and self-efficacy in mathematics learning outcomes shows positive results. Students with higher self-efficacy indices are proven to have better learning outcomes compared to those with lower self-efficacy levels.

**Keywords:** Effectiveness, Mathematics, Self-efficacy, STAD

### ABSTRAK

Penelitian ini bertujuan untuk mengetahui efektivitas model cooperative learning tipe STAD ditinjau dari efikasi diri peserta didik terhadap hasil belajar matematika, khususnya materi KPK dan FPB bagi siswa kelas IV SD Negeri Manyaran 02 yang terbagi menjadi dua rombongan belajar, yaitu kelas IV.A berjumlah 25 peserta didik dan kelas IV.B yang berjumlah 24 peserta didik. Jenis penelitian ini adalah penelitian eksperimental semu. Rancangan eksperimen semu adalah rancangan penelitian eksperimen yang dilakukan pada kondisi yang tidak memungkinkan. Teknik pengumpulan data dengan teknik angket dan tes. Kemudian analisis data menggunakan uji anova dua jalur dilanjutkan dengan uji lanjut anova (komparasi ganda). Berdasarkan uji, instrumen tes dinyatakan valid dengan indeks kesukaran mencapai  $p < 0,30$  untuk kriteria sukar dan  $p > 0,70$  untuk kriteria mudah, serta indeks reliabilitas  $r_{11} > 0,70$ . Temuan studi mengindikasikan bahwa tidak ada hasil signifikan dari model cooperative learning tipe STAD terhadap hasil belajar matematika dilihat dari efikasi diri siswa kelas empat SD. Sementara itu, relasi model STAD dengan efikasi diri pada hasil belajar matematika menunjukkan hasil positif. Siswa dengan indeks efikasi lebih tinggi terbukti memiliki hasil belajar yang lebih baik dibandingkan mereka yang level efikasinya rendah.

**Kata kunci:** Efektivitas, Efikasi diri, Matematika, STAD

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### Introduction

The use of instructional models has significant implications in the field of education. Instructional models encompass not only teaching methods but also embrace strategies, approaches, and frameworks that guide the learning process. In this context, selecting an appropriate instructional model can make a substantial contribution to achieving learning objectives. The right choice of instructional model can create an engaging learning environment, motivate learners, and enhance comprehension of the subject matter. Therefore, understanding the importance of using instructional models forms the foundation for this research, which aims to explore the contribution of the Student Team Achievement Division

(STAD) Cooperative Learning Model to the learning outcomes of students in the context of mathematics education. Various instructional models, including the active learning model, are considered effective in addressing these objectives.

The active learning model is a form of teaching in which students are directly involved in every phase of the learning process (Suparsawan & SD, 2020). Students are the primary actors who determine whether learning takes place or not. In the active learning approach, the role of the teacher is that of a facilitator, responsible for preparing conducive conditions for learning to occur (Sanjaya, 2010). There are several active learning models that can be referenced in the teaching process, including the constructivist teaching model. The constructivist teaching model is a widely spread approach in the realm of education. Von Glaserfeld (quoted by Wardani, 2016) states, "The constructivist vision is an epistemology rooted in philosophy, psychology, and cybernetics." Constructivism is an epistemology grounded in philosophy, psychology, and cybernetics (Supardan, 2016). Sumantri (2015) states that an example of a cooperative learning model is a series of learning activities undertaken by students in specific groups to achieve predetermined learning objectives.

