THE IMPACT OF STUDENT TEAMS ACHIEVEMENT DIVISION (STAD) BY THE GOOGLE SITES PLATFORM ON STUDENTS' MATHEMATICAL CONCEPT UNDERSTANDING

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ABSTRACT

Conceptual understanding is a core element of mathematics learning, enabling students to meaningfully apply mathematical principles in problem-solving. Despite its importance, many learners continue to face difficulties in comprehending and utilizing these concepts effectively. This study investigated the impact of the Student Teams Achievement Division (STAD) cooperative learning model, integrated with the Google Sites platform, on elementary students' comprehension of mathematical concepts. The research adopted a quasi-experimental approach with a non-equivalent control group design. A total of 68 students participated, divided equally into an experimental group and a control group. The experimental group received instruction through the STAD model supported by Google Sites, while the control group was taught using the Think-Pair-Share (TPS) model. Data collection instruments included conceptual understanding tests administered both before and after the intervention, alongside supporting documentation. Findings indicated that students exposed to the STAD model combined with Google Sites demonstrated significantly greater gains in conceptual understanding compared to those taught using the TPS model. Statistical analysis revealed that the integration of Google Sites into the STAD model contributed to a 36.6% improvement in students' conceptual understanding. The results suggest that incorporating digital platforms like Google Sites into cooperative learning strategies such as STAD can offer a promising alternative for enhancing students' comprehension of mathematical concepts. This approach fosters collaboration, active engagement, and deeper processing of mathematical ideas in the classroom.

Keywords: Mathematical Concept Understanding, Google Sites Platform, Student Teams Achievement Division (STAD) Cooperative Learning Model.

A. INTRODUCTION

One of the essential components of learning—particularly in mathematics—is the ability to understand concepts. This is supported by the Badan Standar Kurikulum dan Asesmen Pendidikan (2022), which states that the main

goal of mathematics education is to help students develop a strong understanding of mathematical concepts. Students who possess a solid conceptual foundation are more capable of applying mathematical knowledge in both academic and real-life situations. According to Meidianti et al. (2022), conceptual understanding is crucial as it enables students to apply mathematics in practical contexts and solve problems more effectively. Furthermore, a deep understanding allows students not only to carry out procedures correctly but also to develop more flexible and efficient problem-solving strategies.

Nevertheless, despite the importance of understanding mathematical concepts, many students continue to struggle with both comprehending and applying these concepts when solving problems. Research by Fujiarti & Kurnia (2021) indicates that students' conceptual understanding remains inadequate and relatively low. One contributing factor is their tendency to memorize formulas without truly understanding their meaning, which hinders their ability to apply concepts effectively in problem-solving situations.

Another factor contributing to students' poor conceptual understanding is the continued use of teacher-centered learning models. Andriyani et al. (2024) emphasize that students' limited grasp of mathematical concepts is largely influenced by an overreliance on conventional lecture-based approaches and the use of less engaging instructional media. Furthermore, Radiusman (2020) found that many teachers tend to deliver content directly without providing opportunities for students to actively explore concepts. As a result, students often complete tasks without truly understanding the solutions and struggle to connect learned concepts to more complex problems.

Based on the findings mentioned above, it is evident that students' understanding of mathematical concepts needs to be strengthened from the elementary school level. According to Imawati el al. (2022), effective learning models must be systematically designed to make learning activities more engaging, efficient, and easier to

comprehend. One such model is the Student Teams Achievement Division (STAD) cooperative learning model. This approach not only increases student engagement but also fosters deeper conceptual understanding through discussion, peer explanation, and collaborative problem-solving (Anawulang, et al. 2023; Hidayah & Rini, 2025; Rika Handayani, et al. 2024). Moreover, students are indirectly encouraged to compete and strive to understand the material more thoroughly, as their individual performance contributes to their team's overall achievement.

Students' comprehension is influenced not only by the learning models but also by the media that are employed. Learning media come in a variety of forms, including multimedia, audio, visual, and audiovisual. One example of multimedia learning media is Google Sites-based learning media. According to Rahman & Indrawati (2023), Google Sites-based media are thought to be useful for teaching math. Yulianti & Novtiar (2023) also revealed that the use of Google Sites-based instructional resources has a significant effect on students' mathematical concept comprehension. Furthermore, Kurniawan et al. (2023) emphasized that the visually engaging design of Google Sites can enhance students' motivation to learn. Within the STAD model, Google Sites can also be utilized to integrate real-time quizzes that assess students' conceptual understanding, with individual responses contributing to the overall team score.

