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The Influence of the Cooperative Learning Model of the Think Pair Share (TPS) Type Using Index Card Match on Students' Mathematics Learning Outcomes

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Abstract

Purpose - This study aimed to determine the effect of the Think Pair Share (TPS) cooperative learning model using Index Card Match on the mathematics learning outcomes of class X students of SMAN 1 Pekaitan on the material of three-variable linear equation systems.

Methodology - The research method applied is a quasi-experiment with a Nonequivalent Control Group Design. The sample in this study consisted of 2 groups, namely the experimental group and the control group. Class X3 as the experimental group, consisting of 30 students and class X1 as the control group, consisting of 26 students. The instrument in this study was a post-test of mathematics learning outcomes, which was analysed using the Independent Sample Test with the help of the SPSS 25 application program.

Findings - The results of the study showed a value of 0.004, meaning that the value was significant because the value was <0.005. From the test results, there was a difference between the experimental class group and the control class group.

Novelty - This research is important to do because mathematics is still often considered difficult. The use of the Think Pair Share (TPS) cooperative learning model using Index Card Match is very necessary because it can improve student activity, conceptual understanding, and student learning outcomes.

Significance - Therefore, this research helps teachers choose new ways to achieve learning objectives. It can be concluded that the use of the Think Pair Share (TPS) cooperative learning model using Index Card Match has an effect on the mathematics learning outcomes of class X students at SMAN 1 Pekaitan.

Keywords: Cooperative; Index card match; Mathematics learning outcomes; Think pair share.

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1. Introduction

Education is a crucial factor in building a nation's civilization. Education is a lifelong learning process that can be achieved in various places and situations and positively contributes to individual development. Mathematics is a crucial aspect of education, as it serves as the foundation for various modern disciplines and technologies. The importance of teaching mathematics from an early age is to equip students with logical, analytical, systematic, creative, and critical thinking skills (A'izah & Dewi, 2024). Nevertheless, in reality, learnes frequentl encounter challenges in understanding mathematics, leading to poor academic results. This aligns with the opinion that mathematics is an important element in education that must be taught to all students so that they have the competence to think logically, critically, systematically, creatively, and be able to work together (Nurhayati & Irwan, 2017).

Mathematics learning outcomes reflect students' efforts during the learning process, typically measured through grades or post-learning evaluations (Jumiliana & Rozuna, 2019). Furthermore, learning outcomes can be defined as learning experiences that produce relatively permanent changes in students after participating in the learning process (Purwaningsih, 2022). However, the reality in the field often shows that student learning outcomes remain low, partly due to suboptimal learning experiences. This situation requires teachers to make changes by creating more meaningful, engaging, and accessible learning experiences.

One learning model that can be an alternative is the cooperative model of the Think Pair Share (TPS) type combined with the Index Card Match method (ICM). Both approaches share the same goal: to increase students' active participation in the mathematics learning process. The TPS model encourages students to think individually, discuss with their peers, and then share their thoughts with the class, enabling them to better understand the material (Rukmini, 2020). Meanwhile, the ICM method involves matching cards containing questions and answers, which encourages students to actively engage, collaborate, and discuss with their peers (Annisa & Marlina, 2019).

The ICM learning model can be flexibly applied to various types of materials. One example is systems of linear equations, which emphasizes contextual problem-solving exercises using substitution, elimination, and graphical methods (Saraswati & Hartiningrum, 2019). Through these activities, students not only learn mathematical concepts but also develop communication, collaboration, and critical thinking skills in problem-solving. Thus, the combination of the TPS and ICM models can create a more enjoyable and interactive learning environment, potentially improving student learning outcomes.

Based on observations conducted at SMAN 1 Pekaitan, it was found that students' interest in and learning outcomes in mathematics are still low. This is evident in the students'

low enthusiasm during learning, where they tend to be passive and less engaged. participate in class discussions. Furthermore, math exam results also show many students achieving scores below the passing grade. This can be caused by a lack of varied teaching methods, students' difficulty understanding the material, and a lack of application of mathematical concepts in everyday life. Therefore, a more relevant learning model is needed to improve student motivation and learning outcomes.

Several previous studies support the application of this model. Research conducted on eighth-grade junior high school students showed that the use of the TPS cooperative learning model resulted in better learning outcomes compared to conventional learning models (Elvida, 2019). Another study found that the combination of the TPS model and the ICM method produced better mathematics learning outcomes compared to direct learning, with significant results in hypothesis testing (Elvida, 2019). In addition, other research also states that the ICM model has an influence on students' mathematics learning outcomes, especially on the material on relations and functions (Saraswati & Hartiningrum, 2019).

