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## APPLICATION OF THE TEAM GAMES TOURNAMENT (TGT) MODEL TO IMPROVE BASIC MATHEMATICS LEARNING OUTCOMES FOR CIVIL ENGINEERING STUDENTS

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### Abstract

*Team Games Tournament (TGT) is a cooperative learning model that can improve learning outcomes in Basic Mathematics courses. This study aims to determine the effect of the TGT learning model on the learning outcomes of Basic Mathematics students of the Civil Engineering Study Program. The research method was quasi-experimental with a nonequivalent control group pre-post research design. The research sample is 40 people. The study results show that the TGT learning model influences the learning outcomes of Basic Mathematics students of the Civil Engineering Study Program at Graha Nusantara University Padangsidempuan. Through the application of the TGT learning model, it is proven that the learning outcomes of Basic Mathematics of Civil Engineering Study Program students at Graha Nusantara University Padangsidempuan increased by 48.75% with an effectiveness percentage of 7.14%.*

**Keywords:** effectiveness; learning outcomes; Team Games Tournament (TGT); t-test

### Abstrak

*Team Games Tournament (TGT) merupakan salah satu tipe model pembelajaran kooperatif yang dapat membuat meningkatkan hasil belajar pada mata kuliah Matematika Dasar. Penelitian ini bertujuan untuk mengetahui adanya pengaruh model pembelajaran TGT terhadap hasil belajar Matematika Dasar mahasiswa Prodi Teknik Sipil. Metode penelitian yang digunakan adalah kuasi eksperimen dengan nonequivalent control group pre-post research design. Sampel penelitian berjumlah 40 orang. Hasil penelitian menunjukkan bahwa model pembelajaran TGT berpengaruh terhadap hasil belajar Matematika Dasar mahasiswa Prodi Teknik Sipil Universitas Graha Nusantara Padangsidempuan. Melalui penerapan model pembelajaran TGT terbukti bahwa hasil belajar Matematika Dasar mahasiswa Prodi Teknik Sipil Universitas Graha Nusantara Padangsidempuan meningkat sebesar 48,75% dengan persen efektivitas 7,14%.*

**Kata kunci:** efektivitas, hasil belajar, Team Games Tournament (TGT), uji-t

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## **INTRODUCTION**

Mathematics is a universal science that forms the basis for the development of modern technology, plays an essential role in many fields, and contributes to human thought. Mastering, creating, and developing future technology requires a vital mastery of mathematics from an early age, especially in the fields of number theory, algebra, probability analysis, and discrete mathematics. Students' success in mastering the subject matter of Basic Mathematics can be seen from learning Basic Mathematics. Students are said to be successful if their Basic Mathematics learning outcomes reach the Minimum Completeness Criteria (MCC) set by the University. Conversely, if the student scores below the MCC that has been set, then the student has yet to succeed in learning Basic Mathematics (Surya, 2018).

Mathematics has an essential role in developing students' knowledge, skills, attitudes, and values because it is the basis for logic or reasoning and quantitative solutions used in various other disciplines. However, students still view mathematics as a complex and frightening subject (Rahayuni et al., 2020). Following the results of initial observations and interviews with lecturers supporting the course, information was obtained that in the process of lecturing Basic Mathematics in the first semester of the Civil Engineering Study Program, Faculty of Engineering, Graha Nusantara University Padangsidempuan Academic Year 2021/2022, there were still many students who received Basic Mathematics assignment scores under the minimum completeness criteria (MCC) so that these students were declared not successful in Basic Mathematics courses.

Many factors affect the value of student assignments under the MCC, including during lectures. Students have yet to fully participate in active learning because students only listen to explanations from lecturers without actively participating, and the lack of variations in learning models used during lectures. These things cause students to become bored and quickly get bored in attending lectures, impacting students' mathematical knowledge that could be more optimal. Therefore, a learning model is needed to increase students' Basic Mathematics knowledge so that students' Basic Mathematics learning outcomes also increase.

One of the learning models that can activate students and improve learning outcomes in Basic Mathematics is the Team Games Tournament (TGT) learning model revealed by (Moningka et al., 2022) that the learning outcomes of students who were taught using the Teams Games Tournament type cooperative learning model were higher than the learning outcomes of students without using the Teams Games Tournament type cooperative learning model in the material in Algebraic Forms. It is recommended for further prospective researchers to re-examine the feasibility of using the Teams Games Tournament type cooperative learning model in another subject in mathematics.

