

THE EFFECT OF THE *TEAMS GAMES TOURNAMENT* (TGT) COOPERATIVE LEARNING MODEL USING THE SNAKE AND LADDER GAME AS A MEDIUM ON THE CRITICAL THINKING SKILLS OF JUNIOR HIGH SCHOOL STUDENTS IN ALGEBRA

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Abstract

Critical thinking skills are one of the most important abilities that should be taught in math classes, however, these skills remain relatively low among some junior high school students. This study wants to find out how using the Teams Games Tournament method with a Snakes and Ladders game affects students' ability to think critically about algebra, as well as to determine the magnitude of that effect. The new idea in this study is combining the TGT model with the Snakes and Ladders game to help students develop their critical thinking skills in algebra, and the results are backed by an analysis of how effective the method is. The study used a quantitative method and followed a quasi-experimental approach with a nonequivalent control group setup. The study sample consisted of 60 seventh-grade students at Pahlawan Nasional Junior High School, comprising 30 students in the experimental class and 30 students in the control class. Data were collected using a critical thinking skills test and then analyzed through normality tests, homogeneity tests, an independent samples t-test, and Cohen's d effect size. The t-test results showed a significance value of 0.000, which is less than 0.05, meaning there is a significant difference between the experimental group and the control group. Furthermore, the effect size analysis showed a very large effect. This result shows that using the TGT cooperative learning model with snakes and ladders as a teaching tool is good at helping students think more critically about algebra.

Keywords: Teams Games Tournament (TGT), Snakes and Ladders, Critical Thinking Skills.

INTRODUCTION

Education represents an ongoing learning Journey designed to cultivate the abilities of students and share cultural ideals from one age group to another next (Andhany & Maysarah, 2023). Education is very important because it helps students deal with the different challenges they will face in the 21st century. One essential skill to cultivate during the educational journey is critical thinking. This ability allows learners to examine information, evaluate various alternative solutions, and make decisions logically and systematically. In mathematics education, critical thinking is particularly important because mathematics requires students not only to arrive at the correct answer but also to understand the processes and reasoning underlying the solution to a problem (Agustang A & Mutiara, I. A, 2021).

Mathematics is a discipline that is intimately connected to the cultivation of advanced cognitive abilities, such as critical thinking. Nonetheless, in practice, a large number of learners perceive math to be a challenging area of study, which makes them less confident, passive, and struggle to understand abstract concepts as well as solve non-routine problems (Siregar et al., 2023). In junior high school (SMP), algebra material becomes one of the basic topics that students must master because it forms the foundation for learning mathematics at higher levels. However, algebra is often considered difficult by students because it involves the use of symbols, variables, and more abstract reasoning processes compared to arithmetic. This situation causes many students to have difficulty understanding concepts and solving

algebra problems accurately. (Lestari, K. E & Yudhamegara, M. R, 2018)

Students' low critical thinking skills in mathematics learning are closely tied to a learning process that remains teacher-centered. In practice, instruction is often dominated by the presentation of material and the provision of example problems, while students act as mere recipients of information. This situation results in students being less engaged in the process of discovering concepts, discussing ideas, or expressing their opinions. As a result, the chances for students to cultivate their critical thinking abilities are restricted. In reality, critical thinking abilities can grow when students are allowed to engage in asking questions, examining issues, and justifying their responses (Risnanosanti, 2019).

A method that can be utilized to enhance the critical thinking abilities of learners involves adopting a teaching model that actively involves students in their own education (sarjana, K. S, Baidowi, B, & Arjudin, A, 2020). The Teams Games Tournament (TGT) is a cooperative learning method that emphasizes teamwork, social interaction, and friendly competition in education, as explained by Slavin in 2018. (Slavin, 2018). With this approach, learners work in diverse groups to grasp the subject matter, after which they engage in academic games and competitions designed to solidify their comprehension of the concepts they have studied. These elements grant students the chance to debate, share thoughts, and enhance their critical thinking abilities on a deeper level (Kurniawan, A & Setyabudi, T, 2024).

