

# Team Quiz Learning Model: Improving Elementary School Students' Mathematical Cognitive Learning Outcomes

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## ABSTRACT

This study aims to examine the effect of the Team Quiz learning model on improving fourth-grade students' mathematical cognitive learning outcomes in flat shape material at SD Inpres 55 Ambon. Using a quasi-experimental one-group pretest-posttest design, data were analyzed through the Wilcoxon non-parametric test due to non-normal and non-homogeneous distributions. The results yielded a significance value of  $0.000 < 0.05$ , indicating a significant difference before and after the implementation. N-Gain analysis showed high improvement for 2 students (0.71), moderate for 16 students (0.42), and low for 3 students (0.25). These findings confirm that the Team Quiz model effectively enhances mathematical cognitive outcomes. The novelty of this study lies in integrating a competitive and collaborative learning approach to strengthen student engagement and motivation. The results contribute to evidence-based innovations in mathematics education, emphasizing active learning strategies that foster deeper understanding and improved academic performance.

## Introduction

Mathematics plays an essential role in everyday life because it helps individuals understand and interact with their environment more effectively. Nurmaya et al. (2021) state that mathematics is a discipline that plays an important role in human life and contributes to character building in students, because through mathematics learning, students are expected to develop knowledge and foster creative thinking skills in solving various problems.

Problems in mathematics learning tend to be complex, requiring sharp cognitive thinking so that students are able to find the right solutions. Basri (2018; Nuraeni, 2020) states that cognitive abilities are skills that emphasize brain-based thinking processes and are necessary to perform various tasks, both simple and complex. Therefore, the optimal development of mathematical cognitive thinking skills is very important to achieve maximum learning outcomes.

Based on the initial observations made by researchers, it was found that students' basic mathematical abilities still need to be improved. This condition indicates the need to apply creative learning models and use innovative learning media. In addition, teachers are also expected to utilize interactive mathematics learning applications to assist students in the learning process. This problem has an impact on the low cognitive mathematical learning outcomes of students, especially in solving problems related to flat shapes.

This problem can be overcome through the application of more creative learning methods, one of which is using the *Team Quiz* model. According to Chaudhari and Rodrigues (in Harahap & Juanti, 2023), the *Team Quiz* model is an effective learning method because it fosters cooperation in small groups, where each student plays an active role as part of a team to complete tasks, solve problems, and achieve common goals. Meanwhile, Hirama et al (2019) explain that this learning model is implemented with a system of dividing groups based on material, so that each group has the opportunity to take turns being the questioner and the answerer.

The *Team Quiz* Model is an active learning method that divides students into several groups, with each member responsible for preparing quiz questions, while other groups review their notes. Through this academic competition, positive competition between groups is created, encouraging students to learn with high motivation to achieve the best results (Silberman, 2016; Kharisma et al., 2023). In addition, this model can also increase students' potential, responsibility, and enthusiasm for learning through fun and exciting activities (Nurdiansyah et al., 2021; Izzati et al., 2024).

The *Team Quiz* learning model is expected to improve students' mathematical cognitive learning outcomes. Through optimal mastery of concepts, students can be more active in solving plane geometry problems, not only memorizing formulas, but also understanding the meaning and application of plane geometry concepts more deeply. These cognitive abilities play a role in helping students process and analyze information and deepen their understanding of mathematics.

**Method**

The type of research used was a *pre-experimental design* with a *one-group pretest-posttest* type. (Jannah et al., 2022) A one-group pretest-posttest design was research that only involves one class, beginning with a pretest, followed by treatment, and then a posttest. Figure 1 presents the research design (Creswell & Creswell, 2018).

Group A: O<sub>1</sub> -----X-----O<sub>2</sub>

Figure 1 One Group Pretest-Posttest Design

The research sample involved 21 fourth-grade students. The research instrument was a cognitive learning achievement test. The test was compiled in essay form, then tested for validity and reliability before use. In addition, student observation sheets were used to assess student activity during learning, and teacher observation sheets were used to observe the implementation of the *Team Quiz* model. Inferential analysis was performed using the Wilcoxon test because the data were not normally distributed. This test was used to determine the significant difference between the pretest and posttest scores. If the significance value (p-value) was  $< 0.05$ , then there was a significant effect of the *Quiz Team* model on improving students' cognitive learning outcomes in mathematics. Furthermore, to analyze the improvement in students' cognitive learning outcomes, *N-gain* was used with the formula (Sitania et al., 2022; Reniwuryaan et al., 2022).

$$(g) = \frac{\%(\text{pretest}) \%(\text{posttest})}{100 - \%(\text{Pretest})}$$

The N-gain value was used to interpret the level of improvement in learning outcomes, where  $g > 0.70$  is categorized as high,  $0.30 \leq g \leq 0.70$  is categorized as moderate, and  $g < 0.30$  is categorized as low (Hake in Meltzer, 2020; Pattimukay et al., 2019). The higher the N-gain value, the more effective the learning applied.

**Results and Discussion**

In this study, students were tested using plane geometry test questions to assess their mathematical cognitive learning outcomes. Table 1 presents the descriptive statistics and measurement parameters.