Robert Slavin developed the TGT learning model by dividing students into small groups. This learning technique combines study groups with team competencies and will stimulate student activity because they are required to participate in completing academic assignments (Purwati et al., 2013). In Team Games Tournament (TGT), students play educational games with other team members to contribute points to their team scores. There are five main components in the Team Games Tournament (TGT): class presentation, group study, games, matches, and group awards.

The Team Games Tournament (TGT) learning model contains advantages such as the teaching and learning process taking place with student activity, educating students to practice socializing, better learning outcomes, and being able to master the material in-depth due to the creation of a pleasant learning environment (Wahyudi & Haryono, 2014). Learning activities with games designed in the Team Games Tournament (TGT) learning model allow students to learn more relaxed in addition to growing responsibility, self-confidence, respect for others, discipline, competitiveness, sportsmanship, collaboration and learning involvement of all students (Yudianto & Berman. , 2014).

The success of the Team Games Tournaments (TGT) learning model in improving learning outcomes is supported by (Arrumaisha et al., 2018), which states that the Team Games Tournaments (TGT) learning model can improve biology learning outcomes for students of class X MIPA 5 SMA Negeri 1 Kartasura by 39%. The research done by (Rohmah & Wahyudin, 2016) shows that the average N-gain of mathematical reasoning of students taught by the Team Games Tournaments (TGT) learning model is 0.7594. So that the increase in students' mathematical learning outcomes who are taught with the Team Games Tournaments (TGT) learning model is relatively high, this is the basis for researching the application of the Team Games Tournament (TGT) learning model to improve students' basic mathematics learning outcomes at the University level.

The weakness of previous research is that it is challenging to classify students with heterogeneous academic abilities. There are still high-skill students who are less accustomed and challenging to explain to other students (Nasruddin, 2019). Therefore, the lecturer acting as the controller must be careful in determining the division of the group because the time spent on student discussions is quite large so that it passes the set time. Lecturers must be able to master the class as a whole. In addition, lecturers must also be able to guide students with high academic abilities well so that they can transmit their knowledge to other students. Thus, it is necessary to conduct research entitled "Application of the Team Games Tournament (TGT) Learning Model to Improve Basic Mathematics Learning Outcomes of Civil Engineering Study Program Students." This study aims to determine the effect of the Team Games Tournament (TGT) learning model on the learning outcomes of Basic Mathematics students of the Civil Engineering Study Program

and the effectiveness of the Team Games Tournament (TGT) learning model when compared to conventional learning models. In addition, this research will prove that the Team Games Tournament (TGT) Learning Model can improve the learning outcomes of Basic Mathematics students in the Civil Engineering Study Program.

## **METHOD**

The research sample was the first semester students (one) of the Civil Engineering Study Program, Faculty of Engineering, Universitas Graha Nusantara Padangsidempuan Academic Year 2021/2022, totaling 40 students, consisting of 30 males and ten females with heterogeneous abilities. The research was conducted in September-February 2022, in Odd Semester Academic Year 2021/2022. The type of research to be carried out is a quasi-experimental research with a nonequivalent control group research design. Where in this research, there are two groups: the experimental group and the control group, each consisting of 20 students. Before being given treatment to the experimental group, the experimental group and the control group were given a pre-test, then given treatment to the experimental group by giving the Team Games Tournament (TGT) model treatment while the control group with the conventional model, each group using the Minimum Completeness Criteria (MCC) of 60. After being given the treatment, the experimental group and the control group were given a post-test to find out the results of students' Basic Mathematics learning (Dewi et al., 2019).

Data sources in this research were obtained from the evaluation test at the end of the research. Data collection uses a test technique (question) (Arrumaisha et al., 2018). The research instrument used was a test in the form of multiple choice questions, which had been tested beforehand for the validity, reliability, discriminating power, and level of difficulty of the questions (Jusmawati et al., 2020). The data obtained are from the students' pre-test and post-test results. After the implementation of the research, data were obtained to be processed and analyzed. Data processing is carried out using computer software, Statistical Product and Service Solution (SPSS) version 21.0 for Windows. The pre-test and post-test data were statistically processed with the following steps: 1) Calculating the normalized N-gain to determine the increase in the pre-test and post-test scores of the two groups; 2) Testing normality to determine whether the data distribution is normally distributed or not; 3) Testing the homogeneity of variance to find out whether the variances of the two groups are the same or not; 4) Test the hypothesis using the t-test if the data obtained are normally distributed and use the Mann-Whitney test if the data obtained are not normally distributed (Rohmah & Wahyudin, 2016); 5) Then calculate the effectiveness of the Team Games Tournament (TGT) learning model when compared with conventional learning model (Rahayu et al., 2019).