To make the implementation of the TGT model more engaging, learning materials that can boost student motivation and engagement are needed. One such material is the Snakes and Ladders game. An altered edition of Snakes and Ladders that includes mathematical questions can provide a setting for learning that is enjoyable and demanding. By engaging in activities centered around games, learners are motivated to take a more proactive approach in addressing challenges., discussing with group members, and evaluating the problem-solving strategies they use. So, using the

Snakes and Ladders game is likely to help make the TGT learning model more effective at improving students' critical thinking skills. (Marlina, T & Surya, E, 2019)

The Teams Games Tournament (TGT) collaborative learning approach, which is inspired by the snakes and ladders game, is significantly connected to enhancing students' abilities in critical thinking (Putri, 2018). In this model, students don't just receive information from the teacher, but also actively engage in group discussions, solve problems, voice their opinions, provide reasons for their answers, and evaluate the results of discussions before participating in games and tournaments. Using the snakes and ladders media combined with math questions further encourages students to think analytically, decide on solution strategies, and draw conclusions based on the concepts they've learned. These activities align with indicators of critical thinking skills, so integrating the TGT model with snakes and ladders is believed to create active, collaborative, and meaningful learning while contributing to the improvement of students' critical thinking abilities (Slavin, 2018).

Numerous earlier investigations have demonstrated that the TGT cooperative learning framework positively influences students' outcomes in mathematics, their engagement in learning activities, and their motivation levels. Additional research has indicated that incorporating game-based learning resources can enhance student involvement and excitement throughout the educational experience (Barumbun, 2021). However, research that specifically examines the effect of the Teams Games Tournament (TGT) cooperative learning method using a Snakes and Ladders-themed tool on the critical thinking skills of junior high school pupils regarding algebra remains rather limited.. The majority of prior research mainly concentrated on either students' academic results or their motivation. (Gusti E, 2018)

The shortcomings of earlier research highlight a research gap that necessitates additional exploration. This investigation not only explores the use of the TGT learning model but also merges it with the Snakes and Ladders game, concentrating on enhancing

students' critical thinking abilities in algebra. As a result, this research aims to offer a substantial empirical contribution to the advancement of creative mathematics teaching models and to enhance the body of literature regarding successful learning techniques that foster the critical thinking capabilities of junior high school students.

The uniqueness of this study is found in the combination of the Teams Games Tournament (TGT) collaborative learning approach with a snakes and ladders game format that is specifically created to enhance junior high school students' analytical skills in algebra. Unlike previous studies that generally only examined the impact of the TGT model on learning outcomes or motivation, or the use of snakes and ladders media separately, this study combines both into a single learning strategy and measures its effectiveness on critical thinking skills through inferential statistical analysis supplemented with effect size measurement. In this way, this research provides empirical contributions on the effectiveness of integrating cooperative learning models and educational game media to enhance students' critical thinking skills in math learning.

Based on the information given earlier, the questions this study is looking into are: (1) Does using the Teams Games Tournament (TGT) method, which involves a Snakes and Ladders game, help improve the critical thinking skills of junior high school students in algebra? and (2) How does the TGT approach, which uses a Snakes and Ladders game, affect the critical thinking abilities of junior high school students when learning algebra? This study aims to look into how using the Teams Games Tournament method with a Snakes and Ladders game affects the critical thinking skills of junior high school students in algebra. It also wants to measure how much of an impact this method has by looking at the effect size. The results of this study are expected to help math teachers pick good teaching methods and materials that can help students develop their ability to think critically.

