

## **The Effectiveness of the GASING-Based Teams Games Tournament (TGT) Model in Enhancing Elementary Students' Mathematical Conceptual Understanding**

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### **Article Info**

### **ABSTRACT**

#### **Keywords:**

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This study aims to examine the effectiveness of the Teams Games Tournament (TGT) learning model integrated with the GASING method in improving elementary school students' mathematical conceptual understanding. A quantitative approach was employed using a quasi-experimental design with a pretest–posttest control group structure. The population consisted of all fourth-grade elementary school students, with a sample of 60 students divided into an experimental group and a control group. The instrument used was an essay-based test designed to measure students' conceptual understanding in mathematics. Data were analyzed through normality and homogeneity tests, followed by an independent sample t-test and N-Gain analysis. The findings reveal a statistically significant difference between students taught using the GASING-based TGT model and those taught through conventional instruction, with a significance value of  $0.000 < 0.05$ . In addition, the experimental group achieved a high level of improvement (N-Gain = 0.73), while the control group showed a moderate increase (N-Gain = 0.41). These results suggest that the integration of the TGT model with the GASING method is effective in enhancing students' conceptual understanding in mathematics. The study also highlights the potential of this approach as an innovative alternative that promotes more interactive, engaging, and meaningful learning aligned with the demands of 21st-century education.

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### **INTRODUCTION**

Mathematical conceptual understanding is widely recognized as a core component of mathematics learning at the elementary level. When students truly understand a concept, they are able to connect new knowledge with prior understanding, articulate mathematical ideas logically, and solve problems in flexible and meaningful ways (NCTM, 2018; Kholid et al., 2021). In the context of 21st-century education, this ability serves as a foundation for higher-order thinking skills, including critical thinking, creativity, and problem-solving (OECD, 2019; Utami et al., 2021). At the same time, research consistently shows that students' conceptual understanding is strongly shaped by the quality of instructional practices in the classroom (Hafidzah et al., 2021; Nasution, 2020).

Despite its importance, classroom realities often tell a different story. Many elementary students still struggle to grasp fundamental mathematical concepts. It is quite common to find students who can carry out procedures correctly yet fail to explain the meaning behind the operations or symbols they use (Sari & Hidayat, 2019). Supporting this, Yuliana and Kartini (2021) found that more than half of the students were unable to solve problems requiring conceptual

understanding. Zainal Azis (2019) further notes that this issue is closely linked to limited student engagement during the learning process.

One contributing factor appears to be the continued reliance on conventional, teacher-centered approaches, where students tend to play a passive role (Nizaruddin et al., 2022; Stephan, 2020). Under such conditions, learning often becomes procedural rather than meaningful. In contrast, effective mathematics instruction should engage students cognitively, affectively, and socially in a balanced way (OECD, 2019). Harahap (2017) emphasizes that contextual and activity-based learning models can significantly enhance students' conceptual understanding.

As an alternative, cooperative learning models such as Teams Games Tournament (TGT) have been widely implemented to increase student engagement. TGT encourages collaboration, healthy competition, and motivation through structured educational games (Slavin, 2019; Karina et al., 2025). Meanwhile, the GASING method, introduced by Yohanes Surya, offers a different pathway by helping students understand abstract concepts through concrete, visual, and gradual approaches (Surya, 2018; Safitri et al., 2025). This aligns with findings by Rahmawati and Jamaluddin (2024), who highlight the importance of appropriate strategies and media in strengthening conceptual understanding.

Previous studies indicate that TGT can significantly improve students' mathematics achievement (Karina et al., 2025), while the GASING method has proven effective in enhancing conceptual understanding, particularly in fraction topics (Safitri et al., 2025). However, research integrating these two approaches remains limited. Most studies tend to focus on each method separately, without exploring the potential synergy between them (Asmi et al., 2022; Sumarno et al., 2025).

Given this gap, the present study aims to investigate the effectiveness of integrating the TGT model with the GASING method in improving elementary students' mathematical conceptual understanding. It is expected that the findings will contribute to the development of more interactive, engaging, and relevant mathematics learning innovations for 21st-century classrooms.

## **RESEARCH METHOD**

This study adopts a quantitative approach, specifically using a quasi-experimental research design. The structure follows a pretest–posttest control group design, which, in practice, allows for a comparison between two groups under different learning conditions. One group is exposed to the intervention, while the other continues with conventional instruction.

The experimental group received instruction through the Teams Games Tournament (TGT) model integrated with the GASING method. In contrast, the control group was taught using a more traditional, teacher-centered approach. This distinction, while seemingly straightforward, becomes important when trying to capture how different learning environments shape students' understanding.