Student Team Achievement Division (STAD) is a cooperative learning approach involving student activities and interactions, fostering mutual assistance (Hamalik, 2006; Adnyana, 2020). STAD learning is necessary to enhance students' collaboration abilities and achieve common goals (Astuti, 2016). As proposed by Sudana & Wesnawa (2017), the cooperative approach emphasizes activities and interactions among students to mutually assist in mastering the subject matter to attain optimal achievements. In practice, students are motivated to earn team rewards through collaborative learning with their group (Monika & Adman, 2017). Within the group, members support each other to attain learning outcomes and become the best group while embodying that learning is important, valuable, and enjoyable. Gillies (in Chim, 2015) states: "Significantly, results showed that students in structured groups are more willing to listen, ask for elaborations, share ideas, and provide assistance," indicating that students within structured groups are significantly more inclined to listen, seek clarifications, share ideas, and offer help. Awards are granted to groups that achieve mathematics learning outcomes per predetermined criteria. Group learning enhances and equalizes students' learning outcomes (Shaufia & Ranti, 2020).

This model has proven to provide significant benefits in the field, such as improving social interaction, as evidenced in studies conducted by Wijaya & Arismunandar (2018) and Rahmawati et al. (2022). Furthermore, the STAD cooperative learning model can be utilized to maximize student empowerment, as indicated by research conducted by Maryanti (202) and Qadriah (2019). Additionally, this model supports the achievement of better learning outcomes, as demonstrated by the research conducted by Darmiyanti et al. (2020) and Sari (2022).

In addition to the instructional model's influential role in the effectiveness of the learning process, students' confidence also plays a significant role in influencing mathematics learning outcomes (Simanjuntak, 1993). Each student possesses varying levels of self-confidence. These differences are influenced by several factors, including students' physiological and psychological aspects (Maddux, 2013). Self-confidence, often called self-efficacy, is a psychological aspect students employ in their learning activities to accomplish tasks, as stated by Karsten & Roth (Shalikhah et al., 2016). Self-efficacy is an individual's belief regarding their capability to complete tasks (Wahdaniah et al., 2017).

Self-efficacy plays a crucial role in the development of students, influencing their motivation,

perseverance, and academic performance. Students with high self-efficacy are more likely to be motivated, believing that their hard work will yield positive results, and demonstrating better abilities to overcome obstacles (Kharisma & Safitri, 2023). Additionally, high self-efficacy aids students in managing stress, improving social skills, and making more suitable career choices. With strong self-confidence, students can confront challenges more effectively, enhance independence, and achieve success both in their academic pursuits and in their daily lives.

Research on the STAD cooperative learning model and studies on self-efficacy have been conducted previously. One example is a study by Susila (2022) on improving student learning outcomes in physical education by utilizing the STAD model in practice. Another study by Kusumawardani et al. (2018) explores the impact of implementing the STAD cooperative learning model using poster media to enhance students' learning outcomes. The utilization of social media to implement the STAD model was carried out by Wijaya and Arismunandar (2018) with the aim of improving student learning outcomes.

Previous research on self-efficacy includes a study by Eka (2023) analyzing the influence of problem-based learning models on students' self-efficacy. Another study by Asih and Hasruddin (2023) analyzes the profile of student self-efficacy based on the learning process and outcomes. Additionally, research by Masriah and Atun (2023) investigates the influence of student self-efficacy on learning outcomes, specifically in the subject of Civic Education.

Given the learning outcomes from the first semester, the researcher aims to apply one of the cooperative learning models to determine its effectiveness on mathematics learning outcomes concerning students' self-efficacy. The less-than-optimal results in mathematics learning for fourth-grade students at SD Negeri Manyaran 02 are suspected to be due to the incomplete delivery of mathematical concepts to students. Students rely on notes and attempt to solve problems without fully grasping the mathematical concepts. The teaching model teachers employ for mathematics instruction needs more variety; they primarily explain the material to students, provide practice problems, and assign homework as a concluding activity. As a result, the expected mathematics learning outcomes still need to be achieved.

The novelty offered in this study is placing student self-efficacy as a variable that could influence the effectiveness of learning conducted using the STAD cooperative learning model. Previous studies have not linked the emerging self-efficacy in learning with a specific model and how it affects the effectiveness of that learning. This can aid in identifying additional factors that need to be considered when evaluating the effectiveness of the STAD learning model.

