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The Effect of Think Pair Share Cooperative Learning Model on Students' Conceptual Understanding Ability

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Abstract: *This study aims to investigate the effect of the Think Pair Share (TPS) type of cooperative learning model on students' conceptual understanding of mathematics, specifically on the topic of Three-Variable Linear Equation Systems. The research was conducted at SMAS Budisatrya Medan using a quantitative approach with an experimental method and a quasi-experimental pretest-posttest control group design. The sample consisted of 64 tenth-grade students divided into two groups: an experimental class that received instruction using the Think Pair Share model, and a control class that was taught through conventional methods. The pretest results indicated that the average initial score of students in the experimental class was 6.62, while the control class averaged 5.50. After the intervention, the posttest scores increased to 17.75 in the experimental class and 14.00 in the control class. The difference in score improvement was statistically significant, as evidenced by a t-test result of t = 6.387 with a significance level of p = 0.000. These findings suggest that the Think Pair Share model significantly enhances students' conceptual understanding of mathematics compared to traditional teaching methods. The researchers recommend the use of this model as an effective alternative for mathematics instruction, as it not only improves learning outcomes but also fosters social interaction, critical thinking, and students' self-confidence.*
Keywords*:* *cooperative learning, think pair share, conceptual understanding, mathematics*

Abstrak: Penelitian ini bertujuan untuk mengetahui pengaruh model pembelajaran kooperatif *tipe Think Pair Share* terhadap kemampuan pemahaman konsep matematika siswa pada materi Sistem Persamaan Linear Tiga Variabel. Penelitian dilaksanakan di SMAS Budisatrya Medan dengan menggunakan jenis penelitian kuantitatif, dengan metode eksperimen dan desain *quasi eksperimen pretest-posttest control group*. Sampel terdiri dari 64 siswa kelas X yang dibagi dalam dua kelompok: kelas eksperimen yang menerima pembelajaran dengan model *Think Pair Share*, dan kelas kontrol yang menggunakan pembelajaran konvensional. Hasil *pretest* menunjukkan bahwa rata-rata nilai awal siswa di kelas eksperimen adalah 6,62, sedangkan kelas kontrol 5,50. Setelah perlakuan, nilai posttest meningkat menjadi 17,75 di kelas eksperimen dan 14,00 di kelas kontrol. Selisih peningkatan skor menunjukkan perbedaan yang signifikan, dibuktikan dengan hasil uji-t yang menunjukkan nilai t = 6,387 dan signifikansi p = 0,000. Temuan ini menyimpulkan bahwa penggunaan model *Think Pair Share* secara signifikan meningkatkan pemahaman konsep matematika siswa dibandingkan dengan pembelajaran konvensional. Peneliti merekomendasikan agar model ini dijadikan salah satu alternatif model pembelajaran yang efektif untuk diterapkan dalam pembelajaran matematika. Selain meningkatkan hasil belajar, model ini juga memperkuat interaksi sosial, berpikir kritis, dan kepercayaan diri siswa
Kata kunci: pembelajaran kooperatif, think pair share, pemahaman konsep, matematika

INTRODUCTION

Education is a crucial means of developing human potential to face life's challenges. In line with (Rasyid et al., 2024), education serves as a strategic tool to shape a quality generation capable of addressing the demands of the times. It is a valuable process in human life that prepares and produces quality human resources (Nooryanti et al., 2020). According to Lubis et al., (2024), the essence of education lies in the learning process. Through education, individuals acquire knowledge previously unknown to them, making education an inseparable part of society (Anissa & Lutfi, 2024). The learning process must be made engaging so that students can become more active in developing their abilities (Yani et al., 2024). The ultimate goal of education is to shape individuals with good character and build a dignified national civilization (Fauzia et al., 2024).