Based on this background, this study focuses on the effect of the Think Pair Share (TPS) cooperative learning model combined with the Index Card Match method on high school students' mathematics learning outcomes in the topic of linear equation systems. This research is expected to contribute to the development of more effective, interactive, and enjoyable learning methods. The goal is for students to be more active, understand the material better, and be able to improve their mathematics learning outcomes according to the expected competencies.

2. Methods

This study uses a quasi-experimental method with a Nonequivalent Control Group Design, where sample selection is not done randomly but based on existing classes. Quasi-experiments are experiments that do not randomly assign the smallest unit to the experimental or control group, while Sugiyono (2018) explains that this design involves two groups, namely the experimental group that is given treatment and the control group that is not given treatment. The reason for using this design is because in the context of research in schools, randomization of subjects is difficult because the class division has been determined by the school, so researchers utilize existing classes to be used as experimental groups and control groups according to research need.

Table 1- Posttest-Only Design With Noneequivalent Control Group

Group	Treatment	Posttest
Experiment	X	O
Control	-	O

Source: (Sugiyono, 2018:120)

Information:

X = Learning Treatment using Learning Models Cooperative Think Pair Share (TPS) type with using Index Card Match

- = Implementing conventional learning models (no treatment).
O = Posttest to measure results

The population of this study was all class X students of SMAN 1 Pekaitan in the 2025/2026 academic year, with a sample of two classes, namely X1 as the control class with 26 students and X3 as the experimental class with 30 students, so that the total sample was 56 students. The sampling technique used was nonprobability sampling with the purposive sampling method because the sample selection was adjusted to certain criteria set by the researcher, namely, class X students determined by the school (Sugiyono, 2018).

The division of control and experimental classes was carried out by the school on the assumption that academic abilities between classes were relatively homogeneous. This research was conducted at SMAN 1 Pekaitan, Suak Temenggung Village, in the odd semester of the 2025/2026 academic year. The research variables consisted of the independent variable, namely the Think Pair Share (TPS) Cooperative Learning Model with Index Card Match and the dependent variable, namely students' mathematics learning outcomes.

The research instruments included post-test questions as a learning outcome evaluation tool, teaching modules, and student worksheets (LKPD) that had been tested for validity using Aiken's V and showed a very high category, making them suitable for use (Fujiandri et al., 2025). Data collection techniques were carried out through post-test essay questions.

Data analysis used a t-test to test the hypothesis with the help of the SPSS 25 program, after first conducting the Shapiro-Wilk normality test and Levene's homogeneity test. If the data were not normally distributed, the nonparametric Mann-Whitney test was used. The results of the analysis aimed to determine whether or not there was a significant effect of the implementation of the TPS learning model with Index Card Match on students' mathematics learning outcomes.

3. Result and Discussion

3.1 Results

The differences in learning methods used in the experimental and control classes influenced student learning outcomes. This assumption is evident in the differences in grade preferences obtained by the two classes. To illustrate student learning outcomes, the following presents the results of student grades in the experimental and control classes.

Table 2- Student Grades

	N	Min	Max	Mean	Std.Deviation
Mark	56	31	88	63.73	12.693
Class	56	1	2	1.46	.503
Valid N (listswiss)	56				

Based on the student grade data contained in Table 2, student learning outcomes in the experimental class showed a better and fairly even distribution compared to the control class. In the experimental class, students received grades maximum of 88. Meanwhile, in the control class, the score was quite low, namely 31, with an average overall score of 63.73. This difference could be a sign that the learning methods used in the experimental class had a positive impact on student learning outcomes. The stability of better-maintained grades reflects the existence of equalising conceptual understanding among students. From the results of the student score data, the processed to see whether there is an influence from using the model Cooperative learning type Think Pair Share using Index Card Match on students' mathematics learning outcomes through independent sample tests assisted by SPSS 25 application program. Hypothesis testing has criteria, namely, if the probability (sig) < 0.05, then H0 is rejected. The independent sample test on the post-test value was carried out by students can be seen as follows:

Table 3 - Test Output Independent Sample Test

		Levene's Test for Equality of Variances		t-test for Equality of Means			
		F	Sig.	t	Sig. (2-tailed)	Mean Difference	Std. Error Difference
Mark	Equal variances assumed	.147	.703	2.977	.004	9.471	3.181
	Equal variances not assumed			2,947	.005	9.471	3.214

Based on the Independent Samples Test in Table 3 above, it can be seen from the results that the significance value is 0.004. From the results of the significance value of 0.004 < 0.005, H0 is rejected, and Ha is rejected. accepted, which means there is a difference in the average post-test results carried out by students. Then it can be concluded that the cooperative learning model of the think-pair-share type with using index card matches can be said to be effective in learning material. system of linear equations in three variables (SPLTV).

