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The Influence of the Teams Games Tournament (TGT) Type Cooperative Learning Model on the Mathematical Understanding Ability and Mathematical Attitude of Students

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Abstract

Mathematical comprehension skills and mathematical attitudes are two important aspects of mathematics learning; however, observations at MTs Wahid Hasyim Sukosari Kunir indicate that both aspects remain relatively low as a result of teaching that tends to be teacher-centered. The purpose of this study is to ascertain how students' mathematics attitudes and understanding abilities are affected by the Teams Games Tournament (TGT) cooperative learning approach. This study used a quantitative methodology with a quasi-experimental design more precisely, a Nonequivalent Pretest-Posttest Control Group Design. The study population consisted of 41 seventh-grade students, all of whom were included in the sample through saturation sampling, comprising 21 students in the experimental class and 20 students in the control class. Data were collected using a mathematical comprehension test and a mathematical attitude questionnaire that met validity and reliability criteria, and were then analyzed using descriptive statistics, normality tests, homogeneity tests, and an independent samples t-test. With a significance value (Sig. 2-tailed) of 0.000 < 0.05 for both variables, the study's findings show that the Teams Games Tournament (TGT) cooperative learning model significantly affects students' mathematical attitudes and comprehension. As a result, the Teams Games Tournament (TGT) cooperative learning model works well as an alternate teaching strategy for raising students' mathematical attitudes and comprehension.

Keywords Cooperative Learning; Mathematical Attitudes; Mathematical Comprehension; Teams Games Tournament

INTRODUCTION

Education is one of the factors in improving the quality of human resources, particularly through mathematics instruction. Mathematics not only serves as a foundational discipline but also plays a role in developing logical, systematic, critical, and creative thinking skills. Therefore,

mathematics instruction emphasizes not only students' ability to arrive at the correct answers but also their ability to understand concepts in depth. One of the key objectives of mathematics education is mathematical understanding-that is, students' ability to comprehend, connect, and meaningfully apply mathematical concepts (Zarkasyi et al., 2017). In addition to cognitive aspects, success in mathematics learning is also influenced by affective aspects in the form of mathematical attitudes, which include self-confidence, interest in learning, perseverance, openness to others' opinions, and an appreciation for the importance of mathematics in daily life (Sumarmo, 2013).

Based on observations during the Field Experience Program (PPL) at MTs Wahid Hasyim Sukosari Kunir, the mathematical comprehension skills of seventh-grade students are still relatively low. This was evident when students struggled to understand integer operations. Most students were able to solve problems similar to the examples provided but encountered difficulties when faced with different problem formats. Furthermore, students were unable to explain the reasoning behind their answers, indicating that their understanding remains procedural and has not yet reached a conceptual level. This issue is closely tied to a learning process that is still teacher-dominated, which limits students' opportunities to develop mathematical understanding.

These issues also contribute to students' low mathematical attitudes; some students exhibit low interest in learning, lack confidence in expressing their opinions or solving problems, and give up easily when faced with mathematical problems. In fact, mathematical attitudes are one of the factors that support student engagement in the learning process. Mahyuni et al. (2024) state that interest and motivation to learn influence student engagement in learning. Furthermore, Veloo et al. (2018) explain that the Teams Games Tournament (TGT) cooperative learning model can foster positive student attitudes toward mathematics through collaborative activities, interaction, and active engagement in learning. Therefore, a learning model is needed that can improve mathematical comprehension skills while simultaneously fostering students' mathematical attitudes in an integrated manner.

One learning model that has the potential to address these issues is the Teams GamesTournament (TGT) cooperative learning model. This model integrates classroom presentations, collaboration in heterogeneous groups, academic games, tournaments, and group rewards, thereby creating an active, enjoyable, and healthily competitive learning environment. Through group discussions, games, and academic tournaments, students have the opportunity to exchange ideas, build conceptual understanding, and increase their motivation and sense of responsibility in learning. With these characteristics, the TGT model is considered capable of developing students' mathematical comprehension skills while also improving their attitudes toward mathematics during the learning process.