Mathematics is a discipline that aids problem-solving through calculation. It plays a vital role in many aspects of daily life and is utilized by various fields as a tool to solve problems (Maysarah et al., 2023). (Rahma & Reflina, 2023) emphasize that mathematics contributes to the development of literacy and numeracy skills, including reading, writing, counting, analyzing, and solving real-life problems. Siregar et al., (2024) define mathematics as an abstract, deductive, and consistent science that is based on agreement, employs symbols, and is oriented toward a defined universe of discourse. Therefore, mathematics must be taught effectively in schools. Despite its importance, not all students enjoy learning mathematics (Agustina et al., 2018). It has a hierarchical structure in which each concept is built upon previous ones (Siagian, 2017), meaning that understanding prior mathematical concepts is essential for learning subsequent material (Maysarah et al., 2017). Conceptual understanding is thus a key foundation for meaningful mathematics learning (Yulianty, 2019).

A primary objective of mathematics education is the development of conceptual understanding, as concepts facilitate higher-order thinking and help students comprehend and retain structured material (M. Sari et al., 2018). This understanding is essential for solving various problems, even the most basic ones (Lubis & Rahmadhani, 2023), and forms the basis of mathematical learning, where one concept is interconnected with others (Sengkey et al., 2023). Therefore, a key indicator of effective mathematics education is a student's ability to truly understand concepts rather than simply memorize them. However, in practice, many students still struggle to grasp abstract mathematical concepts, particularly in the classroom.

Conceptual understanding of mathematics is a fundamental aspect of meaningful learning and is reflected through several key indicators. These indicators include the ability to classify mathematical objects based on relevant properties, which demonstrates mastery of the essential characteristics of a concept (Salsabila & Pujiastuti, 2022; Saputri, 2025). In addition, the ability to provide examples and non-examples reflects an understanding of the boundaries and scope of a concept (Fitria et al., 2022). Conceptual understanding is also evident in students' ability to restate concepts in their own words, indicating deeper conceptual mastery (Nurani et al., 2021; Umam & Zulkarnaen, 2022). Furthermore, the ability to apply concepts and use specific procedures in problem solving demonstrates operational conceptual understanding (Fauziah et al., 2022).

A common problem currently observed is the low level of students' mathematical conceptual understanding. Based on the National Assessment (Asesmen Nasional/AN), low mathematical conceptual understanding remains a widespread issue across schools in Indonesia. Prasanti et al., (2025) also state that Indonesian students' mathematical conceptual understanding is categorized as low. Furthermore, a report from the Center for Educational Assessment (2024) indicates that over the past three years, students' numeracy skills—particularly in geometry and algebra—have not yet met the established standards.. Many students find it difficult to understand spatial forms and apply equations in more complex problems. The data also indicate that more than 80% of students can only solve basic problems, with few demonstrating reasoning and strong conceptual understanding (Arsiah et al., 2024). Moreover, the 2022 Programme for International Student Assessment (PISA) survey shows that only around 18% of Indonesian students reached Level 2 in mathematics well below the OECD average. This level reflects a basic ability to understand and apply mathematical concepts independently (OECD, 2023).

Consistent with these findings, interviews conducted with mathematics teachers at SMAS Budi Satrya in Medan revealed that many students still experience difficulties in understanding the fundamental concepts of the subject matter. Teachers noted that this challenge is evident in students' inability to apply concepts when solving problems. This suggests that students’ conceptual understanding must be improved, particularly in the topic of Three-Variable Linear Equation Systems (SPLTV), which involves concepts such as linear equations, algebra, substitution, elimination, and variable relationships. Students often manage to solve problems only when the format matches examples from the textbook but struggle with contextual problems or when asked to justify their steps. In such cases, students tend to copy answers, indicating a reliance on memorized procedures rather than actual conceptual comprehension. As Sari, et al., (2023) emphasized, the main goal of learning is understanding, not memorization. Thus, teachers must be careful in their explanations to avoid misconceptions. Salsabila, et al., (2024) also argue that conceptual understanding is critical for students, as it enables smoother transitions to higher levels of education.