The issue of students' poor comprehension of mathematical concepts, which is exacerbated by passive learning and a dearth of engaging learning resources, has prompted researchers to investigate the impact of a cooperative learning model of the Student Teams Achievement Division (STAD) type using the Google Sites platform. It is anticipated that this model will enhance primary school students' conceptual comprehension skills through more technology-based, interactive, and collaborative learning.

B. METHODS

This study employed a quantitative research approach using a quasi-experimental method. According to Sugiyono (2016, p. 8),

quantitative research is a positivist methodology applied to specific populations or samples. The study used a Non-Equivalent Control Group Design, involving two groups: an experimental class and a control class. This aligns with Isnawan (2020, p. 11), who explains that such a design requires two sample classes: one that receives treatment (the experimental group) and one that does not (the control group). In this study, the experimental group was taught using the STAD cooperative learning model with the aid of the Google Sites platform, while the control group was taught using the TPS cooperative learning model.

According to Jakni (2016, p. 80), a population refers to the total group of objects or subjects possessing specific characteristics determined by the researcher for analysis and generalization. The population in this study consisted of all fourth-grade students in Area II of Babakancikao District, Purwakarta Regency. From this population, a sample was drawn, which represents a subset of the population selected for data collection Asrulla et al. (2023). The sampling technique used was non-probability sampling, specifically purposive sampling, where participants were selected based on predetermined criteria Ansori & Iswati (2020, p. 113).

The research instruments included tests designed to assess students' understanding of mathematical concepts, administered both before (pretest) and after (posttest) the treatment, along with non-test instruments in the form of documentation. The collected data were analyzed using the normality test, homogeneity test, independent sample t-test, simple linear regression analysis, and the Mann–Whitney U test (used when the data did not meet the assumptions of normality or homogeneity of variance). All statistical analyses were conducted using SPSS version 30.

C. RESULT AND DISCUSSION

Result

The purpose of this study is to examine how the Student Teams Achievement Division (STAD) cooperative learning models, with the use of the Google Sites platform, has improved students' comprehension of

mathematical concepts. A pretest was used to gauge the starting proficiency of students in both classrooms prior to treatment, and a posttest was used to gauge how well the students in both classes understood mathematical concepts following treatment.

1. Analysis of Pretest and Posttest Data on Mathematical Concept Understanding

This descriptive analysis aimed to determine the mean, median, mode, standard deviation, minimum score, and maximum score. The pretest and posttest scores of the experimental and control classes were analyzed using SPSS version 30, and the results are presented as follows:

Table 1 Descriptive Statistics of Pretest and Posttest Scores

Class Experiment				
N	*Pretest*		*Postest*	
34	$\bar{x}$	S	$\bar{x}$	s
	38,3	10,965	74,2	15,675

Class Control				
N	*Pretest*		*Postest*	
34	$\bar{x}$	S	$\bar{x}$	s
	40,2	15,072	56,4	16,291

(Source: Research 2025)

Table 2 Independent Samples t-Test Results for Posttest Data

	p-value	Description
Equal variances assumes	< 0,001	*p-value* (*Sig*.) ≤ α Significant Difference

(Source: Research 2025)

Table 2 shows that the posttest significance value for the experimental and control classes is below the 0.05 threshold, indicating a significant difference in the mathematical concept understanding ability between the groups. Consequently, the results suggest that the experimental group outperformed the control group in terms of their understanding of mathematical concepts.

2. Analysis of The Improvement of Mathematical Concept Understanding

The following presents the results of students' improvement in mathematical concept understanding, as measured by their pretest and posttest scores analyzed using SPSS version 30:

Table 3 Descriptive Statistics of N-Gain Scores

Group	N-*Gain* Score		$\bar{x}$	N-*Gain* Criteria
	Min	Max		
Experimental (STAD)	0,17	1,00	0,596	Medium
Control (TPS)	0,00	1,00	0,288	Low

(Source: Research 2025)

Table 4 N-Gain Scores Normality Test Results

Group	Shapiro Wilk			Description
	Statistics	df	Sig.	
Experimental	0.99	34	0.256	Normal
Control	0.204	34	< 0.001	Not Normal

(Source: Research 2025)

Because the normality test results of the control class showed abnormal results, the test continued with the mean difference test using Mann Whitney.

Table 5 Mann-Whitney Test Results for N-Gain Scores

Group	Asymp. Sig (2-tailed)	Description
Experimental (STAD)	< 0,001	Significant Difference
Control (TPS)		

(Source: Research 2025)

The results presented in the table indicate that the Asymp. Sig. (2-tailed) value is 0.001, which is below the significance level of 0.05. This suggests a significant difference in students' mathematical concept understanding between the experimental and control groups.