METHOD

This study used a quantitative method that included a quasi-experimental design

with a non-equivalent control group. (Sugiyono, 2019). The research took place at Pahlawan Nasional Junior High School, situated at Jl. Durung No. 205, Medan, within the Medan Tembung District, Medan City, North Sumatra. The people who took part in this study were seventh-grade students who were attending school during the academic year 2025–2026. The population for the research comprised 118 students spread out over four different classes. The sample was chosen through purposive sampling, considering factors such as academic proficiency, class size, and the recommendations of subject teachers. In accordance with these standards, Class B from 7th Grade was chosen to be the experimental group, while Class C from the same grade was selected as the control group, consisting of 30 students in each. The research focus was on students' critical thinking skills regarding algebra material, while the strategy included utilizing the Teams Games Tournament (TGT) collaborative learning framework centered around the Snakes and Ladders game.

The research process was done in a step-by-step way through four stages. First, the preparation stage, which included consultations with mathematics teachers regarding student conditions and the research material; initial observations at the school; submission of a research permit application; formulation of the research problem; determination of the population and sample; development of instructional materials in the form of teaching modules applying The Teams Games Tournament (TGT) is a cooperative learning model that uses a snakes-and-ladders game format, and it focuses on development, validation, and pilot testing of the critical thinking skills assessment instrument. Second, the implementation phase, which began with administering a pretest to the experimental and control classes to assess students' initial abilities. In the experimental class, the teacher used the Teams Games Tournament (TGT) cooperative learning method, which was based on a snakes-and-ladders game. This approach followed several stages: class presentation, forming teams, playing games, holding a tournament, and

recognizing the teams. These activities took place over three sessions. Meanwhile, the control class had regular, traditional instruction. This stage concluded with the administration of a posttest to both classes to measure students' critical thinking skills following the intervention. Third, the data processing stage, which included collecting pretest and posttest data, conducting descriptive analysis, performing a normality test using the Shapiro–Wilk test, a homogeneity test using Levene's test, and a hypothesis test using the independent samples t-test to determine whether the Teams Games Tournament (TGT) cooperative learning model based on the Snakes and Ladders game had an effect on students' critical thinking skills. In addition, Cohen's *d* was calculated to determine the magnitude of the effect of the implemented learning model. All the data analysis was done with IBM SPSS Statistics. Fourth, the conclusion stage included summarizing the research findings from the data analysis to address the research questions.

The assessment tool utilized was an essay-style test focused on critical thinking, comprising five items for the pretest and five for the posttest. Data were collected through written tests consisting of a pretest and posttest to measure students' critical thinking skills according to Polya. The test instrument consisted of 5 essay questions arranged based on four indicators of critical thinking skills, namely (1) the ability to analyze problems, (2) the ability to identify relevant concepts, (3) the ability to evaluate solution strategies, and (4) the ability to draw logical conclusions. Prior to implementation, the tool underwent a process of content validation, which involved expert evaluation by two faculty members from the Mathematics Education Study Program at UIN North Sumatra: Reflina, M. Pd., and Sri Rahma Yani Harahap, M. Pd. This was followed by a test of empirical validity. The findings from this empirical validity assessment indicated that all items on the test were considered valid, as their calculated *r* values exceeded the threshold *r* value of 0.254. For the pretest, the calculated *r* values were 0.929, 0.857,

0.868, 0.945, and 0.924. In the case of the posttest, the *r* values calculated were 0.823, 0.785, 0.742, 0.801, and 0.704. Consequently, all test items fulfilled the validity requirements and are appropriate for use as research instruments.

Besides being valid, the instrument also meets the reliability criteria. The reliability test using Cronbach's Alpha coefficient showed that the pretest instrument got a score of 0.905 and the posttest instrument got 0.805. Both values are higher than 0.70, which means the instrument has a high level of reliability and is suitable to be used as a data collection tool for research.