The objectives of this research are as follows, 1) To determine whether there is a difference in the influence of the STAD teaching model and conventional (traditional) teaching on mathematics learning outcomes. 2) To identify whether there is an influence of the level of self-efficacy on students' mathematics learning outcomes. 3) To ascertain whether there is an interaction between the STAD teaching model and self-efficacy in relation to students' mathematics learning outcomes.

### **Research Methods**

This research employs a quasi-experimental approach to assess the effectiveness of the STAD cooperative learning model in conditions that do not allow for a true experimental study. This study aims to assess the influence of an action or treatment on students' behavior or to test hypotheses about whether there is an effect of the action when compared to another action.

The treatment in question implements the STAD cooperative learning model as the first variable. The second variable that affects the dependent variable is students' self-efficacy. Meanwhile, the dependent variable is mathematics learning outcomes. Based on the type of research used, this study falls under the category of quasi-experimental research, given that it is not feasible to control all relevant variables. As Budiyono (2014) stated, "The purpose of quasi-experimental research is to obtain information that approximates the information that could be obtained from actual experiments, which is not feasible to control and/or manipulate all relevant variables."

The design used in this study is a 2 x 2 factorial design, as presented in the following table:

**Table 1.** 2x2 Factorial Design

Treatment ( $A_1$ )	Self-efficacy ( $B_1$ )	
	High self-efficacy ( $B_1$ )	Low self-efficacy ( $B_2$ )
Cooperative Learning Model STAD type ( $A_1$ )	$A_1 B_1$	$A_1 B_2$
Learning model conventional ( $A_2$ )	$A_2 B_1$	$A_2 B_2$

Information:

$A_1$  = STAD type cooperative learning model

$A_2$  = Conventional learning models

$B_1$  = High self-efficacy

$B_2$  = Low self-efficacy

$Y$  = Mathematics learning outcomes

$A_1B_1$  = The group of students subjected to the STAD cooperative learning model has high self-efficacy.

$A_1B_2$  = The students subjected to the STAD cooperative learning model have low self-efficacy.

$A_2B_1$  = The students subjected to the conventional learning model have high self-efficacy.

$A_2B_2$  = The students subjected to the conventional learning model have low self-efficacy.

Based on Table 1, it is explained that there are two treatments administered within the research classroom, namely the STAD teaching model and the conventional teaching model. The students possess two levels of self-efficacy: high self-efficacy and low self-efficacy. By conducting measurements within each treatment group, we can identify how the combination of both these factors influences learning outcomes. The factorial design allows us to observe the effects of each factor independently, as well as the interactions between these factors. Table 1 presents four resulting combinations of the determined factors.

*Population*

The parameters of the study consist of all fourth-grade students from SD Negeri Manyaran 02, totaling 49 students, for the academic year 2020/2021, distributed across 2 classes, namely Class IV. A and IV.B. The sampling technique aims to achieve valid and accountable conclusions, ensuring that the selected sample represents each population group. The sampling method utilized in this research is Random Sampling. Random sampling (probability sampling)

involves randomly selecting samples from all population members without considering existing strata within the population. To determine the participants for this study, a lottery method was employed. The first selected lottery number was assigned as the experimental group with the STAD cooperative learning model, and the second selected number was assigned as the control group with the conventional teaching model. The two experiments with the STAD cooperative learning model were Class IV. A and the control group with the conventional teaching model was Class IV.B.

### *Research Instruments*

The starting point for developing the instruments is the established variables. In this study, the instruments to be used are tests and questionnaires. The test instrument is employed to gather data on students' mathematics learning outcomes related to Least Common Multiple (KPK) and Greatest Common Divisor (FPB). On the other hand, the questionnaire instrument is used to collect data on the high or low levels of students' self-efficacy.