Table 1 Descriptive Statistics

	N	Mean	Maximum Score	Minimum Score	Standard Deviation
Pre-test	21	50.23	70	35	11.23
Posttest	21	71.52	85.00	55	9.93

Based on Table 1, it is known that 21 students took the pretest and posttest. The average pretest score of 50.23 increased to 71.52 on the posttest, indicating an improvement in learning outcomes after the implementation of the *Team Quiz* learning model. The minimum

score also increased from 35.00 to 55.00, while the maximum score rose from 70.00 to 85.00. The standard deviation decreased from 11.23 to 9.93, indicating that the students' abilities after learning became more evenly distributed. Overall, these results describe that descriptively, the *Team Quiz* model has a positive effect on improving students' mathematical cognitive learning outcomes.

Next, to analyze whether there is an effect of the *Team Quiz* learning model on improving students' mathematical cognitive learning outcomes, a preliminary test of data normality and homogeneity was conducted. Table 3 presents the results of these tests.

Table 2. Normality and Homogeneity Tests of Students' Cognitive Learning Outcomes

Normality Test	Sig.	
	Pretest	Posttest
Kolmogorov Smirnov	0.008	0.018
Decision	Not Normal	
Homogeneity Test		Pre-test-Post-test
Levene's Test		0.914
Decision	Homogeneous	

Based on the results of the analysis in Table 2, it is known that the normality test using the Kolmogorov-Smirnov test shows that the data is not normally distributed, because the significance value of the pretest is  $0.008 < 0.05$  and the posttest is  $0.018 < 0.05$ . However, the Levene test results show that the data is homogeneous with a significance value of  $0.914 > 0.05$ . Based on these results, the analysis cannot be continued using parametric tests, so the non-parametric Wilcoxon Test is used. Before conducting the Wilcoxon test, the following research hypotheses are established:

$H_0$  : There is no difference in students' mathematical cognitive learning outcomes before and after the implementation of the *Team Quiz* learning model

$H_1$ : There is a difference in students' mathematical cognitive learning outcomes before and after the implementation of the *Team Quiz* learning model.

The Wilcoxon test results show that the significance value  $\text{Sig} < \alpha = 0.05$ , so  $H_0$  is rejected and  $H_1$  is accepted, which means that there is a difference in students' mathematical cognitive learning outcomes before and after the application of the *Team Quiz* learning model. This indicates that the *Team Quiz* learning model has an effect on improving students' mathematical cognitive learning outcomes.

To determine the level of improvement in learning outcomes quantitatively, an N-gain analysis was then conducted as presented in Table 3.

Table 3 Improvement in Students' Mathematical Cognitive Learning Outcomes

Improvement Category	Parameter		
	Frequency	Average N-gain $\langle g \rangle$	Average Percentage N-gain $\langle g \rangle$
High	2	0.71	71
Medium	16	0.42	42
Low	3	0.25	25

Based on the results of the N-gain analysis in Table 3, the increase in students' mathematical cognitive learning outcomes showed variation in each category. A total of 2 students (9.5%) were in the high category with an average N-gain of 0.71 or an equivalent increase of 71%. Most students, namely 16 students (76.2%), were in the moderate category with an average N-gain of 0.42 or an increase of 42%. Meanwhile, 3 students (14.3%) were classified in the low category with an average N-gain of 0.25 or 25%. Overall, these results indicate that the application of the *Team Quiz* learning model was able to improve students' cognitive mathematical learning outcomes in the moderate category.

The improvement in students' mathematical cognitive learning outcomes was due to the effectiveness of the *Team Quiz* learning model. The *Team Quiz* learning model emphasizes collaboration through group work, where the material is divided into several sub-topics and each team is responsible for compiling quizzes with short answers while the other teams use the time to review and study their notes (Riang Tati et al., 2024). Through group interaction, students learn to work together, share ideas, and help their teammates, thereby developing their social and collaborative skills (Marcella et al., 2018; Amalia et al., 2024). The main objective of implementing this model is to increase student activity in understanding material concepts and strengthen their mathematical cognitive thinking skills.

In practice, *Team Quiz* actively involves students through quizzes or academic competitions between groups. During these activities, students discuss and work together to solve plane geometry problems, encouraging them to express and develop mathematical ideas, making learning more interactive and enjoyable (Risda et al., 2024).

Dalvi revealed that the *Team Quiz* learning model is a model that can encourage students to be more active in the learning process through question and answer activities that take place in an exciting and fun atmosphere (Herlina et al, 2023; Ummah et al., 2025). This model also helps teachers create more participatory learning, so that students can more easily remember and understand the material that has been learned (Hakim & Fahrurrozi, 2024).

Overall, the results of the study indicate that the application of the *Team Quiz* model is effective in improving the mathematical cognitive abilities of elementary school students. Through active, collaborative, and reflective learning activities, students are able to think more maturely and logically. This is in line with Barokah's (2024) view that cognitive aspects are important to develop in elementary school students because they involve mental processes that enable individuals to connect, assess, and consider events, thereby gaining a deeper understanding.

## Conclusion

Based on the results of the study, it can be concluded that the application of the *Team Quiz* learning model has a positive effect on improving students' cognitive learning outcomes in mathematics. There is a significant difference between learning outcomes before and after the application of this model in fourth-grade students at SD Inpres 55 Ambon, which shows that *Team Quiz* is effective in improving students' mathematical understanding and thinking skills.

Quantitatively, this improvement is reflected in the results of the N-gain analysis, where 2 students were in the high category with an average of 0.71 (71% improvement), 16 students were in the medium category with an average of 0.42 (42% improvement), and 3 students were in the low category with a score of 0.25 (25% increase). The application of the *Team Quiz* model also created an active, interactive, and positively competitive learning atmosphere. Through fun team activities and quizzes, students were encouraged to participate more actively, work together, and help each other in understanding concepts and solving mathematical problems.

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