To address this issue and improve learning quality, innovative teaching models are needed ones that encourage active student participation in thinking, discussing, and sharing ideas. Learning is a process of constructing meaning derived from what students hear, feel, and experience (Asrul et al., 2020). In line with Vygotsky’s theory of cognitive development, learning is strongly influenced by social interaction and cultural context. Vygotsky believed that children acquire knowledge through active engagement with more knowledgeable individuals, such as teachers or peers (McLeod, 2025). The Think Pair Share (TPS) model is an appropriate alternative. It is believed to enhance students' conceptual understanding through cooperative learning that encourages idea exchange. This model supports academic achievement, character development, and student skills. TPS provides ample time for students to think, respond, interact, and contribute with peers, thereby deepening their understanding of mathematical concepts (Damanik & Nasution, 2024).

The TPS cooperative learning model has three main stages: Think, which promotes independent thinking; Pair, where students discuss in pairs to help each other grasp difficult concepts for deeper and more comprehensive understanding; and Share, where students share their ideas with other pairs or the entire class, developing speaking, listening, and respect for others’ opinions. This process improves communication and collaboration skills (Lestari, 2023). According to Sururoh et al., (2018), the TPS model significantly increases student motivation and conceptual understanding. It enhances active student engagement during the learning process and strengthens mathematical comprehension.

Several prior studies have investigated the application of the TPS cooperative learning model in mathematics. For instance, Tambunan, (2020) found that TPS could develop students' mathematical communication skills. However, the study did not deeply examine conceptual understanding, especially in the more complex topic of SPLTV. Likewise, Ramadani et al., (2022)reported that TPS improved conceptual understanding among Grade VII students, but the content level and educational stage did not represent the challenges faced by senior high school students, particularly in learning SPLTV.

Although previous research has demonstrated the positive impact and effectiveness of the TPS model in mathematics learning, a research gap remains: no studies have specifically explored the effect of the Think Pair Share cooperative learning model on the topic of Three-Variable Linear Equation Systems (SPLTV) in Grade X senior high school students. Therefore, this study aims to fill that gap by examining how the TPS model influences students' conceptual understanding in this topic, which is complex and requires mastery of algebraic concepts, mathematical modeling skills, and strategies for solving systems of three equations. The novelty of this study lies in its focus on SPLTV as the subject matter.

METHODE

This study employed a quantitative research approach. According to Sarmanu, (2017), quantitative research aims to assess whether existing theories hold true. Quantitative research typically incorporates various methods, such as experiments and surveys. In this study, the experimental method was applied (Ramadhan, 2021). The research design used was a quasi-experimental pretest-posttest control group design, a type of experimental study. In quasi-experiments, there is a control variable, although it does not fully control the influence of external variables (Hartono, 2019).

This study was conducted at SMAS Budisatrya, Medan City, North Sumatra. The research site was selected based on the alignment of the school's characteristics with the research objectives, as well as the availability of classes and students that supported the implementation of the research design. The study was carried out during the second semester of the 2024/2025 academic year, with the research subjects being tenth-grade students who were studying the topic of Systems of Linear Equations in Three Variables (SPLTV).

The population of this study comprised all tenth-grade students at SMAS Budisatrya in the 2024/2025 academic year. The total population consisted of 126 students distributed across four classes, namely X-1, X-2, X-3, and X-4. The population had relatively homogeneous characteristics in terms of curriculum, grade level, and mathematics learning background. The sampling technique used was cluster random sampling, a method applied when the population is grouped into clusters rather than individual units (Salim, et al., 2024). From the four classes, two classes were selected as the research sample. Class X-1 was designated as the experimental group and received instruction using the cooperative learning model of *Think Pair Share*, while class X-3 was assigned as the control group and received conventional instruction. This sampling technique was chosen to maintain the natural classroom learning process and to minimize disruption to the existing class structure.

