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# TGT vs STAD: Comparing vocational students' performance between two cooperative learning models

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ABSTRACT

Various factors – such as low interest, motivation, and poor problem-solving skills – contribute to vocational high school students' low mathematics learning outcomes. The cooperative learning models of Teams Games Tournament (TGT) and Student Team Achievement Division (STAD) are the alternative teaching strategies proven to improve student learning outcomes. This study aims to compare the effects of the two models on the mathematics learning outcomes of eleventh-grade students at SMK Negeri 1 Salam – a vocational high school in Indonesia. The research uses a quantitative approach with a true experimental design of the posttest-only control group design type. We randomly selected two classes from a homogeneous population, which applied the TGT model to one class and the STAD model to the other. They used a learning outcome test that experts had validated and tested for reliability. Data were analyzed using the independent sample t-test and one-tailed test. The research results show a significant difference in the influence between the TGT and STAD models on mathematics learning outcomes, with the average score of the TGT group being higher (78.57) compared to the STAD group (74.11). One-tailed tests show that the TGT model has a significantly greater impact than STAD. Thus, the TGT model is considered more effective in improving the mathematics learning outcomes of vocational school students because it can create a competitive, enjoyable learning atmosphere and encourage active student participation.

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## Introduction

The mathematics learning outcomes of students in vocational high schools remain a serious challenge in education. Various studies show that students at vocational high schools often achieve low mathematics learning outcomes not only because they lack cognitive ability but also due to limited interest, motivation, and problem-solving skills. Hidayat et al. (2022) emphasize that vocational high school students' low mathematical problem-solving abilities occur due to weak

skills in planning and evaluating solution strategies, making it difficult for students to apply mathematical concepts in the context of word problems.

Additionally, Noviawan et al. (2022) identified that students lose interest in learning mathematics because they do not enjoy the subject, pay little attention in class, and feel disconnected from the material and the teacher's teaching method. About 71.35% of respondents stated that they are not interested in studying mathematics because they find it difficult and are not interested in the subject. Ferdiansyah et al. (2025) also observed a similar condition and emphasized that students' lack of interest in math tasks and materials significantly contributes to low mathematics learning outcomes in vocational schools.

Sari et al. (2023) also revealed that internal factors—such as students' lack of interest and motivation—and external factors—such as monotonous teaching methods and an unsupportive learning environment—make it difficult for vocational high school students to learn mathematics. Students' negative perception of mathematics as an unenjoyable and challenging subject worsens these difficulties. These findings indicate that improving mathematics learning outcomes in vocational schools requires a comprehensive intervention in teaching strategies that can enhance student engagement and approaches that stimulate students' interest and confidence.

One of the approaches deemed effective is the implementation of the Teams Games Tournament (TGT) cooperative learning model, which combines teamwork with academic competition. Chairhany (2020) reported that the implementation of the TGT model significantly increased student motivation and learning outcomes. The student's mastery of mathematics rose from 13.33% to 100% after two implementation cycles. A similar finding was also noted by Bahri and Rifai (2020), who recorded an average learning outcome increase from 78.34 to 87.66, with classical completeness reaching 89.05%.

Furthermore, Anggraeni (2019) notes that the TGT model not only improves learning outcomes but also fosters student motivation and a competitive spirit in a pleasant learning atmosphere. By actively involving students through team discussions and academic tournaments, TGT encourages full student engagement in the learning process, in line with the demands of 21st-century learning.

In addition to TGT, the cooperative learning model known as Student Team Achievement Division (STAD) is widely applied to improve mathematics learning outcomes. The STAD model emphasizes cooperation in heterogeneous groups, where each member has the responsibility to help other members achieve learning completeness. Amelia (2020) showed that the implementation of STAD increased the average learning outcomes from 67.59 to 80.56, with completeness rising from 62% to 85%. Research by Rofi (2021) also noted a significant increase in student active participation and concept understanding after the implementation of STAD.

The STAD model impacts cognitive aspects and strengthens learning motivation and social engagement. Nurhanifah (2024) and Adhia (2015) reports that the STAD approach consistently enhances students' learning enthusiasm and collaboration. Thus, STAD is a strategic alternative that improves learning outcomes and develops students' social skills and responsibility. Cooperative learning models such as Teams Games Tournament (TGT) and Student Teams Achievement Division (STAD) have a similar basic structure: group work in heterogeneous teams to achieve common academic goals. However, both have essential differences in evaluation approaches and learning dynamics.