Various studies have demonstrated the effectiveness of the Teams Games Tournament (TGT) model in mathematics instruction. Wati et al. (2022) reported that the implementation of the TGT model had a significant effect on students' mathematical comprehension. Arifin et al. (2020) showed that students who learned using the TGT model had better mathematical

conceptual understanding compared to those in conventional instruction. Bela et al. (2024) also stated that the TGT model can improve students' ability to understand mathematical concepts through collaborative activities among students. The results of a systematic literature review by Nurjanah et al. (2025) also concluded that the TGT model consistently has a positive impact on conceptual understanding across various educational levels, while Mahyuni et al. (2024) showed that the TGT model influences students' mathematical conceptual understanding and interest in learning. Nevertheless, most of these studies still examine cognitive and affective aspects separately, whereas research analyzing the simultaneous influence of the TGT model on mathematical conceptual understanding and mathematical attitudes at the Madrasah Tsanawiyah level remains limited. In light of these conditions, this study makes a novel contribution by investigating the simultaneous effects of the Teams Games Tournament (TGT) cooperative learning model on students' mathematics attitudes and comprehension at MTs Wahid Hasyim Sukosari Kunir. The purpose of this study is to ascertain how students' mathematics attitudes and comprehension are affected by the Teams Games Tournament (TGT) cooperative learning approach.

METHOD

This study employed a quantitative quasi-experimental technique with a nonequivalent pretest-posttest control group design. During the even semester, the study was carried out at MTs Wahid Hasyim Sukosari Kunir. The study population consisted of 41 seventh-grade students, all of whom were included in the sample using a saturated sampling technique. According to Sugiyono (2022), the saturation sampling technique is a method of determining a sample in which all members of the population are used as the sample. The sample consisted of 21 students in the experimental class and 20 in the control class. The experimental class used the Teams Games Tournament (TGT) model, while the control class used the conventional model. Research data were obtained through a mathematical comprehension test, a mathematical attitude questionnaire, and documentation. Prior to use in the study, all instruments had passed validity and reliability tests and were therefore deemed suitable as data collection tools.

The data were analyzed using IBM SPSS Statistics 27. The analysis began with descriptive statistics to characterize mathematical comprehension and attitudes toward mathematics. Prerequisite tests were then carried out, such as a homogeneity test using Levene's test and a normality test using the Shapiro-Wilk test. To ascertain the impact of the Teams Games Tournament (TGT) learning model on students' mathematical comprehension abilities and attitudes toward mathematics, hypothesis testing was carried out using an independent samples t-test at a 5% significance level after verifying that the data satisfied the assumptions of normality and homogeneity.

FINDINGS AND DISCUSSION

Findings

The Effect of the Games Tournament (TGT) Cooperative Learning Model on Mathematical Comprehension

To determine the level of mathematical comprehension among students in the control and experimental classes before and after instruction, a descriptive statistical analysis was performed using the pretest and posttest results. The results of the analysis are presented in Table 1.

Table 1. Descriptive statistics of mathematical comprehension ability

Report

Nilai Kelas	Mean	N	Std. Deviation	Minimum	Maximum
Nilai Pretest Kelas Kontrol	49.40	20	7.598	32	64
Nilai Posttest Kelas Kontrol	62.70	20	6.937	52	72
Nilai Pretest Kelas Eksperimen	52.95	21	6.184	44	64
Nilai Posttest Kelas Eksperiman	77.52	21	6.385	68	88
Total	60.76	82	12.876	32	88

Source: source description

Based on Table 1, the mean pretest score for the control class was 49.40, while that for the experimental class was 52.95. After instruction, the mean posttest score for the control class increased to 62.70, while that for the experimental class reached 77.52. The maximum score in the experimental class was 88, higher than that of the control class, which was 72. In addition, the standard deviation in both classes indicated a relatively good distribution of data. Descriptively, these results show that the students' mathematical comprehension skills in the experimental class were higher than those in the control class after the Teams Games Tournament (TGT) cooperative learning model was implemented.