## RESULTS AND DISCUSSION

### Learning Outcomes of Basic Mathematics Before Implementing the Team Games Tournament (TGT) Learning Model

Learning Outcomes of Basic Mathematics Before Implementing the Team Games Tournament (TGT) Learning Model Implementation of the pre-test aims to see the initial ability of students to understand the material being taught. Based on the data on Basic Mathematics learning outcomes in general, the average value of the Basic Mathematics pre-test in the experimental and control groups was not much different. The experimental group had an average score of 80, and the control group was 78.25. Mathematically, the difference in the mean value of the Basic Mathematics pre-test of the two groups is 1.75. After implementing the pre-test, it was found that 19 students (95%) each from the control group and the experimental group succeeded in learning Basic Mathematics. Meanwhile, one student (5%) from each control group and the experimental group has yet to succeed in learning mathematics.

Based on the results of calculations using statistical tests using computer software, namely Statistical Product and Service Solution (SPSS) version 21.0 for Windows, it is known that the results of the Basic Mathematics pre-test of the control group and the experimental group are normally distributed and have homogeneous variance. In detail, the results of the normality and homogeneity tests of the pre-test data are presented in Tables 1 and 2 below:

**Table 1. Normality Test On Pre-test Data**

Group	$X^2_{table}$	$X^2_{count}$	$\alpha$	Conclusion
Control	7.815	0.4522	0.05	Normal
Experimental	7.815	2.2447	0.05	Normal

**Table 2. Homogeneity Test On Pre-test Data**

Activity	$F_{count}$	$F_{left\ table}$	$F_{right\ table}$	$\alpha$	Conclusion
Pre-test	1.1056	0.3995	2.503	0.05	Homogeneous

### Learning Outcomes of Basic Mathematics After Implementing the Team Games Tournament (TGT) Learning Model

Basic Mathematics Learning Outcomes After Implementing the Team Games Tournament (TGT) Learning Model At the pre-test data analysis stage, it was found that the results of learning Basic Mathematics in the control group and the experimental group were the same. Post-test was conducted to see the level of understanding of students' mathematical concepts after learning took place (Rohmah & Wahyudin, 2016). In addition, the post-test also aims to see the improvement in learning outcomes of Basic Mathematics students of the Civil Engineering Study Program, Universitas Graha Nusantara Padangsidimpuan. Based on the data on Basic Mathematics learning outcomes in general, the average post-test scores for Basic Mathematics in the

experimental and control groups were not much different. The experimental group had an average score of 89.75, and the control group was 88.75. Mathematically, the difference between the two groups' average post-test scores for Basic Mathematics is 1. After the post-test, the results showed that all students (100%) from the control group and the experimental group were successful in learning Basic Mathematics.

Based on the results of calculations using statistical tests using computer software, namely Statistical Product and Service Solution (SPSS) version 21.0 for Windows, it is known that the results of the Basic Mathematics post-test of the control group and the experimental group are normally distributed and have homogeneous variances. In detail, the results of the post-test data normality and homogeneity tests are presented in Tables 3 and 4, respectively:

**Table 3. Normality Test On Post-test Data**

Group	$X^2_{table}$	$X^2_{count}$	$\alpha$	Conclusion
Control	3.841	0.1838	0.05	Normal
Experimental	3.841	0.9171	0.05	Normal

**Table 4. Homogeneity Test On Post-test Data**

Activity	$F_{count}$	$F_{left\ table}$	$F_{right\ table}$	$\alpha$	Conclusion
Post-test	0.9383	0.3479	2.874	0.05	Homogeneous

### Gain Analysis of Basic Mathematics Learning Outcomes

The analysis of the improvement in learning outcomes of Basic Mathematics in the control and experimental groups was carried out by analyzing the N-gain data. Based on the calculations, the control group's average N-gain was 0.4828, and the experimental group's average N-gain was 0.4875. So, according to the N-gain criteria, the quality of learning outcomes for students in the control and experimental groups is at a moderate level. Mathematically, the N-gain of the two groups was not significantly different, and the difference was 0.0047. The results of the N-gain analysis are presented in Table 5 below:

**Table 5. N-gain Analysis**

Group	$\bar{X}_1$	$\bar{X}_0$	$\bar{X}_m$	G
Control	88.75	78.25	100	0.4828
Experimental	89.75	80	100	0.4875

### Analysis of the Influence of the Team Games Tournament (TGT) Learning Model on Basic Mathematics Learning Outcomes

Because the data from the pre-test and post-test results of learning Basic Mathematics in the control and experimental groups are normally distributed and have the same variance, the effect test is a parametric statistical test using a t-test. The hypothesis test is a t-test at a significance level of 5% ( $\alpha = 0.05$ ). It uses a minimum standard value ( $\mu_0$ ) = 60.00, the expected value to state that

students have mastered 60% of the learning objectives by the one-sided t-test, as stated by (Ananda and Fadhli, 2018). The formulation of the one-sided hypothesis t-test is as follows:

$H_0 : \mu = 60.00$  (Team Games Tournament (TGT) learning model does not significantly affect the learning outcomes of Basic Mathematics students of the Civil Engineering Study Program, Graha Nusantara University, Padangsidempuan).

$H_a : \mu > 60.00$  (Team Games Tournament (TGT) learning model has a significant effect on learning outcomes of Basic Mathematics students of Civil Engineering Study Program, University of Graha Nusantara Padangsidempuan). In detail, the results of the t-test is presented in Tables 6 below:

**Table 6. The Results of t-test**

Statistic test	t <sub>count</sub>	t <sub>table</sub>	$\alpha$	Conclusion
t-test	13.6882	2.093	0.05	H <sub>0</sub> is rejected H <sub>a</sub> is accepted

From the results of the t-test carried out, the value of t-count = 13.6882 and t-table = 2.093, then t-count  $\geq$  t-table, which means  $H_0$  is rejected, and  $H_a$  is accepted. So the results of the study concluded that the Team Games Tournament (TGT) learning model significantly affected the learning outcomes of Basic Mathematics students of the Civil Engineering Study Program, Universitas Graha Nusantara Padangsidempuan. By comparing the average difference between the pre-test and post-test scores of the control group and the experimental group, it was found that the percent effectiveness of the Team Games Tournament (TGT) learning model on learning outcomes in Basic Mathematics is 7.14%. In detail, the results of the percent effectiveness is presented in Table 7 below:

**Table 7. The Percent Effectiveness**

Group	$\bar{X}_d$	% E
Control	10.5	7.14
Experimental	9.75	

## Discussion

Based on the data processing of the pre-test and post-test results that have been described previously, it shows that there is an increase in learning outcomes of Basic Mathematics in students who are taught by the Team Games Tournament (TGT) learning model by 48.75%. The increase in Basic Mathematics learning outcomes with the Team Games Tournament (TGT) learning model is higher than conventional learning, which increases Basic Mathematics learning outcomes by 48.28%. Thus, the Team Games Tournament (TGT) learning model positively influences Basic Mathematics learning outcomes for students of the Civil Engineering Study Program, Universitas

Graha Nusantara Padangsidimpuan. The increase in student learning outcomes obtained above is supported by research by Arrumaisha et al. (2018: 150), which states that the Team Games Tournaments (TGT) learning model can improve biology learning outcomes for students of class X MIPA 5 SMA Negeri 1 Kartasura by 39%.

Based on the research results obtained, it can be seen that the learning outcomes of Basic Mathematics students of the Civil Engineering Study Program, Universitas Graha Nusantara Padangsidimpuan, who are taught using the Team Games Tournament (TGT) learning model are better when compared to those the learning outcomes of Basic Mathematics students of the Civil Engineering Study Program, Graha Nusantara University. Padangsidimpuan taught using conventional learning models, and this is possible because with the application of the Team Games Tournament (TGT) learning model, the teaching and learning process takes place with student activity, educating students to practice socializing, learning outcomes are better and can master the material in-depth due to the creation of a pleasant learning environment (Wahyudi and Haryono, 2014).