The STAD model is more straightforward and systematic: the teacher delivers the material, and students work in groups, followed by individual quizzes and progress scoring as the basis for team rewards. This approach suits teachers new to implementing cooperative learning because it


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provides a clear structure and supports collaborative interaction among students (Asih & Prihatnani, 2021; Wahartojo, 2016). Moreover, research by Purwaningrum et al. (2016) shows that the STAD model has a significant impact on mathematics learning outcomes and is more effective than the TPS strategy when combined with heterogeneous mapping of students' initial abilities.

On the other hand, the TGT model combines competitive elements through a tournament format, which aims to boost learning enthusiasm, enhance individual responsibility, and create an enjoyable learning atmosphere. Academic game activities in TGT provide space for students to learn while playing in a structured manner. Setiyani and Suhendri (2017) suggest that TGT can significantly enhance students' creative thinking abilities, mainly because its mechanism encourages students to actively discuss, compete healthily, and build self-confidence within groups. According to Aqshal et al. (2022), their meta-analysis on various cooperative learning models in vocational high schools indicates that the TGT model falls into the high-effect-size category. This finding suggests that TGT consistently improves learning outcomes, particularly in subjects emphasizing practical skills and conceptual understanding.

The main difference between the TGT and STAD models is the evaluation method used. The STAD model relies on individual quizzes as an evaluation tool after group activities, while the TGT model utilizes competitive academic tournaments. The competitive element in TGT creates a more interactive and enjoyable learning atmosphere, while STAD offers a more systematic approach focusing on individual evaluation within the team. Several studies show that classroom dynamics greatly influence the effectiveness of each model, students' anxiety levels and the teacher's role as a facilitator (Asih & Prihatnani, 2021; Rizky et al., 2024; Wahartojo et al., 2016). A pleasant learning atmosphere in TGT can enhance student engagement, although both models did not show significant differences at all anxiety levels. Therefore, selecting a learning model should consider academic effectiveness and adapt to the characteristics of the students and the classroom context.

The problem of low mathematics learning outcomes among students in vocational high schools, particularly in geometry topics such as circles, serves as an important backdrop for evaluating the effectiveness of learning models. Although researchers have demonstrated that both models improve learning outcomes, very few studies directly compare them in the context of vocational high school mathematics learning.

Therefore, this study aims to analyze the differences in the effects between the TGT and STAD cooperative learning models on the mathematics learning outcomes of XI grade students at SMK 1 Salam. In addition, this study also aims to assess the extent to which the TGT model has a greater impact compared to STAD in improving learning outcomes as a basis for developing more targeted learning strategies in the context of vocational education.

This research compares two popular cooperative learning models, TGT and STAD, using experimental quantitative data and analyzing their effects on cognitive learning outcomes in circles. This research uses a truly experimental approach with a posttest-only control group design to provide empirical contributions to the development of mathematics pedagogy in vocational high schools.

## Method

This research uses a quantitative approach with a proper experiment type (Mertens, 2015; Muijs, 2004), as it involves two experimental groups randomly selected from a homogeneous population. This study uses a posttest-only control group design, where researchers measure outcomes only after delivering the treatment to each group.

The researchers conducted the study in the even semester of the 2023/2024 academic year at SMK Negeri 1 Salam. The population included all students from the XI APHP program, which consisted of four classes: XI APHP 1, XI APHP 2, XI APHP 3, and XI APHP 4. To ensure the equivalence of initial abilities, the researcher first collected daily test scores and conducted a homogeneity test, which showed that the population was homogeneous.

The sample was selected using the simple random sampling technique sampling (Golzar & Noor, 2022; Olken, 1993; Singh & Masuku, 2014) because each class had an equal chance of being selected. Based on the draw, class XI APHP 1 was designated as experiment group 1 (TGT model treatment) and class XI APHP 3 as experiment group 2 (STAD model treatment).

The researchers prepared the learning devices according to the syntax of each model and conducted the learning process in several sessions, following the school's math class schedule. The researchers observed the implementation during the process to ensure it followed the correct procedure.

After the treatment, both groups took a learning outcome test using essay questions. Experts validated the instrument, and the researchers tested its reliability using the Cronbach Alpha formula, which produced a coefficient of 0.602, which is considered sufficient. The researchers used these test results as the primary data to analyze the influence of the learning model.

The data were statistically analyzed through normality and homogeneity tests to ensure the fulfillment of parametric analysis assumptions. Next, the researcher used an independent sample t-test to determine the difference in the effects between the TGT and STAD models on mathematics learning outcomes and to evaluate whether the TGT model has a significantly greater impact than the STAD model.

## Results and discussion

This study aims to compare the effects of the Team Game Tournament (TGT) and Student Team Achievement Division (STAD) cooperative learning models on the mathematics learning outcomes of vocational high school students. After the treatment, the researchers recorded an average score of 78.57 for the TGT group and 74.11 for the STAD group in mathematics learning outcomes.