The population of the study consisted of all fourth-grade students at a public elementary school in Medan during the 2025/2026 academic year. Rather than selecting individuals randomly, the study employed cluster random sampling, meaning intact classes were chosen as samples. Two classes were selected, IV-A and IV-B, resulting in a total of 60 students. One class was assigned as the experimental group, while the other served as the control group.

In terms of variables, the study distinguishes between an independent variable and a dependent variable. The independent variable is the instructional model, namely the GASING-based TGT approach. The dependent variable, on the other hand, is students' mathematical conceptual understanding. To avoid ambiguity, this concept is defined operationally through several indicators: students' ability to restate concepts in their own words, classify objects based on given concepts, distinguish between examples and non-examples, represent ideas in multiple forms, and apply concepts in problem-solving situations.

To measure these abilities, an essay-based test was used. This type of instrument was chosen intentionally, as it requires students not only to arrive at answers but also to explain their reasoning. The test items were developed based on the defined indicators and were first reviewed through expert judgment to ensure content validity. Following this, a pilot test was conducted to examine empirical validity, reliability, item difficulty, and discrimination power. The results indicated that the instrument met the necessary criteria and was suitable for use in the study.

The research procedure unfolded in three main stages. The first was the preparation phase, which involved designing instructional materials and finalizing the research instruments. Next came the implementation phase. Both groups were given a pretest to assess their initial level of understanding. After that, the experimental group participated in learning sessions using the TGT model combined with the GASING method, while the control group continued with conventional instruction. This phase took place over four meetings. Finally, in the closing stage, both groups were given a posttest to measure any improvement in their conceptual understanding.

For data analysis, statistical procedures were carried out using appropriate software. The process began with testing assumptions, including normality using the Kolmogorov–Smirnov test and homogeneity using Levene's test. Once these conditions were satisfied, the hypothesis was tested using an independent sample t-test to determine whether there was a significant difference between the two groups. In addition, N-Gain analysis was conducted to provide a clearer picture of the extent of students' improvement after the intervention.

The hypothesis guiding this study is that there is a significant difference in mathematical conceptual understanding between students taught using the GASING-based TGT model and those taught through conventional methods.

## **RESULTS AND DISCUSSION**

### **Results**

This study set out to examine whether the integration of the Teams Games Tournament (TGT) model with the GASING method could meaningfully improve students' conceptual understanding in mathematics. To get a clearer picture, the analysis draws on both descriptive and inferential statistics based on pretest and posttest scores from the experimental and control groups.

#### **1. Descriptive Statistical Analysis**

The descriptive results of students' mathematical conceptual understanding are presented in Table 1.

Table 1. Descriptive Statistics of Students' Mathematical Conceptual Understanding

Kelompok	N	Pretest Mean	Pretest SD	Posttest Mean	Posttest SD
Experimental	30	58.3	8.2	85.4	6.7
Control	30	57.8	7.9	73.2	8.1

At first glance, both groups appear to start from almost the same point. The difference in pretest means, 58.3 for the experimental group and 57.8 for the control group, is minimal, suggesting that their initial abilities were relatively comparable. That baseline similarity matters, because it makes any later differences a bit more meaningful.

After the intervention, however, the pattern begins to shift. The experimental group shows a rather sharp increase, reaching an average score of 85.4. The control group also improves, though not as strongly, with a posttest mean of 73.2. So yes, both groups made progress, but the extent of that progress clearly differs.

## 2. Assumption Testing

Before moving into hypothesis testing, the data were first examined to ensure that key statistical assumptions were met.

The normality test, conducted using the Shapiro–Wilk method, indicated that all pretest and posttest data were normally distributed, as the significance values exceeded 0.05. In a way, this reassures us that the data behave as expected and can be analyzed further without major concerns.

Next, the homogeneity test using Levene's method produced a significance value of 0.342, which is also above 0.05. This suggests that the variances between the two groups are sufficiently similar, allowing for a fair comparison.

## 3. Hypothesis Testing

To determine whether the observed differences were statistically significant, an independent sample t-test was conducted. The results are summarized in Table 2.

Table 2. Independent Sample t-Test Results

Data	t-value	df	Sig. (2-tailed)	Conclusion
Posttest	6.347	58	0.000	H <sub>0</sub> rejected

The t-test results show a t-value of 6.347 with a significance level of 0.000. Since this value is well below the 0.05 threshold, the null hypothesis is rejected. In practical terms, this means that the difference between the experimental and control groups is statistically significant.

It is worth pausing here for a moment. A significant result like this does not just indicate difference, it suggests that the instructional approach itself may have played a meaningful role in shaping students' outcomes.

## 4. N-Gain Analysis

To better understand how much improvement actually occurred, an N-Gain analysis was carried out. The results are presented in Table 3.