#### 1. Test

The test instrument for mathematics learning outcomes on the topics of LCM (Least Common Multiple) and GCD (Greatest et al.) employs a multiple-choice test format. After analyzing the test instrument's trial results, 30 multiple-choice questions were selected and administered to the research sample.

##### a. Test Instrument Analysis

###### 1) Validity Test

An instrument is considered valid when it measures what it is intended to measure and the degree of precision in measuring is consistent. For learning outcomes tests, several criteria serve as benchmarks for determining the validity of an instrument:

- a) The test items should be representative samples to assess how far the learning objectives have been achieved, both in terms of the content taught and from the perspective of the learning process.
- b) The emphasis of the test items should be balanced with the content taught.
- c) All additional knowledge taught or covered should be optional to answer the test questions correctly.

A test instrument is considered valid if it meets the criteria for instrument evaluation as follows:

- a) Test items are aligned with the test blueprint.
- b) The content of the test items corresponds to the indicators.
- c) The content of the test items has been taught to the students.
- d) The content of the test items is understandable to the students.
- e) The content of the test items does not allow for multiple interpretations.
- f) The test items are relatively easy and easy.

###### 2) Reliability

The reliability of an instrument is associated with its consistency and precision in measurement. According to Budiyono (2014), an instrument is considered reliable when the measurement results are relatively consistent. This means that the measurements are relatively similar when taken on the same individual at different times or on different individuals (but under the same conditions) at different times. The reliability test for the test in this research uses the Kuder-Richardson KR-20 formula, which is as follows:

$$r_{11} = \left[ \frac{n}{n-1} \right] \left[ \frac{S_t^2 - \sum p_i q_i}{s_t^2} \right] \quad (1)$$

With:

- $r_{11}$  : Instrument reliability index  
 $n$  : lots of instruments  
 $p_i$  : the proportion of the number of subjects who answered correctly on item  $i$ .  $q_i = 1 - p_i$   
 $S_t^2$  : total variation

In this study, the test is said to be reliable if it exceeds 0,70 ( $r_{11} > 0,70$ )  
 (Budiyono, 2014)

### 3) Analysis of Instrument Items

#### a) Difficulty Index

A question is considered good when it possesses an appropriate level of difficulty, meaning it is relatively easy and easy. To determine the difficulty index for each test item, the following formula is used:

$$P = \frac{B}{J_s} \quad (2)$$

With:

- $P$  : Difficulty index  
 $B$  : The number of test takers who answered the questions correctly  
 $J_s$  : Total number of test takers

In this study, the questions were considered good if  $0,30 < P < 0,70$   
 (Suharsimi Arikunto, 1998:212)

#### b) Discriminating Power

The Discrimination Power of a question refers to its ability to differentiate between students with high and low abilities. Zaenal Arifin (2009:133) establishes upper and lower groups for this purpose. If the number of students is substantial ( $>30$ ), it can be determined as 27% of the total test-takers.

$$DB = \frac{N_t - N_r}{N} \quad (3)$$

Information:

- $DB$  : Discriminating Power  
 $N_t$  : The number of high-ability students who correct answers  
 $N_r$  : The number of low-ability students' correct answers  
 $N$  : The number of students is 27% of the test takers

**Table 2.** Different Power Score Classification

Different Power Score	Category
$-1 \leq DB < 0,20$	Bad
$0,20 \leq DB < 0,30$	Not good
$0,30 \leq DB < 0,40$	Good
$DB \geq 0,40$	Good enough

Table 2 elucidates the classification of discriminant power values obtained from calculations

based on the discriminant power formula. Based on Table 2, the researcher utilized discriminant power values with scores greater than or equal to 0.30, categorized as good and good enough.

## 2. Questionnaire

The questionnaire testing in this research uses the Likert Scale model to collect student self-efficacy data. The statements in the questionnaire serve as indicators of students' self-efficacy levels, presented as multiple-choice questions with four answer options. Scoring for positive items is assigned as follows: A is given a score of 4, B is given a score of 3, C is given a score of 2, and D is given a score of 1. Meanwhile, for negative items, the scoring is as follows: A is given a score of 1, B is given a score of 2, C is given a score of 3, and D is given a score of 4.