The research instrument consisted of subjective written essay tests designed to assess students' conceptual understanding. These tests served as tools for collecting quantitative data from the two study groups. Instruments used to measure variables in science education are generally available and have been tested for validity and reliability (Sugiyono, 2022). However, if the instruments do not meet required standards of validity and consistency, they cannot be used effectively for measurement. The analysis showed that the instrument used in this study met the standards for both validity and reliability, making it a consistent and accurate measurement tool. Once the instrument was deemed appropriate, data collection was conducted. The collected data were then analyzed using normality and homogeneity tests before performing hypothesis testing.

The normality test employed the Shapiro-Wilk method to determine whether the data were normally distributed, where data are considered normal if the p-value > 0.05. The homogeneity test used Levene's Test to examine the equality of variances between groups; the data are considered homogeneous if the p-value > 0.05. The results of these two tests determined the appropriate hypothesis testing method. If the data were found to be both normal and homogeneous, the analysis continued with the Independent Samples t-test to determine whether there was a significant difference between the groups, using the criterion of p-value < 0.05, which would indicate a statistically significant difference.

RESULTS AND DISCUSSION

This study employed a quantitative research approach using a t-test, aiming to examine the effect of the Think Pair Share cooperative learning model on students' conceptual understanding by analyzing the differences in mean scores between two independent groups: the treatment (experimental) group and the comparison (control) group. The research data obtained were described by the researcher for each variable and analyzed with the assistance of IBM SPSS Statistics 25. The following section provides a detailed description of the research data for each variable:

Table 1. Results of Descriptive Statistical Analysis

Descriptive Statistics						
	N	Range	Minimum	Maximum	Mean	Std. Deviation
Pre-Test of Experiment	32	8	3	11	6.62	2.282
Post-test of Experiment	32	8	13	21	17.75	2.079
Pre-Test of Control	32	6	3	9	5.50	1.685
Post-Test of Control	32	9	10	19	14.00	2.590
Valid N (listwise)	32					

Table 1 presents the results for minimum, maximum, mean, range, and standard deviation values (to assess score distribution) for two classes, each consisting of 32 students. The pre-test results show that the average score of students in the experimental class was 6.62, which is significantly higher than the control class with an average of 5.50. The standard deviation was 2.282 for the experimental class and 1.685 for the control class. The maximum score in the experimental class reached 11, whereas the control class only reached 9.

The post-test results indicate a similar pattern: the experimental class achieved an average score of 17.75, considerably higher than the control class's average of 14.00. The standard deviation was 2.079 in the experimental class and 2.590 in the control class. The maximum score in the experimental class was 21, while in the control class it was 19.

Before conducting the independent sample t-test, prerequisite tests were carried out, including the normality test to confirm that the data were normally distributed, and the homogeneity test to assess the equality of variances between the two groups. These preliminary tests were performed using the pre-test and post-test scores from both the experimental and control classes. The results of the normality test are presented in Table 2 below.

Table 2. Results of Normality Test

Class	**Shapiro-Wilk**		
	Statistic	**df**	**Sig.**
Pretest A (Control)	.942	32	.085
Postest A (Control)	.956	32	.210
Pretest B (Experiment)	.947	32	.116
Postest B (Experiment)	.939	32	.070

Based on the output of the normality test using the Shapiro-Wilk test, as presented in Table 2, all significance values (p-values) were greater than 0.05 ((p-*value*) > 0,05). This indicates that all data were normally distributed, as data are considered to follow a normal distribution when the significance value is greater than 0.05 ($sig > 0{,}05$). Furthermore, the results of the homogeneity tests for the pretest and posttest are presented sequentially in Tables 3 and 4 below.