3.2 Discussion

In this study, the learning process was divided into two groups, namely the control group. experimental and control groups. The experimental group uses a cooperative learning model, cooperative Think Pair Share (TPS) type, using Index Card Match, while the control group used conventional learning, namely the learning process with the lecture method. The learning process in the experimental group began with the delivery of apperception by the teacher (researcher), motivation, and learning objectives. Process learning using the cooperative learning model of the Think Pair Share type (TPS) using Index Card Match has 3 stages, namely as follows

Figure 1. Think Stage

As seen in Figure 1, it shows a picture of the Think stage in the experimental group. At the Think stage,students begin by listening to and understanding the teacher's explanation. about the material of the Three Variable Linear Equation System (SPLTV) for approximately 10 minutes, after explaining the material, the teacher distributes LKPD. In the LKPD, students solve problems independently*;* this process helps students to develop the ability to think and learn individually. The Think stage in the learning process using the cooperative learning model type Think Pair Share functions to fostering individual understanding of knowledge and concepts. This event is in line with with the opinion expressed by Darmawan (2023), "Learning well starts when a person is involved in understanding new information before exchanging ideas with others others". Thinking individually can help students form a foundation of knowledge and make it easier for students to discuss in the next stage (Pratami, 2024). The next stage is the Pair stage where students will be formed into groups, for more details, pay attention to the picture and the following explanation.

In Figure 2 above shows the Pair stage combined with Index Card Match in the experimental group. In the Pair stage , students are formed into groups consisting of 2 people, each group discusses the answers from each student. This process is used so that students exchange ideas from the results of each student's answers, are there any differences from both answers, if any, students will discuss and conclude about the final results answers to the questions in the LKPD. After completing the discussion, the teacher will distribute two types of different cards for each student, the cards contain questions and steps solution steps.

Figure 2. Pair Stage + Index Card Match

At this stage, students understand the cards they each get while listen to the teacher's explanation about the steps in how to match the cards next, students start looking for pairs of cards and discussing them with their groups. Pair of cards to complete the final result of the question card. Use of Index Cards Match (ICM) at the Pair stage helps students think actively. The matching activity Cards support a broader learning process and train thinking skills. critical. According to Kisman et al. (2024) the interaction between students in the Pair stage is in line with social constructivism theory to build shared knowledge through collaboration. The final stage is the Share stage, the following is a picture and explanation of the Share stage:

Figure 3. Share Stage

Figure 3 shows the Share stage of the experimental group. This stage is the final stage of the learning process because at this stage students compile final conclusions from the results of group discussions and come to the front of the class to present it while other groups listen and give responses. According to Siller & Ahmad (2024), presenting discussion results in front of the class can improve communication skills, building self-confidence, and training thinking skills critical students because students need to be able to explain and be responsible for their answers delivered. This process supports in-depth learning, where the material is not not only remembered but also well understood through social interactions and arguments regularly (Keramati & Gillies, 2022).

The use of Student Worksheets (LKPD) in experimental classes is very plays an important role in the Share stage, because LKPD functions as a guide and notes written from the students' thinking process. According to Anggraeni et al. (2022), the LKPD compiled well not only functions as a training tool, but also as a scaffolding tool which supports students in building understanding gradually. Implementation of the cooperative learning model type Think Pair Share (TPS) with Using Index Card Match has been proven to be effective in increasing student learning activities because it provides an opportunity for students to think independently, discuss in small groups, and share their thoughts with the whole class (Fernando & Wijaya, 2022) . This encourages student engagement and strengthens their understanding of the concept the material presented. According to Cristina et al. (2023) the cooperative learning model type TPS using ICM can create a collaborative learning environment, trigger students' courage to express ideas, and significantly improve students' mathematics learning outcomes.

Strengthening by using Index Card Match (ICM) makes the process learning becomes more fun and interactive. This method helps students practice thinking by matching cards containing questions and answers, so that students are more active in remembering and understanding the material. According to Nurhaswinda, et al (2025) said that "The use of Index Card Match (ICM) in the learning process can "increase enthusiasm for learning and accelerate understanding of mathematical concepts."