Based on the data obtained from the learning outcomes of Basic Mathematics students of the Civil Engineering Study Program, Universitas Graha Nusantara Padangsidimpuan, the group of students who were taught using the conventional learning model obtained an average of 78.25 with a standard deviation of 13.48 at the time of the pre-test. After the post-test was held, the group of students who were taught using the conventional learning model obtained an average of 88.75 with a standard deviation of 9.23. Meanwhile, the group of students who were taught using the Team Games Tournament (TGT) learning model obtained an average of 80 with a standard deviation of 14.18 at the time of the pre-test. After the post-test was conducted, the group of students who were taught using the Team Games Tournament (TGT) learning model obtained an average of 89.75 with a standard deviation of 8.94. From the average value, it can be seen that students who are taught using the Team Games Tournament (TGT) learning model have a higher average score than students who are only taught using conventional learning models.

Based on the one-sided t-test that has been carried out, it is found that the t-count is  $13.6882 > t\text{-table is } 2.093$ , then  $H_0$  is rejected. So that the application of the Team Games Tournament (TGT) learning model has a positive effect on the success of learning Basic Mathematics for students of the Civil Engineering Study Program, Graha Nusantara University Padangsidimpuan; this means that the Team Games Tournament (TGT) learning model significantly improves Basic Mathematics learning outcomes for students of Civil Engineering Study Program, Graha Nusantara University Padangsidimpuan. The results of Basic Mathematics learning for Civil Engineering Study Program students at Graha Nusantara University Padangsidimpuan who were taught using the Team Games Tournament (TGT) learning model



were better than Basic Mathematics for Civil Engineering Study Program students at Graha Nusantara University Padangsidempuan who were taught using conventional learning models. The difference in Basic Mathematics learning outcomes is indicated by the average difference in Basic Mathematics learning outcomes between groups of students who are taught by the Team Games Tournament (TGT) learning model and students who are taught by conventional learning models, each of 1.75 at the pre-test and 1 at the post-test.

Based on the calculation of the control group's and experimental groups' N-gain's N-gain, each obtained an average N-gain of 0.4828 and 0.4875. This means that the quality of basic mathematics learning outcomes for students in the control and experimental groups is moderate. From the results of the data analysis, the Team Games Tournament (TGT) learning model is more effectively used in learning Basic Mathematics than conventional learning models. Because the Team Games Tournament (TGT) learning model has advantages compared to conventional learning models, including the teaching and learning process takes place with student activity, educates students to practice socializing, better learning outcomes, and can master the material in-depth due to the creation of a learning environment that is conducive to learning. fun (Wahyudi and Haryono, 2014).

This study shows that the Team Games Tournament (TGT) learning model has an effectiveness percentage of 7.14% to improve basic mathematics learning outcomes for students of the Civil Engineering Study Program, Universitas Graha Nusantara Padangsidempuan. With the implementation of the Team Games Tournament (TGT) learning model, students are motivated to be more active in learning. The application of the Team Games Tournament (TGT) learning model is very suitable and effective for use at the University; this is due to the assumption that the optimization of student learning outcomes in Basic Mathematics is influenced by the learning conditions created by the lecturers in the classroom. Therefore, the class only sometimes focuses on the lecturer as the primary source of knowledge. Then lectures become the foremost learning strategies that are usually carried out in conventional classes.

The improvement in learning outcomes of students who received the Team Games Tournament (TGT) was higher when compared to students who only received conventional learning; this is because the Team Games Tournament (TGT) learning model can improve students' understanding of concepts. In addition, this learning model can improve lecturer performance, and student achievement is a tip, guide, strategy, and the entire learning process that can sharpen student memory. Thus, this learning model implements a fun and meaningful learning process (Lastia, 2021).

## CONCLUSION

Based on the research results obtained, it can be concluded that the results of the t-test hypothesis test using a significance level of 0.05 indicate that  $t\text{-count} \geq t\text{-table}$  or  $13.6882 \geq 2.093$ ; this means that  $H_0$  is rejected or  $H_a$  is accepted. So that the Team Games Tournament (TGT) learning model improves the learning outcomes of Basic Mathematics students of the Civil Engineering Study Program, Universitas Graha Nusantara Padangsidempuan, by 48.75%. The Team Games Tournament (TGT) learning model has an effectiveness percentage of 7.14% to improve Basic Mathematics learning outcomes for Civil Engineering Study Program students, Universitas Graha Nusantara Padangsidempuan. Thus, applying the Team Games Tournament (TGT) learning model is very suitable and effective for universities.

Although this research has proven that the Team Games Tournament (TGT) learning model is better used in learning when compared to conventional learning models, it needs to be studied more deeply. So, for further researchers, it is suggested to examine the factors that influence applying the Team Games Tournament (TGT) learning model with the help of electronic media in improving student learning outcomes.

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