Data evaluation was performed utilizing descriptive statistics to outline the critical thinking abilities of students. This was succeeded by tests for normality and homogeneity as necessary preliminary steps. The findings from the normality test indicated that the data collected from the study followed a normal distribution, whereas the homogeneity test conducted via Levene's Test produced a Levene's Statistic of 4.192 and a significance value of 0.145, which is greater than 0.05. This demonstrates that the variances between the two groups were similar. With the conditions of normality and homogeneity established, hypothesis testing was carried out through an independent samples t-test to assess the impact of the Teams Games Tournament (TGT) cooperative learning model, which is grounded in the Snakes and Ladders game, on students' critical thinking abilities. Moreover, Cohen's *d* was used to calculate the effect size, determining the extent of the effect from the learning model that was implemented.

RESULT AND DISCUSSION

This study looks at how combining the Teams Games Tournament method with a Snakes and Ladders game influences the critical thinking skills of junior high school students as they learn algebra. The study took place at Pahlawan Nasional Junior High School and involved seventh-grade students. Class VII B was the group that received the new approach, while Class VII C was the group used for comparison.

Table 1. N Gain Test Results

	Class	N	Mean	Std. deviation	Std.Error Mean
Gain	7B	30	31.2000	3.98618	.72777
	7C	30	1.2000	2.65746	.48518

Looking at the table above, here are the results from the descriptive analysis of the pretest and posttest scores for both the control group and the experimental group, each consisting of 30 students, show differences in initial and final abilities between the two groups. You can see a summary of the descriptive data on the increase (Gain) in students' critical thinking skills for both classes. Class 7B, which acted as the Experimental Class, had a sample size (N) of 30 students, with an average (Mean) increase of 31.20 and a standard deviation of 3.986. Meanwhile, Class 7C, which acted as the

Control Class, had a sample size (N) of 30 students, with an average (Mean) increase of 1.20 and a standard deviation of 2.657.

From the evaluation of the average scores, it can be clearly stated that the enhancement of students' critical thinking abilities in the class that employed the TGT learning model with Snakes and Ladders media (Class 7B) surpasses that of the class utilizing traditional teaching methods (Class 7C). The following step is the Normality Test aimed at determining if the data follows a normal distribution, and the findings are shown in Table 2.

Table 2. Normality Test Results

	Class	Statistic	df	Sig
Gain	7B	.942	30	.101
	7C	.523	30	.235

According to the preceding Table 2, the findings from the normality assessment conducted through the Shapiro-Wilk approach indicate a significance value (Sig.) of 0.101 for Class 7B and 0.235 for Class 7C. The criterion for determining the outcome of the normality test is that if the Sig. value exceeds 0.05, then the data is considered normally distributed. Since the significance values for both classes are greater than 0.05 ($0.101 > 0.05$ and $0.235 > 0.05$), It can be

inferred that the Gain scores reflecting the critical thinking abilities of students in each class exhibit a normal distribution. The next step involves conducting the homogeneity test to ascertain if the variances of the data from both groups are equal. Following the confirmation of normal distribution of the data, the homogeneity test is executed utilizing Levene's Test. The findings are displayed in Table 3.

Table 3. Homogeneity Test Results

		Levene Statistic	df1	df2	Sig.
Gain	Based Of mean	4.192	1	58	.145
	Based of Median	7.881	1	58	.007
	Based on Median and With Adjusted df	7.881	1	57.757	.007
	Based on trimmed mean	5.453	1	58	.023

According to the table presented, the variance homogeneity test results in the row for Based on Mean indicate a Levene Statistic

of 4.192 and a significance (Sig.) value of 0.145. The criteria for testing indicate that if the Sig. value exceeds 0.05, the variances of

the data groups are deemed homogeneous. Given that 0.145 is greater than 0.05, it can be inferred that the data regarding the enhancement of critical thinking abilities between Class 7B and Class 7C possess equivalent or homogeneous variances.

Subsequently, an Independent Sample T-Test was conducted for hypothesis testing with a significance threshold set at 5% ($\alpha = 0.05$) to determine if there was a notable difference in the Critical Thinking abilities

After the intervention was carried out, the students in the experimental group were compared to the students in the control group. The hypotheses that were tested are listed here: H_0 : There isn't a big difference in how well students in the experimental group think critically compared to those in the control group. H_a : There is a clear difference in how well students in the experimental group think critically compared to students in the control group.