Table 3. Results of Pretest Homogeneity Test

Test of Homogeneity of Variance					
		Levene Statistic	df1	df2	Sig.
Result of Pre-Test	Based on Mean	3.390	1	62	.070
	Based on Median	2.787	1	62	.100
	Based on Median and with adjusted df	2.787	1	59.564	.100
	Based on trimmed mean	3.416	1	62	.069

Table 4. Result of Posttest Homogeneity Test

Test of Homogeneity of Variance					
		Levene Statistic	df1	df2	Sig.
Result of Post-Test	Based on Mean	1.300	1	62	.259
	Based on Median	1.539	1	62	.219
	Based on Median and with adjusted df	1.539	1	60.354	.220
	Based on trimmed mean	1.391	1	62	.243

Based on the results of the homogeneity tests presented in Tables 3 and 4, the significance value (Sig. Based on Mean) for the pretest was 0.070, and for the posttest, it was 0.259. Both values are greater than 0.05, indicating that the null hypothesis (H_0) is accepted. This means that the variances of the two classes are homogeneous.

The hypothesis test was conducted using the Independent Samples t-test with the aid of IBM SPSS Statistics. The objective was to determine whether there is a statistically significant difference in students' conceptual understanding between the treatment group (experimental) and the comparison group (conventional).

Since the data met the assumptions of normal distribution and homogeneity of variance, the appropriate method for analysis was the t-test at a 5% significance level. The decision of the hypothesis testing for this study is presented in Table 5 as follows.

Table 5. Result of Hypotesis Test

Independent Samples Test										
		Levene's Test for Equality of Variances		t-test for Equality of Means						
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
									Lower	Upper
Result	Equal variances assumed	1.300	.259	6.387	62	.000	3.750	.587	2.576	4.924
	Equal variances not assumed			6.387	59.227	.000	3.750	.587	2.575	4.925

Based on Table 5, the Sig. (2-tailed) value was 0.000. Since the probability value (Sig.) is less than 0.05 ($0.000 < 0.05$), the null hypothesis (H_0) is rejected. This indicates that there is a significant difference in students' conceptual understanding between those who received the Think Pair Share (TPS) cooperative learning model (experimental group) and those who received conventional instruction (control group). In other words, the TPS model had a positive effect on the conceptual understanding of Grade X students at SMA Budisatrya Medan.

This quantitative study used an experimental method with a quasi-experimental pretest-posttest control group design to examine the effect of the Think Pair Share cooperative learning model on students' conceptual understanding in the topic of Three-Variable Linear Equation Systems (SPLTV). The results of the analysis confirmed the effectiveness of the model. The posttest average score in the experimental class was 17.75, higher than that of the control class, which was 14.00. This difference indicates that students in the experimental group demonstrated a higher level of conceptual understanding compared to those in the control group, suggesting that the TPS model contributed to this improvement.

The implementation of the TPS model in mathematics instruction began with the think phase, where students individually analyzed problems presented in the student worksheet (LKPD). This was followed by the pair phase, in which students discussed their individual responses with a partner. Finally, in the share phase, pairs who had reached a consensus shared their solutions and reasoning with the class, while other students listened and provided feedback.

Throughout these three phases, students were found to be better able to understand mathematical concepts, as each phase allowed them to build and validate their own understanding. During the think phase, students engaged independently with the problems, drawing on their prior knowledge. In the pair phase, classroom observations revealed that initially hesitant students became more confident and articulate after discussing with a peer. They complemented and corrected each other's reasoning. During the share phase, students gained further confirmation of their understanding from peers, other groups, and the teacher. Students also showed greater engagement by asking questions and re-explaining solution steps during presentations. This step-by-step process enabled students not to work in isolation, but rather to test and strengthen their conceptual understanding through collaboration, thereby positively impacting learning outcomes.

Inferential statistical analysis of the conceptual understanding test involving 64 Grade X students at SMA Budisatrya Medan revealed a significance level of 0.000. Referring to the threshold value of $\alpha = 0.05$, this result confirms that the null hypothesis (H_0) must be rejected, and the alternative hypothesis (H_a) is accepted. Therefore, it can be concluded that the Think Pair Share cooperative learning model has a significant effect on students' conceptual understanding.