Figure 1 visually compares students' learning outcomes between the TGT and STAD groups.

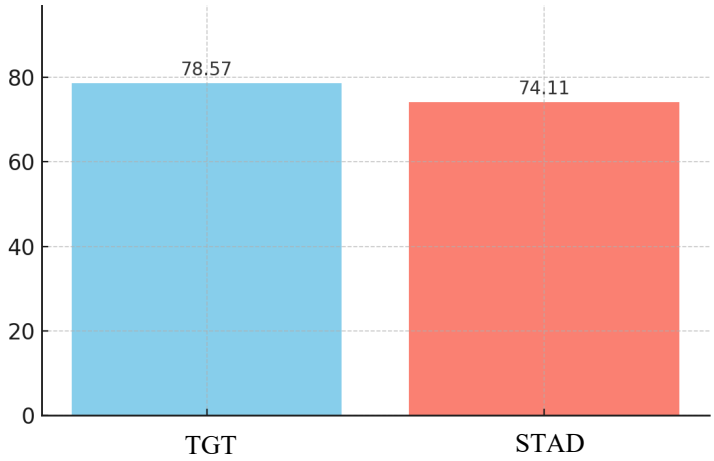


**Figure 1**. Learning outcomes after the experiment


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The researchers conducted hypothesis testing to address two research objectives. The first hypothesis examines the differences in the effects of the two learning models.

- $H_{01}$: There is no difference in the effect between the TGT and the STAD model on mathematics learning outcomes.
- $H_{11}$: There is a difference in the effect between the TGT and the STAD model on mathematics learning outcomes.

The results of the independent sample t-test show a significance value of p = 0.015. Because p < 0.05, The researchers rejected $H_{01}$ and accepted $H_{11}$, indicating a significant difference between the two learning models in influencing learning outcomes.

The researchers conducted a one-tailed t-test to evaluate the relative superiority of the TGT model using the following hypothesis:

- $H_{02}$: The TGT model is not more influential than STAD on mathematics learning outcomes.
- $H_{12}$: The TGT model has a greater influence than STAD on mathematics learning outcomes.

The researchers found that the TGT group scored significantly higher than the STAD group, with a one-tailed significance level below 0.05. Based on this result, they rejected $H_{02}$ and accepted $H_{12}$.

The research results show that the TGT-type cooperative learning model is more effective than STAD in improving students' mathematics learning outcomes. The researchers demonstrated the TGT model's effectiveness by showing that the TGT group achieved a higher average score (78.57) than the STAD group (74.11). Statistical test results confirmed this difference as significant at the 5% level. These findings indicate that the TGT approach has a more substantial impact on optimizing students' academic achievements.

The TGT model benefits from the competitive elements built into the academic tournament mechanism. Setiyani and Suhendri (2017) shows that TGT can enhance creative thinking skills and actively engage students in mathematics learning, particularly due to its more enjoyable learning activities and the encouragement of individual responsibility. Aqshal et al. (2022) also noted that the effectiveness of TGT falls into the high category based on the results of a meta-analysis of various cooperative learning models applied in vocational high schools.

Meanwhile, the STAD model effectively improves learning outcomes, albeit with a more moderate impact. This moderate effectiveness aligns with the findings of Amelia (2020) and Rofiah (2021) who showed that STAD enhances learning outcomes through teamwork and individual quiz mechanisms. In addition to cognitive aspects, the STAD approach contributes to developing social skills and collective responsibility within groups (Nurhanifah et al., 2024).

However, when compared directly, TGT offers additional advantages through mechanisms of healthy competition and tournaments as evaluation tools that can enhance students' learning motivation (Rizky et al., 2024). The interactive learning atmosphere in the TGT model plays a key role in its effectiveness. Asih and Prihatnani (2021) emphasize that the learning model's success depends on the teacher's role and students' comfort in the cooperative classroom.

Thus, the results of this study reinforce the conclusion that the selection of a learning model must consider not only the structure of cooperative learning but also an evaluative approach that aligns with the characteristics of the learners. In the context of vocational schools, where students prefer practical and competitive activities, the TGT model seems more capable of significantly improving learning outcomes.

## Conclusion

Based on the analysis and discussion results, the cooperative learning models of Team Game Tournaments (TGT) and Student Team Achievement Division (STAD) affect students' mathematics learning outcomes differently. There is a significant difference in the impact between the two models, where the TGT model shows a greater influence than STAD.

The TGT model is more effective in improving students' mathematics learning outcomes because it can create a competitive, enjoyable learning atmosphere and encourage active participation. These findings underscore the importance of selecting teaching strategies that align with the characteristics of vocational school students, particularly to enhance motivation and academic achievement in mathematics subjects.

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