Before testing the hypotheses, we first conducted the prerequisite tests for the analysis, including the normality test and the homogeneity test, to ensure that the data met the assumptions of parametric statistics.

Table 2. Results of Prerequisite Tests for Mathematical Comprehension Ability

Tests of Normality

		Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Kelas	Statistic	df	Sig.	Statistic	df	Sig.
Hasil	Pretest Kelas Kontrol	.127	20	.200*	.973	20	.807
	Posttest Kelas Kontrol	.128	20	.200*	.918	20	.092
	Pretest Kelas Eksperimen	.165	21	.139	.924	21	.103
	Posttest Kelas Eksperimen	.140	21	.200*	.933	21	.157

*. This is a lower bound of the true significance.

a. Lilliefors Significance Correction

Test of Homogeneity of Variance

		Levene Statistic	df1	df2	Sig.
Nilai	Based on Mean	.165	1	39	.687

Source: source description

All groups have significance values larger than 0.05, indicating that the data are normally distributed, according to Table 2's Shapiro-Wilk test results. Additionally, a significant value of 0.687 was obtained from the homogeneity test using Levene's test, suggesting that the variances of the two groups are homogeneous. As a result, the data satisfy the requirements for employing the independent samples t-test to test hypotheses.

The impact of the Teams Games Tournament (TGT) cooperative learning paradigm on students' arithmetic understanding abilities was then tested using the independent samples t-test. Table 3 displays the test results.

Table 3. Results of the Independent Samples t-Test for Mathematical Comprehension Ability

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
									95% Confidence Interval of the Difference	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
Hasil	Equal variances assumed	.165	.687	-7.125	39	.000	-14.824	2.081	-19.032	-10.615

Source: source description

Based on Table 3, the Sig. (2-tailed) value is 0.000 < 0.05. Additionally, the t-value is -7.125 with a mean difference of -14.824. These results indicate that there is a significant difference in students' mathematical comprehension abilities between the experimental and control classes. Therefore, H_{01} is rejected and H_{11} is accepted, meaning that the Teams Games Tournament (TGT) cooperative learning model has a significant effect on mathematical comprehension ability.

The Effect of the Games Tournament (TGT) Cooperative Learning Model on Mathematical Attitudes

To determine the profile of students' mathematical attitudes in the control and experimental classes before and after instruction, a descriptive statistical analysis was conducted on the pretest and posttest scores. The results of the analysis are presented in Table 4.

Table 4. Descriptive statistics of mathematical understanding attitudes

Report

Total

Kelas	Mean	N	Std. Deviation	Minimum	Maximum
Kelas Kontrol	48.40	20	3.575	43	57
Kelas Eksperimen	61.71	21	5.414	51	70
Total	55.22	41	8.132	43	70

Source: source description

Based on Table 4, the mean mathematical attitude score for students in the control class was 48.40 with a standard deviation of 3.575, while the experimental class had a mean of 61.71 with a standard deviation of 5.414. The minimum score in the control class was 43 and in the experimental class was 51, while the maximum scores were 57 and 70, respectively. Descriptively, these results indicate that students' mathematical attitudes in the experimental class were better than those in the control class after the implementation of the Teams Games Tournament (TGT) cooperative learning model.

Before hypothesis testing, the mathematical attitude data were tested using normality and homogeneity tests as prerequisites for analysis. The test results are presented in Table 5.

Table 5. Results of the Mathematical Comprehension Prerequisite Test

Tests of Normality

		Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Kelas	Statistic	df	Sig.	Statistic	df	Sig.
Total	Kelas Kontrol	.115	20	.200*	.956	20	.471
	Kelas Eksperimen	.135	21	.200*	.930	21	.139

*. This is a lower bound of the true significance.

a. Lilliefors Significance Correction

Source: source description

Test of Homogeneity of Variance

		Levene Statistic	df1	df2	Sig.
Total	Based on Mean	.783	1	39	.382

Source: source description

Based on Table 5, According to the Shapiro-Wilk test results for normality, the experimental group's significance value was 0.139 and the control group's was 0.471. Since each group's significant values were higher than 0.05, the mathematical attitude data are normally distributed and the assumption of normality is valid. The two groups' variances are homogeneous, according to the homogeneity test findings using Levene's Test, which produced a significance value of 0.382. The Independent Sample t-Test can therefore be used to test hypotheses because the data satisfies its conditions.