Based on both descriptive and inferential analysis, the Think Pair Share (TPS) model was shown to have a positive impact on students' conceptual understanding. The findings indicate that students' involvement in the learning process increased significantly, which helped them construct more accurate and meaningful understanding. This supports the view of Anderson & Krathwohl (2011), who emphasized that collaborative learning promotes active participation and provides opportunities for students to construct knowledge independently, leading to enhanced conceptual understanding (Fadly, 2022).

This study is consistent with Dewi et al., (2021), who found an increase in student mastery from 12.5% → 56.25% → 75%, with a t-test result of $t = 6.15 >$ t-table $= 2.09$ ($p < 0.05$). It was concluded that the TPS model effectively improved students' mathematical conceptual understanding. Similar findings were reported by Afryanza et al. (2019), where $t = 2.6768 >$ t-table $= 2.024$ ($p < 0.05$), confirming the effectiveness of the TPS model in improving students' conceptual understanding. These results indicate that the application of the Think Pair Share (TPS) cooperative learning model has a significant and positive effect on the conceptual understanding of Grade X students at SMA Budisatrya Medan. The more consistently this model is applied, the greater the improvement in students' conceptual understanding

These results are consistent with the study by Lestari & Luritawaty (2021), which demonstrated that the *Think Pair Share* (TPS) model significantly improves students' mathematical conceptual understanding and academic achievement. Alignment with previous findings is also evident in the study by Sarmah and Ismail (2023), who reported that tenth-grade high school students taught using TPS achieved better conceptual understanding than those taught using traditional methods (Purwadi, 2020). The increase in student engagement and conceptual understanding observed in this study is also relevant to the findings of Nuraeni & Nugraheni, (2022), although their research focused more on the STAD type of cooperative learning. Furthermore, improvements in students' ability to classify mathematical objects and to provide examples and non-examples are consistent with the findings of Yuliansyah (2023) in algebra learning (Ahmad, 2023). This study also supports the findings of Husna and Santosa (2024), which showed that TPS helps students restate concepts effectively and use mathematical procedures more confidently through paired discussions and class sharing (Mardatillah et al., 2023) .

The *Think Pair Share* learning model makes a strong contribution to improving students' mathematical conceptual understanding because its instructional syntax is designed to activate cognitive processes gradually and deeply. The *think* stage allows students to independently analyze the problems provided by the teacher, encouraging them to identify relevant concepts, properties, and mathematical relationships before discussion. This stage plays an important role in building initial understanding and cognitive readiness. During the *pair* stage, students discuss their ideas with a partner to compare solutions, test the validity of their reasoning, and complement each other's understanding. This interaction facilitates effective idea exchange and conceptual clarification. In the *share* stage, students present their discussion results to the class, reinforcing conceptual understanding through mathematical communication and feedback from both the teacher and peers (Karlinawati et al., 2021).

Each stage of TPS directly supports indicators of mathematical conceptual understanding. The ability to classify mathematical objects develops through paired discussions that enable students to identify characteristics and criteria of concepts more accurately (Yulistia & Hidayati, 2023). The ability to provide examples and non-examples is strengthened as students actively propose and evaluate relevant cases during discussion (Riskayanti, 2023). The *share* stage trains students to restate concepts in their own words, which is crucial for reinforcing understanding and minimizing misconceptions (Indriani et al., 2022). In addition, the application of concepts and the use of mathematical procedures improve as students are encouraged to solve contextual problems with support and feedback from peers (Sudane, 2023; Yulistia & Hidayati, 2023). Thus, TPS has been proven effective in developing students' mathematical conceptual understanding comprehensively.