Table 3. N-Gain Analysis Results

Group	N-Gain	Category
Experimental	0.73	High
Control	0.41	Moderate

The experimental group achieved an N-Gain score of 0.73, which falls into the high category. Meanwhile, the control group recorded a score of 0.41, categorized as moderate. This gap reinforces what was already hinted at in the descriptive results, the improvement in the experimental group was not only higher, but meaningfully so.

### Discussion

The findings of this study indicate that the implementation of the GASING-based Teams Games Tournament (TGT) learning model is significantly more effective in improving students' mathematical conceptual understanding compared to conventional instruction. This can be seen from the differences in posttest mean scores as well as the statistical test results, which revealed a significant difference between the two groups. In addition, the high N-Gain score achieved by the experimental group suggests that the applied learning model was able to provide optimal improvement in students' conceptual abilities.

More specifically, the improvement in students' mathematical conceptual understanding can be explained through the characteristics of the TGT model, which emphasizes social interaction, group collaboration, and healthy competition. Throughout the learning process, students were not merely passive recipients of information. Instead, they actively engaged in discussions, exchanged ideas, and solved problems collaboratively. This finding is consistent with the study conducted by Tua Halomoan Harahap (2017), which states that activity-based and socially interactive learning can significantly enhance students' conceptual understanding.

On the other hand, the GASING method contributed substantially to helping students understand abstract mathematical concepts more easily. Its concrete, visual, and gradual approach allowed students to build understanding from direct experiences toward symbolic representations. This is supported by the findings of Rahmawati and Jamaluddin (2024), who emphasized that the use of appropriate learning media and instructional strategies can deepen students' mathematical conceptual understanding. In this sense, the integration of TGT and GASING creates a complementary combination of social interaction and conceptual visualization.

Furthermore, improvements in mathematical conceptual understanding were also evident across several indicators, including the ability to restate concepts, classify objects, and apply concepts in problem-solving situations. Students in the experimental group demonstrated stronger abilities in explaining concepts logically and using multiple representations compared to those in the control group. This finding aligns with the study of Marah Doly Nasution (2020), which suggests that active learning can improve students' mathematical thinking skills more comprehensively.

The findings of this study are further supported by previous research demonstrating that the TGT model is effective in improving students' learning outcomes and conceptual understanding (Karina et al., 2025), while the GASING method has proven capable of enhancing conceptual understanding through simple and enjoyable learning approaches (Lilisula, 2019). Similarly, Hafidzah et al. (2021) stated that innovative learning models can significantly improve students' mathematical abilities. Zainal Azis (2019) also emphasized that active student engagement in the

learning process contributes positively to the improvement of mathematical conceptual understanding.

The main contribution of this study lies in the integration of two instructional approaches, namely TGT and GASING, which have generally been implemented separately in previous studies. The results demonstrate that combining these approaches can create a learning environment that is not only interactive and enjoyable but also effective in strengthening students' mathematical conceptual understanding. These findings reinforce the study conducted by Wahyuni and Fitriana (2021), which concluded that integrating innovative learning approaches can simultaneously improve students' active participation and conceptual understanding.

From a theoretical perspective, the success of this model can be explained through Lev Vygotsky's (1978) social constructivist theory, which emphasizes that effective learning occurs through social interaction and environmental support. The GASING-based TGT model provides opportunities for students to actively construct knowledge through discussion, exploration, and direct experience. This is also in line with the demands of 21st-century learning, which emphasize the development of collaboration, communication, and critical thinking skills (OECD, 2019).

Therefore, the findings of this study directly address the research objective, namely to demonstrate the effectiveness of the GASING-based TGT model in improving students' mathematical conceptual understanding.

## **CONCLUSION**

Based on the findings and discussion, it can be concluded that the implementation of the GASING-based Teams Games Tournament (TGT) learning model is effective in improving elementary students' mathematical conceptual understanding. This conclusion is supported by the significant difference found between the experimental and control groups through the independent sample t-test, as well as the high N-Gain score achieved by the experimental group. The integration of the TGT model with the GASING method was able to create a learning environment that was interactive, collaborative, and enjoyable, encouraging students to become more actively involved in the learning process. In addition, the GASING approach, which emphasizes concrete and gradual concept presentation, helped students develop a deeper understanding of mathematical concepts.

In light of these findings, teachers are encouraged to implement the GASING-based TGT model as an alternative approach in mathematics instruction, particularly to enhance students' conceptual understanding. Schools are also expected to support the implementation of innovative learning models by providing adequate facilities, instructional resources, and professional development opportunities for teachers. Furthermore, future researchers are recommended to expand this study by involving broader subject areas, different educational levels, and additional variables such as critical thinking, creativity, and problem-solving abilities. More comprehensive analyses are also needed to strengthen and enrich future research findings.

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