Hypothesis testing was conducted using the Independent Samples t-Test to determine the effect of the Teams Games Tournament (TGT) cooperative learning model on students' attitudes toward mathematics. The test results are presented in Table 6.

Table 6. Results of the Independent Samples t-Test for Mathematical Comprehension Ability

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
Total	Equal variances assumed	.783	.382	-8.836	39	.000	-12.040	1.363	-14.797	-9.284

Source: source description

Based on Table 6, the Sig. (2-Tailed) value of 0.000 is smaller than the significance level of 0.05. The t-value of-8.836 with a Mean Difference of-12.40 indicates that there is a significant difference between the mathematical attitudes of the control class and the experimental class. Based on the results of the hypothesis testing, H_{02} is rejected and H_{12} is accepted. Thus, the application of the Teams Games Tournament (TGT) cooperative learning model has a significant effect on students' attitudes toward mathematics.

Discussion

The results of a study on the impact of the Teams Games Tournament (TGT) cooperative learning paradigm on mathematical cognition and attitudes toward mathematics are the main topic of this section. The findings are then related to relevant theories and previous research.

The Effect of the Teams Games Tournament (TGT) Cooperative Learning Model on Mathematical Comprehension

The study's findings, which demonstrate that TGT-based instruction is more successful at enhancing comprehension than traditional instruction, suggest that the TGT cooperative learning model has a substantial impact on students' mathematical comprehension. This improvement is evident not only in students' academic performance but also in their active engagement throughout the learning process via group discussions, academic games, and tournaments.

The improvement in mathematical comprehension occurred because the TGT model provided students with the opportunity to build conceptual understanding through interaction with their peers. During the class presentation stage, the teacher provided an explanation of the material as the foundation for learning. Next, during the "teams" stage, students collaborate in heterogeneous groups to discuss the material and solve the problems presented. This discussion process allows students to exchange information, provide explanations, and help peers who are struggling, thereby deepening their conceptual understanding (Johnson & Johnson, 2017).

In addition, the games and tournaments provide students with the opportunity to apply the concepts they have learned in a fun and competitive setting. Through academic games, students are encouraged to think more actively, recall the concepts they have learned, and apply them to solve problems. These activities help students connect mathematical concepts with the problem-solving process, ensuring that their understanding is not merely procedural but also conceptual (Sulaiman et al. 2024).

The results of this study are consistent with the theory of cooperative learning proposed by Slavin (2015), which states that cooperative learning can improve learning outcomes through positive peer interaction, individual responsibility, and group collaboration. In the TGT model, each group member is responsible for helping their peers understand the material, so that learning success depends not only on individual ability but also on the success of the group as a whole. These conditions encourage students to be more active in constructing their own knowledge.

The findings of this study are also consistent with the theory proposed by Klipatrick et al. (2001), which states that conceptual understanding is the ability to comprehend concepts, operations, and relationships among concepts in mathematics. Through the TGT model, students not only learn to use formulas or problem-solving procedures but also understand the relationships between concepts through discussion, question-and-answer sessions, and collaborative problem-solving. Consequently, learning becomes more meaningful because students are able to explain the reasoning behind each solution they arrive at.

The results of this study are consistent with the research by Wati et al. (2022), which concluded that the Teams Games Tournament (TGT) learning model has a significant effect on students' mathematical comprehension. The study by Bela et al. (2024) also showed that collaborative activities within the TGT model can enhance the understanding of mathematical concepts because students have the opportunity to discuss and help one another in solving problems. Furthermore, Mahyuni et al. (2024) reported that the implementation of the TGT model can improve students' mathematical concept comprehension through more active and interactive learning. The alignment of the results of this study with previous research indicates that the TGT model is an effective learning alternative for improving students' mathematical comprehension.