The data collection technique used in this research involves questionnaires and tests.

### a. Questionnaire

According to Budiyono (2014), a questionnaire is a data collection method involving written questions presented to research subjects, respondents, or data sources, with written responses also provided. In this research, the questionnaire pertains to self-efficacy. The questionnaire is used to categorize students into high and low self-efficacy groups.

### b. Test Model

According to Budiyono (2014), the test model is a data collection method that presents a series of questions or tasks to research subjects.

This research uses the test model to obtain data on students' mathematics learning outcomes. The test consists of multiple-choice questions on exponentiation and square roots. The choice of a multiple-choice test is because it can effectively measure students' mathematics learning outcomes.

## *Method of Data Analysis*

The data analysis technique employs statistical methods with a two-way ANOVA test. Before conducting data analysis, the prerequisite tests are performed, namely the tests for normality and homogeneity, as follows:

### 1. Prerequisite Tests

#### a. Normality Test

The normality test determines whether the research sample originates from a normally distributed population. The normality test in this research employs the Lilliefors test model.

b. The homogeneity of Variance Test is used to determine whether the variances of the research samples come from populations with equal variances. The Bartlett test model with the Chi-squared test statistic is utilized to assess the homogeneity of variances.

## 2. Hypothesis Testing

In this research, a two-way ANOVA is employed to analyze the data. Table 3 is a summary of a Two-Way Analysis of Variance (Two-Way ANOVA) and contains information about main effects, interactions, and error variability within the analysis. The table starts by presenting information about the sources of main effects. There are three main components being analyzed: Factor A (Row), Factor B (Column), and the interaction between Factor A and B (AB Interaction). For each component, provided information includes the degrees of freedom (df),

the number of observations (N), and the F-test statistic. This F-test statistic is compared with the critical  $F^*$  value obtained from the F-distribution table to determine if there are significant differences between the compared groups. The observed p-value can also be used to measure statistical significance. "Row (A)" refers to the main effect of Factor A (or the variable tested in the row of the table). The provided information includes df, N, F-test statistic ( $F_a$ ), and the critical  $F^*$  value compared to alpha ( $\alpha$ ) to determine if this effect is significant. "Column (B)" refers to the main effect of Factor B (or the variable tested in the column of the table). The information provided is similar to the "Row (A)" section and includes df, N,  $F_b$ , and the critical  $F^*$  value compared to  $\alpha$ . "AB Interaction" refers to the interaction effect between Factor A and B. Similar to before, df, N,  $F_{ab}$  (F-test statistic for interaction), and the critical  $F^*$  value are compared to determine if this interaction is significant. "Error (G)" reflects the error variability within the analysis. The values of df and RKG (error variation) are given. "Total" includes the total degrees of freedom and overall df within the analysis. The "Note" clarifies that P is the observed probability, and  $F^*$  is the F value obtained from the F-distribution table.

**Table 3.** Summary of Two-Way Analysis of Variance

Main effect var source	JK	Dk	RK	F	$F \alpha$	F
Row (A)	JKA	$p - 1$	RKA	$F_a$	$F^*$	$< \alpha \text{ or } > \alpha$
Column (B)	JKB	$q - 1$	RKB	$F_b$	$F^*$	$< \alpha \text{ or } > \alpha$
AB Interaction	JKAB	$(p-1)(q-1)$	RKAB	$F_{ab}$	$F^*$	$< \alpha \text{ or } > \alpha$
Error (G)	JKG	$N-pq$	RKG	-	-	
Total	JKT	$N-1$	-	-	-	

Note: P is the observed probability;

$F^*$  is the F value obtained from the table

(Budiyono, 2014)

#### a) Post Hoc Comparison

The post hoc comparison, also known as follow-up testing to ANOVA, is performed when the ANOVA results reject the null hypothesis. Its purpose is to identify differences in means for each pair of columns, rows, and cells. The Scheffe model is used for post hoc comparisons.