Table 4 Results of Independent Sample T-Test

		F	Sig.	t	df	Sig.(2-tailed)	Mean
Gain	Equal variances Assumed	4.192	.045	34.298	58	.000	30.000
	Equal variances not Assumed			34.298	50.526	.000	

The results of the Independent Samples t-Test showed a t-value of 34.298 with a degree of freedom (df) of 50.526. The significance value in the Sig. (2-tailed) column was 0.000, with a Mean Difference of 30.000. The basis for decision-making in hypothesis testing is that if the Sig. (2-tailed) value < 0.05 , then H_0 is rejected and H_a is accepted, whereas if Sig. (2-tailed) > 0.05 , then H_0 is accepted and H_a is rejected. Since the obtained significance value is less than 0.05 ($0.000 < 0.05$), H_0 is rejected and H_a is accepted. Thus, it can be concluded that there is a significant difference in critical thinking skills between students who learn using the

Teams Games Tournament (TGT) cooperative learning model based on board game media and students who follow conventional learning in algebra material. These results show that applying the Teams Games Tournament (TGT) cooperative learning model based on Snakes and Ladders media is effective in improving students' critical thinking skills.

In order to assess how much the TGT model utilizing Snakes and Ladders as a medium impacts students' critical thinking abilities, a calculation of effect size was conducted using Cohen's d formula. Table 5 displays the outcomes.

Table 5. Test Results for Effect Size

Sig. (2-tailed)	0,000
Standardizer	2,727
Mean Difference	30,000
Cohen's d	11,048
Category	Very Large Effect

The results of the hypothesis test using the Independent Samples t-Test revealed that the significance level (Sig., 2-tailed) was 0.000, which is less than the 0.05 threshold. Therefore, the null hypothesis

(H_0) is dismissed, and the alternative hypothesis (H_a) is approved. This shows that using the Teams Games Tournament method as a cooperative learning approach had a big impact on how well junior high school

students were able to think critically about algebra. These findings suggest that there is a difference in how well students think critically between those who played the "Snakes and Ladders" game and others "based TGT approach and those who received traditional instruction is attributable to the implementation of a learning model that promotes active engagement, collaboration, and direct participation in solving problems. Consequently, the TGT method utilizing the "Snakes and Ladders" game can act as a valuable alternative educational approach aimed at enhancing the standards of mathematics instruction, especially in fostering students' critical thinking abilities.

In addition, the effect size calculation using Cohen's d resulted in a value of 11.048. This value was calculated by dividing the difference in the posttest mean scores between the experimental class and the control class by the pooled standard deviation. The average posttest score of the experimental class was 90.80, while the average posttest score of the control class was 60.67, resulting in a mean difference of 30.00. The pooled standard deviation used as the divisor (standardizer) was 2.727. Thus, Cohen's d was calculated as $d = (90.80 - 60.67 / 2.727) = 11.048$. According to Cohen, a d value ≥ 0.80 falls into the large effect category. Therefore, the Cohen's d value of 11.048 indicates that the Teams Games Tournament (TGT) cooperative learning model based on the snakes and ladders media has a very strong practical effect on students' critical thinking skills.

The findings from the research reveal that the Teams Games Tournament (TGT) cooperative learning approach, which employs a Snakes and Ladders game as an educational tool, significantly enhances students' critical thinking abilities in algebra. This is supported by a p -value of 0.000 (which is less than 0.05). The experimental group showed better average performance than the control group. Throughout the educational activities, learners in the experimental group exhibited greater participation in group discussions, responding to queries, sharing views, and tackling challenges presented in the Snakes

and Ladders game. These circumstances allowed learners to develop conceptual comprehension on their own while also improving their critical thinking capacities.