3. Analysis of the Impact of the STAD Model Assisted by the Google Sites Platform on Students' Mathematical Concept Comprehension

3.1 Analysis of the Simple Linear Regression Model

The following presents the results of the simple linear regression analysis:

Table 6 Results of the Simple Linear Regression Equation: Constants and Coefficients

Model	Coefficients	
	Unstandardized B	Coefficients Std. Error
Constant	41,206	7,992
Pretest	0,864	0,201

(Source: Research 2025)

Based on the calculations described above, the following simple linear regression equation was obtained:

$$\hat{Y} = 41{,}206 + 0{,}864X$$

Given that the regression coefficient is positive, it can be inferred that the STAD cooperative learning model, facilitated by the Google Sites platform, exerts a positive impact on students' mathematical concept comprehension.

3.1 Determination of the Coefficient of Determination

The following presents the results of the coefficient of determination:

Table 7 Results of the Coefficient of Determination Test

r	r square	Std. Error of the Estimate
0,605	0,366	12,6793

(Source: Research 2025)

After obtaining the R-squared value, the next step is to calculate the coefficient of determination (D) using the formula below:

$D = r^2 \times 100$
$= 0{,}366 \times 100\%$
$= 36{,}6\%$

The results show that the coefficient of determination (D) is 36.6%, suggesting that the use of the STAD cooperative learning model supported by the Google Sites platform platform for 36.6% of the variability in students' ability to understand mathematical concepts.

Discussion

The results of this study demonstrate that the STAD-type cooperative learning model assisted by the Google Sites platform has a significant positive impact on students' mathematical concept comprehension. As presented in Table 2, the posttest scores of the experimental class were significantly higher than those of the control class ($p < 0.05$). Furthermore, the descriptive analysis in Table 3 revealed an average N-Gain score of 59% in the experimental class, indicating a moderate level of improvement. The Mann-Whitney test results in Table 5 also confirmed a significant difference in the posttest scores between both classes, with the experimental group showing greater improvement.

Table 6 presents the simple linear regression analysis, indicating that the implementation of the STAD model assisted by Google Sites increased students' concept comprehension ability by 0.864 units. This positive regression coefficient suggests a favorable influence of the treatment. Supporting this, the coefficient of determination in Table 12 shows that the model accounts for 36.6% of the variance in students' conceptual understanding.

The effectiveness of the STAD model can be attributed to its structured group learning mechanism, which fosters collaboration, peer interaction, and active engagement. In heterogeneous groups, high-performing students assist their peers, reinforcing their own understanding while supporting others. This aligns with Slavin (2005) view that cooperative structures enhance cognitive learning through peer explanation and repeated

practice. The incorporation of quizzes—both group and individual—provides repeated reinforcement, consistent with behavioral learning theory Skinner in Isti'adah, (2020, p. 79-80), where feedback and rewards strengthen learning responses.

The reward system in STAD, where accumulated individual scores contribute to group recognition, also serves as a motivational factor. According to reinforcement theory, such extrinsic motivators encourage consistent performance and engagement among learners. The use of the Google Sites platform further amplifies this learning process by providing a centralized, user-friendly, and interactive environment. It allows students to revisit materials, complete tasks collaboratively, and access feedback efficiently. The visual and interactive features of the platform help maintain student interest and reduce learning anxiety.

These findings are consistent with prior research. For example, Jayeswari et al. (2023) emphasized the effectiveness of cooperative strategies in enhancing mathematical understanding. Similarly, Handayani et al. (2024) found that STAD promotes motivation and a positive learning atmosphere. Supriatna dkk. (2024) found that the integration of Google Sites as an instructional medium is effective in enhancing students' conceptual understanding and academic achievement. Studies by Rahman & Indrawati (2023) also support the effectiveness of Google Sites in increasing student engagement and learning outcomes, due to its ability to deliver content in an attractive and interactive format. In summary, the integration of the STAD cooperative model and Google Sites enhances not only students' mathematical concept comprehension but also their motivation and participation in the learning process.

D. CONCLUSION

The study's findings, which are based on the previously discussed research and discussion, are as follows: (1) students who use the Student Teams Achievement Division (STAD) cooperative learning model on the Google Sites platform improve their mathematical concept understanding ability more than students who use the Think Pair

Share (TPS) cooperative learning model; and (2) there is a 36.6% increase in fourth-grade elementary school students' mathematical concept understanding ability when they use the STAD cooperative learning model on the Google Sites platform.

The researcher made the following recommendations regarding this study: Since the study's focus is on developing mathematical concept understanding ability instruments, it is advised to develop mathematical ability instruments in other areas. Additionally, the study found that using a cooperative learning model of the STAD type with the help of the Google Sites platform improved students' mathematical concept understanding ability by 36.6%, meaning that other factors influenced 63.4% of the students' performance. Therefore, more research on other aspects that affect students' ability to increase their grasp of mathematical concepts can be done.

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