Several steps in applying the Scheffe model include:

- Identifying all pairs of mean comparisons.
- Formulating hypotheses corresponding to each comparison.
- Determining the significance level ( $\alpha$ ) = 0.05.
- Calculating the F-test statistic using the following formula:

$$F_{i-j} = \frac{(x_i - x_j)}{RKG \left( \frac{1}{n_i} + \frac{1}{n_j} \right)} \quad (4)$$

With:

$F_{i-j}$  : the value of  $F_{abs}$  for the comparison between column I and column j

$X_i$  : The mean in column i

$X_j$  : The mean in column j

RKG : The mean squared error obtained from the analysis of variance calculations.

$n_i$  : The sample size in column  $i$

$n_j$  : The sample size in column  $j$

with the critical region:  $DK = \{F|F > (q - 1)F\alpha; p - 1 N - pq\}$  (5)

The symbols in the post hoc comparison of means between columns are similar in meaning to those used in the post hoc comparison of means between rows, only by replacing "row" with "column."

a. Comparison of means between columns.

The Scheffe test to find comparisons of means between columns is as follows:

b. Comparison of means between cells in the same column.

The Scheffe test for comparing means between cells in the same column.

c. Comparison of means between cells in the same row.

The Scheffe test for comparing means between cells in the same row is as follows.

$$F_{ij} - ik = \frac{(x_{ij} - x_{ik})^2}{RKG \left( \frac{1}{n_{ij}} + \frac{1}{n_{ik}} \right)} \quad (6)$$

With:

$F_{ij-ik}$  : The value of  $F_{ij}$  for the comparison between column  $i$  and column  $ij$ , and the mean in cell  $ik$ .

$X_{ij}$  : Mean in column  $ij$

$X_{kj}$  : Mean in column  $kj$

RKG : The mean squared error obtained from the analysis of variance calculations.

$n_{ij}$  : The sample size in column  $ij$

$n_{kj}$  : The sample size in column  $kj$

With the critical region:  $DK = \{F|F > (pq - 1) F\alpha; pq - 1 N - pq\}$

(Budiyono, 2014)

## Result and Discussions

### Result

This research was conducted at a public elementary school in Semarang city, specifically at SD Negeri Manyaran 02. The research subjects were fourth-grade students of Class IV. A and Class IV.B for the academic year 2020/2021. There were 49 fourth-grade students divided into 2 study groups: Class IV. A with 25 students and Class IV.B with 24 students. The instrument tested in this research was a mathematics learning outcomes test focusing on LCM (Least Common Multiple) and GCD (Greatest Common Divisor). The test instrument intended for the experimental participants was planned to consist of 35 items. The mathematics learning outcomes test instrument, developed by the researcher, is in multiple-choice format and comprises 35 items with four answer options: A, B, C, and D.

### 1. Hypothesis Testing

Hypothesis testing for the prerequisite test employs a two-way ANOVA, which includes normality and homogeneity tests.

#### a. Normality Test

A normality test is conducted to determine whether the sample originates from a normally distributed population. With a significance level of 0.05, the following table presents a summary of the normality test results using the Lilliefors model in SPSS for students' mathematics learning outcomes data.

**Table 4.** Tests of Normality

	Kolmogorov-Smirnov <sup>a</sup>			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
Standardized Residual for result	.127	44	.073	.953	44	.073

a. Lilliefors Significance Correction

Table 4. Tests of Normality displays the names of the normality tests used, namely the Kolmogorov-Smirnov test and the Shapiro-Wilk test. The calculated results are shown for the statistic value, significance value or p-value, and degrees of freedom for both of these tests. Based on the normality test results using SPSS 22, a significance value (sig.) of 0.073 was obtained, greater than 0.05. This indicates that each sample is normally distributed.