The boost in students' ability to think critically can be understood by looking at the features of the Teams Games Tournament (TGT) learning model. In this model, students collaborate in heterogeneous groups to understand the material, then participate in academic games and tournaments that encourage every group member to actively participate. These processes of discussion and academic competition require students to analyze problems, present reasons, evaluate answers, and defend their opinions based on the concepts they have learned. These activities match the signs of critical thinking skills, which focus on the ability to look at things carefully, think about their value, and make smart conclusions.

The use of the Snakes and Ladders game also plays a role in enhancing the effectiveness of learning. This game makes learning more fun, which helps students feel more excited to take part in the lesson. The questions integrated into the game encourage students to think actively and collaborate in solving the problems presented. Through these activities, students gain a more meaningful learning experience compared to conventional, teacher-centered instruction.

Using the Snakes and Ladders game along with the TGT learning model helps students build their critical thinking skills by working through problems one step at a time. Each student is required to analyze problems, determine a solution strategy, and justify their answers. This process encourages students not only to memorize concepts but also to understand the relationships between them, thereby allowing their critical thinking skills to develop more effectively.

This study also found that using the TGT model along with a snakes-and-ladders game leads to more active learning experiences than traditional methods. Student engagement during discussions, games, and tournaments provides them with opportunities to exchange ideas, correct mistakes, and reinforce their understanding of mathematical concepts. So, using the TGT learning model with the Snakes and Ladders

game helps students think more critically and creates a learning experience that is more teamwork-focused, talkative, and centered around the students themselves.

The results of this research align with Vygotsky's concept of social constructivism, which suggests that knowledge is formed through interpersonal interactions and hands-on learning activities. By participating in group discussions and academic competitions within the TGT framework, learners can collaboratively build knowledge alongside their classmates, leading to an enhanced grasp of concepts. Furthermore, incorporating game-based media creates an educational setting that fosters students' active participation in their learning journey.

The outcomes of this research are corroborated by earlier studies indicating that the Teams Games Tournament (TGT) learning framework enhances students' academic performance, learning engagement, and advanced thinking abilities. Additional investigations into the application of game-oriented resources in mathematics teaching have demonstrated that these tools can increase students' enthusiasm, involvement, and active participation throughout the educational experience. Therefore, the findings of this study not only support prior evidence but also present concrete proof that the combination of the TGT approach with the Snakes and Ladders game is successful in improving students' critical reasoning abilities in algebra.

The considerable effect size (Cohen's $d = 11.048$) strengthens the conclusion that the enhancement in critical thinking abilities seen in the experimental group was not simply an anomaly in the data but was truly affected by the intervention implemented. These results suggest that the Teams Games Tournament (TGT) cooperative learning framework, which utilizes the Snakes and Ladders game, is not only statistically significant but also significantly influences mathematics education in practice.

From an academic perspective, this research adds to the advancement of mathematics education, especially in initiatives aimed at enhancing critical thinking abilities among junior high school learners. The combination of collaborative

learning strategies with educational games has shown significant success in fostering engaging, fun, and student-focused learning environments. Consequently, the Teams Games Tournament (TGT) teaching model, which is founded on the Snakes and Ladders game, may act as a beneficial alternative strategy for improving students' critical thinking capabilities in algebra.

CONCLUSION

Based on the study performed with seventh-grade pupils at SMP Pahlawan Nasional, it can be determined that implementing the Teams Games Tournament (TGT) collaborative learning approach with snakes and ladders as a medium has a notable impact on the algebraic critical thinking abilities of junior high school learners. This indicates that implementing the TGT model alongside snakes and ladders is superior to traditional education methods in enhancing students' critical thinking abilities.

The influence of the Teams Games Tournament (TGT) cooperative learning approach that utilizes snakes and ladders media on enhancing students' critical thinking abilities is categorized as having a very large effect according to the analysis of effect size. This shows that using the TGT model along with snakes and ladders media really helps improve students' critical thinking skills by encouraging active, collaborative, and student-focused learning activities.

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