Although the findings of this study indicate that the *Think Pair Share* (TPS) model positively influences students' mathematical conceptual understanding, several limitations should be considered. One major constraint relates to time limitations in classroom learning. Implementing TPS requires a longer allocation of time for thinking, discussion, and sharing stages, and under limited classroom time conditions, discussions may not be conducted optimally or in depth (Restiani & Sariniwati, 2022; Rizky Pratana et al., 2021).

In addition, students' social conditions may also serve as limiting factors. Students with low self-confidence or limited communication skills tend to be less active during paired discussions or class sharing, which may hinder equal conceptual understanding among students (Setyawan et al., 2023). Another limitation concerns classroom management, as the effectiveness of TPS is highly dependent on the teacher’s ability to guide discussions to remain focused and meaningful (Listyotami, 2022).

From the content perspective, not all mathematics topics are suitable for the TPS approach, particularly highly abstract or complex concepts that require more direct and structured explanations (Marlena et al., 2021). Furthermore, in technology-based learning contexts, limitations in facilities and internet connectivity may hinder the smooth implementation of TPS, especially during discussion and interaction activities among students (Listyotami, 2022; Setyawan et al., 2023).

The implications of this study emphasize that the *Think Pair Share* (TPS) learning model can serve as an effective strategy for improving the quality of mathematics instruction in the classroom. Through the *think*, *pair*, and *share* stages, students are provided with opportunities to build conceptual understanding independently, clarify ideas through peer discussion, and restate concepts in their own words. This process helps students achieve deeper and more meaningful mathematical understanding. These findings align with the study by Wahjuningsih et al., (2023), which showed that TPS not only improves mathematics learning outcomes but also enhances students’ learning motivation compared to conventional instructional methods.

Beyond cognitive outcomes, TPS also has important implications for the development of students’ social and collaborative skills. Paired discussions and class sharing activities train students to work cooperatively, respect others’ opinions, and build confidence in communication. Samaila et al., (2024) emphasized that peer interaction in TPS-based learning fosters collaborative skills and promotes peer learning attitudes.

Furthermore, TPS contributes to the development of students’ critical thinking skills. The processes of analyzing problems, comparing solutions, and presenting arguments encourage students to evaluate information more reflectively. This is consistent with the findings of (S.Pd., 2021), which showed that TPS implementation enhances students’ critical and creative thinking skills in solving mathematical problems. Therefore, this study implies that the TPS model is worthy of consideration as a comprehensive approach to mathematics instruction, as it not only focuses on conceptual mastery but also supports the development of essential 21st-century skills.

CONCLUSION AND RECOMMENDATIONS

The Think Pair Share (TPS) cooperative learning model has a significant effect on students’ conceptual understanding in mathematics, particularly on the topic of Three-Variable Linear Equation Systems (SPLTV). Statistical analysis revealed an average posttest score improvement of 11.13 points in the experimental class, which was higher than the 8.50-point gain observed in the control class. This finding demonstrates that students taught using the TPS model experienced greater learning gains compared to those taught using conventional methods. The consistent difference in mean posttest scores, favoring the experimental class, confirms the superior effectiveness of the TPS model in enhancing students’ conceptual understanding in mathematics.

Based on the findings of this study, several recommendations can be proposed to relevant stakeholders so that the advantages of the *Think Pair Share* (TPS) model can be optimized while potential challenges can be anticipated. For mathematics teachers, the TPS model can be used as an alternative instructional strategy and is recommended to be carefully planned, particularly with regard to time management and the organization of discussions to ensure that each stage—*think*, *pair*, and *share*—runs effectively. Teachers also need to pay attention to students' characteristics, especially in fostering self-confidence and communication skills among less active students through continuous guidance and reinforcement. Furthermore, future researchers are encouraged to investigate the implementation of TPS across different mathematics topics, educational levels, and longer time periods, so that a more comprehensive understanding of the effectiveness of TPS can be obtained and the generalizability of the findings can be strengthened.

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