#### b. Homogeneity Test

The homogeneity test determines whether the compared populations have the same (homogeneous) variances. This homogeneity variance test is conducted on two sample groups. With a significance level of 0.05, a summary of the homogeneity variance test results using the Bartlett test for students' mathematics learning outcomes data is presented.

**Table 5.** Levene's Test of Equality of Error Variances Dependent Variable: MATHEMATICS LEARNING OUTCOMES.

F	df1	df2	Sig.
.653	3	40	.586

Tests the null hypothesis that the error variance of the dependent variable is equal across groups. a. Design; Intercept + CLASS + SELF\_EFFICACY + CLASS + SELF\_EFFICACY

In Table 5, the F (Test Statistic F) is the statistical value generated from the Levene's test. This value measures the comparison between the between-group variability (variability among groups) and the within-group variability (error variability). The F value is calculated as the ratio of the mean absolute deviations of each group to the overall absolute deviation. The df1 (Degrees of Freedom 1) is the degrees of freedom associated with the numerator in the calculation of the F value. Typically, df1 is equal to the number of groups minus 1. The df2 (Degrees of Freedom 2) is the degrees of freedom associated with the denominator in the calculation of the F value. Usually, df2 is the total number of observations minus the number of groups. Sig (Significance or p-value) is the significance value or p-value resulting from the Levene's test. It indicates how significant the difference in variances between the groups is. If the sig value is less than the designated significance level (e.g., sig < 0.05), there is sufficient evidence to reject the null hypothesis that the variances between the groups are equal.

In the context of this test, we compare the calculated F value with the critical value from the F-distribution to make a decision about whether to reject the null hypothesis. If the calculated F value is greater than the critical F value at the specified significance level, we tend to reject the null hypothesis and conclude that there is a significant difference in variances between the groups.

**Table 6.** Tests of Between-Subjects Effects

	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	1134.845a	3	378.262	9.711	.000	.421
Intercept	228127.257	1	228127.257	5856.426	.000	.993
CLASS	354.563	1	354.563	9.102	.004	.185
SELF EFFICACY	322.911	1	322.911	8.290	.006	.172

CLASS* SELF EFFICACY Error	76.602	1	76.602	2.018	.163	.048
Total	1558.132	40	36.953			
Corrected Total	270233.000	44				
	2692.977	43				

Dependent Variable: MATHEMATICS LEARNING OUTCOMES.

R.Squared = .421 (Adjusted R Squared = .376)

"Tests of Between-Subjects Effects" is a section within the results of an ANOVA analysis often found in statistical software outputs like SPSS. This section provides information about main effects and interactions in the ANOVA analysis between the existing factors. Sig. (Significance) is the p-value that indicates how significant the F-test results are. If the p-value is less than the established significance level (usually 0.05), we tend to reject the null hypothesis that there is no difference among the compared groups.

### Discussions

#### 1. Discussions of Result 1

Obtained significance value of  $0.004 < 0.05$ , the first hypothesis is rejected. Thus, it can be concluded that there is a difference in students' learning outcomes between the STAD cooperative learning model and the conventional learning model concerning mathematics learning outcomes in terms of self-efficacy.

Similarities with previous research are found in the study by Mutiara et al. (2023), where the results showed differences in students' learning outcomes between those using a specific learning model and conventional learning models. Learning outcomes improved when utilizing diverse models.

Conventional learning has several drawbacks compared to the STAD (Student Teams Achievement Divisions) cooperative learning model. Conventional learning tends to be passive, where students mostly act as listeners or recipients of information from the teacher. In contrast, within the STAD model, students actively engage in learning through group work and direct participation in learning activities. Conventional learning can cause some students to become inactive or participate less in the learning process due to a lack of opportunities to interact or contribute in class. STAD provides more opportunities for each student to actively engage in learning. The cooperative learning of STAD assists in developing students' social skills such as communication abilities, teamwork, leadership, and tolerance towards others' opinions, aspects that often do not receive attention in conventional learning.