In contrast to the experimental group, in the control group, the learning process done conventionally with direct explanation from the teacher and work done questions without the support of LKPD or Index Card Match strategy. Students are more focused listening, taking notes, and solving problems independently. Interaction between students and the opportunity to share ideas is quite small. This event creates a learning atmosphere that tend to be less active compared to the experimental group. To provide a more detailed explanation of the control class in the conventional learning process pay attention to the following pictures and explanations:

Figure 4. Conventional Learning

Figure 4 shows a picture of the conventional learning process in class. control. In this class group, the teacher begins by providing motivation to the students. students and continued with the presentation of the material on the Three Variable Linear Equation System (SPLTV). The learning process in the control class uses the lecture method as well as work on practice questions individually, the teacher explains the material and students ask questions if did not understand the material presented. The control class used learning conventionally shows lower learning outcomes. Learning Conventional learning only focuses on the teacher and there is very little interaction between students. Statement This is in line with research by Dzulfian Syafrian et al. (2025) which shows that the conventional learning process often makes students become less active and does not provide opportunities to explore ideas or discuss impact on low learning outcomes.

Conventional learning in the control class does not involve group presentations or class discussions (Pasaribu et al., 2024). This learning is mostly explained by the teacher. Although conventional learning is able to deliver material quickly and effectively, student interaction is generally lacking. Learning that is too dominant with the teacher can causes students to be passive, because students only act as recipients, not as a producer of knowledge (Hanifah, 2016). The differences in learning methods that used in the experimental class and control class has an effect on learning outcomes students. This assumption is evident from the differences in the grade preferences produced by the two classes. To provide an overview of student learning outcomes, the following presents the results of student scores. in the experimental class and control class.

Based on student grade data, student learning outcomes in the experimental class show better and more even distribution compared to the control class. In the class experiment, the majority of students got scores above 63. While in the control class there

are several values that are quite low, namely 31. This difference could be a sign that the learning methods used in the experimental class had a positive impact on student learning outcomes. The stability of better maintained grades reflects the existence of equalizing understanding of concepts among students.

The results of this study are in accordance with the Behaviourism theory put forward by BF. Skinner (Wahyuddin, 2016). In the experimental class, positive encouragement was provided, such as appreciation, recognition, or useful feedback. Students' learning attitudes will develop better, and student learning outcomes will improve. According to previous research conducted by Solin et al. (2025) the application of positive consolidation in the process of learning can increase student motivation and directly influence improving student grades.

The results of this study can be linked to John Sweller's Cognitive Load theory (Ratu & Elfira, 2024). This theory explains that the learning process becomes more efficient when the material is delivered maximally. Learning methods, cooperative Think Pair Share (TPS) type using Index Card Match (ICM) in experimental classes can reduce unnecessary cognitive load and emphasise the essence of the material. Students will find it easier to understand and remember the concepts of the material delivered (Hafizah et al., 2025).

The results of this study explain that there is a clear difference between students' mathematics learning achievement using cooperative learning models Think Pair Share (TPS) type, using Index Card Match, and learning conventionally (Fernando & Wijaya, 2022). Judging from the results of the t-test, which shows that the significance value is 0.004, which means < 0.005, this shows that the difference between the two samples is statistically significant. Researchers can conclude that the application of the model Think Pair Share (TPS) type cooperative learning using Index Cards Match influences students' mathematics learning outcomes.

The results of this study are in line with research conducted by Salam (2017) which explains that the use of the cooperative learning model of the Think Pair Share type (TPS) can clearly improve student learning outcomes compared to the learning process. conventional learning. Likewise, research by Sirait & Apriyani (2020), which shows that the use of Index Card Match (ICM) is effective in improve student learning outcomes. From the results of the explanation above, the researcher concluded that by combining the cooperative learning model of the Think Pair Share (TPS) type and Index Card Match can be a good and effective combination of learning processes for improve students' mathematics learning outcomes at school.

4. Conclusion

Based on the results and discussions that have been presented, it can be concluded that there is a clear difference between the mathematics learning outcomes of students who apply the model Think Pair Share (TPS) type cooperative learning using Index Cards Match compared with students who applied conventional learning. Seen from the t-test results which showed significant results, thus indicating that the model Think Pair Share

(TPS) type cooperative learning using Index Cards Matching has an impact on students' mathematics learning outcomes. Based on research results, Researchers suggest that teachers implement the cooperative learning model type Think Pair Share (TPS) with Index Card Match media to increase participation and student learning outcomes, especially in mathematics. Students are expected to be more active in every stage of cooperative learning so that the learning process becomes more meaningful.

Schools are expected to provide support and facilities for the implementation of the model. innovative learning such as TPS and ICM. In addition, further researchers can develop research by involving more samples, longer duration length, combining TPS with other methods, or applying it to other subjects and different levels of education. Evaluation of learning outcomes should also not only be done through post-test, but includes student activities and attitudes during the learning process.

Conflict of Interest

The authors declare no conflicts of interest

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