The Effect of the Teams Games Tournament (TGT) Cooperative Learning Model on Mathematical **Comprehension Skills**

The results of the study show that the implementation of the Teams Games Tournament (TGT) cooperative learning model has a significant effect on students' mathematical attitudes. These findings indicate that the TGT model not only enhances students' cognitive aspects but also has a positive impact on their affective aspects, including self-confidence, interest in learning, perseverance, openness in discussions, and appreciation for mathematics learning. This improvement in mathematical attitudes is evident in students' more active engagement during the learning process and their increased enthusiasm in participating in each stage of the learning activities.

The improvement in mathematical attitudes occurred because the Teams Games Tournament (TGT) model provided all students with the opportunity to actively engage in the learning process. Through group discussion activities, each student was encouraged to express their opinions, exchange information, and collaborate in solving the problems presented. Students feel more comfortable sharing their thoughts and don't hesitate to ask questions when they run into problems because these activities foster a more participatory learning

environment. In addition, interactions among students during the learning process also foster mutual respect and appreciation for their peers' opinions.

The stages of games, tournaments, and team recognition are key characteristics of the TGT model that contribute to improving students' attitudes toward mathematics. Academic games and tournaments provide an enjoyable learning experience, making students more motivated to study mathematics. Meanwhile, rewarding the groups with the highest scores boosts students' enthusiasm for learning, sense of responsibility, and cooperation among peers. These conditions create a positive learning environment, making students more enthusiastic about participating in mathematics lessons.

The findings of this study are consistent with the theory of cooperative learning proposed by Slavin (2015), which states that cooperative learning can enhance learning motivation through social interaction, group collaboration, and the recognition of high-performing groups. Furthermore, Sumarmo (2013) explains that mathematical attitudes are one of the affective aspects that play a crucial role in the success of mathematics learning because they reflect students' interest, self-confidence, perseverance, and appreciation for mathematics. Research by Damayanti et al. (2024) also shows that the implementation of the TGT model has a positive impact on student engagement during the learning process, thereby fostering a positive attitude toward mathematics. Therefore, learning that actively engages students will provide greater opportunities for developing a positive mathematical attitude.

The findings of this study are also supported by the research by Mahyuni et al. (2024), which concluded that the implementation of the Teams Games Tournament model can increase students' interest in learning through interactive and enjoyable learning activities. Similarly, the study by Veloo et al. (2018) showed that the TGT model has a positive effect on students' attitudes toward mathematics learning because it enhances engagement, cooperation, and learning motivation. The consistency of these findings indicates that the Teams Games Tournament cooperative learning model is an effective alternative for developing students' mathematical attitudes.

Overall, the results of this study indicate that the Teams Games Tournament (TGT) cooperative learning model has a positive effect on students' mathematical comprehension and attitudes toward mathematics. The characteristics of this model-which emphasize cooperation, discussion, academic games, tournaments, and group rewards-create a learning environment that is more active, interactive, and student-centered. Thus, the TGT model can serve as an effective alternative for improving the quality of mathematics education, both cognitively and affectively.

CONCLUSION

This study aims to analyze the effect of the Teams Games Tournament (TGT) cooperative learning model on the mathematical comprehension and attitudes of seventh-grade students at MTs Wahid Hasyim Sukosari Kunir. The results show that the implementation of the Teams Games Tournament (TGT) cooperative learning model has a significant effect on students'

mathematical comprehension and attitudes. These findings indicate that the TGT model is effective in facilitating the development of students' cognitive and affective aspects through learning that is oriented toward cooperation and active participation. Therefore, the TGT model has the potential to be an alternative learning method that can be applied to improve the quality of mathematics education. Future research is recommended to examine the application of the TGT model across different subject matter, educational levels, or variables with a broader sample size to obtain more comprehensive empirical evidence.

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