#### 2. Discussions of Result 2

The obtained significance value is  $0.006 < 0.05$ , the first hypothesis is rejected, meaning there is a difference in mathematics learning outcomes between students with high self-efficacy and those with low self-efficacy. This applies to both classes subjected to the STAD learning model and classes using conventional learning models. The results of this research are relevant to a study conducted by (Wulanningtyas & Ate, 2020), which found that the higher the students' self-efficacy, the higher their mathematics learning achievement. Conversely, lower self-efficacy resulted in lower mathematics learning achievement. This aligns with the outcomes of the present study.

Regardless of the learning model used, students with high self-efficacy tend to be more motivated to tackle mathematical challenges. They believe in their ability to master the material,

thus are more motivated to learn and overcome potential difficulties. Students with high confidence in their abilities tend to employ more effective learning strategies. They might actively seek solutions, experiment with various approaches, and utilize available resources to comprehend mathematical concepts.

### 3. Discussions of Result 3

The obtained significance value is  $0.163 > 0.05$ , the first hypothesis is accepted, meaning there is no interaction between the learning model and self-efficacy concerning the mathematics learning outcomes of the students. In other words, the differences in mathematics learning outcomes among each category of the learning model do not consistently vary across each category of self-efficacy, or there is no consistent difference in the mathematics learning outcomes among each category of self-efficacy concerning each category of the learning model. These results differ from previous research. Unlike the study by Wirawan (2023), which found that a specific model of learning, namely project-based learning, influenced the improvement of students' learning outcomes based on self-efficacy, indicating an interaction between that learning model and self-efficacy towards learning outcomes.

However, in this study, it was found that there is no consistency in the relationship between mathematics learning outcomes and students' self-efficacy across various learning models. This implies that students' self-efficacy does not always consistently determine mathematics learning outcomes, regardless of the learning model used. This research also indicates that there is variation or inconsistency in the relationship between mathematics learning outcomes across different levels of students' self-efficacy, depending on the learning model used. In other words, students' self-efficacy in a particular learning model may not always be a consistent indicator in determining mathematics learning outcomes.

### Conclusion

Based on the two-way ANOVA analysis using SPSS, with a significance level of 0.05, the conclusions are as follows: Firstly, a significance value of 0.004 was obtained, which is smaller than 0.05. Therefore, the first hypothesis is rejected, leading to the conclusion that there is a difference in students' learning outcomes between the STAD teaching model and the conventional teaching model regarding mathematics learning outcomes when considering self-efficacy. Secondly, a significance value of 0.006 was obtained, which is smaller than 0.05. Therefore, the second hypothesis is rejected, indicating a difference in mathematics learning outcomes between students with high and low self-efficacy. This holds for both classes subjected to the STAD and conventional teaching models. Thirdly, a significance value of 0.163 was obtained, which is greater than 0.05. Therefore, the third hypothesis is accepted, indicating no interaction between the teaching model and self-efficacy concerning students' mathematics learning outcomes. In other words, there is no difference in mathematics learning outcomes among student categories in each teaching model that is inconsistent with each self-efficacy category, or there is no difference in mathematics learning outcomes among self-efficacy categories that is inconsistent with each teaching model category. This study has limited generalizability due to its focus on a specific group of students at the fourth-grade level in a particular elementary school. The findings of the research may not be directly applicable to the general population of students at different grade levels or in different schools. For future researchers, it is advisable to involve more schools and different grade levels to gain a broader understanding of the extent to which the effectiveness of the Student Team Achievement Division (STAD) Cooperative Learning Model can be generally applied in various educational contexts. This can be achieved, especially by linking it to the concept of self-efficacy, analyzed with more in-depth instruments.

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