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THE EFFECT OF TGT (Team Games Tournament) LEARNING MODEL ASSISTED BY CROSSWORD PUZZLE MEDIA FOR LEARNING OUTCOMES IN MATHEMATICS

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ABSTRACT

Learning is an important aspect of education that influences individual quality. However, the lack of variety in teaching methods often results in low student learning outcomes, especially in Mathematics subjects at SDN Kapuk 11 Pagi. This research aims to determine the effect of the TGT (Team Games Tournament) type learning model assisted by crossword media on the mathematics learning outcomes of fourth grade elementary school students. Using a quantitative method with a quasi-experimental design, the sample consisted of 60 grade IV students who were divided into experimental and control groups. Data was collected through a written test and analyzed using the Independent Sample T-test. The research results show that the application of the TGT learning model using crossword puzzles significantly improves student learning outcomes. The average score of the experimental group students was 86.00, while the control group was 64.83. The t test shows the calculated t value of 9.49 is greater than the t table value of 2.003 with an effect size of 1.47 which indicates a high influence. In conclusion, the TGT type cooperative learning model assisted by crossword puzzles is effective in improving students' mathematics learning outcomes by increasing cooperation, motivation and skills, making learning more interesting and interactive. Teachers are encouraged to use this model effectively and vary their teaching methods to improve the quality of learning.

KEYWORDS *TGT (Teams Games Tournament), Crossword Puzzle, Learning Outcomes, Mathematics Learning.*

INTRODUCTION

Learning is one of the aspects of education that influences the development of individual quality. According to Suprihati Ningrum in the Amaliyah journal (Khoirunnisa & Amaliyah, 2023), learning is an activity that involves knowledge, skills, experience, and systematically organizing the environment to facilitate student learning. The environment in this context consists of education, methods,

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media, and equipment needed to convey information. The acquisition of concepts in the educational process forms the foundation that influences learning activities.

At the cognitive and moral development stages of elementary school students, they learn through play by interacting with their peers (Endah, 2017). To ensure that cognitive development proceeds well, one effective learning model is the TGT (Team Games Tournament) model. TGT is a learning model developed by Robert Slavin that is easy to implement, involving all students without status differences, emphasizing group learning to improve student learning outcomes (Adela, 2024). The TGT learning model is unique because it concludes with an engaging game competition (Merti, 2020).

One characteristic of elementary school students is their love of games. For these students, play is a necessity that cannot be eliminated. The games used in learning must be educational. Various educational games can serve as learning tools (Daga, 2021), one of which is the Crossword Puzzle. Crossword Puzzles encourage critical thinking and teach students to collaborate (Permatasari, 2022). Crossword Puzzle is a game in which empty boxes are filled based on horizontal and vertical questions (Mawardhani et al., 2023). It contains a series of questions, and the answers are words or phrases that serve as keys to fill in the empty boxes designed in a specific pattern. Crossword Puzzles are educational media for reviewing previously taught material (Leni Diah Putri et al., 2023). This review process helps students recall the material that has been covered, thereby helping them achieve cognitive, affective, and psychomotor learning objectives (Muliastrini, 2020).

One of the subjects taught in elementary school is Mathematics. Mathematics is an essential subject as it helps solve daily life problems and serves as a tool for logical and clear thinking (Khotimah & As'ad, 2020). Mathematics as a discipline that studies patterns and structures, changes, and space (Fatqurhohman, 2016). Informally, it can also be referred to as the science of numbers and numerals. From a formalist perspective, Mathematics is the study of abstract structures defined axiomatically using symbolic logic and notation (Zainuri, 2023).

Mathematics learning outcomes represent the abilities students acquire in Mathematics through experience and practice during the teaching and learning process, reflecting their mastery of the subject, as evidenced by their Mathematics grades and problem-solving skills (Dudung, 2018).

Based on observations and interviews in a fourth-grade Mathematics class at SD Negeri Kapuk 11 Pagi, West Jakarta, the minimum competency criterion (KKM) was set at 7.5. However, many students have not yet reached this criterion, particularly in Mathematics. This is due to several issues in the learning process, including some teachers still using lecture (audio) methods to deliver material, leading to less active student participation and attention.

Given the issues mentioned above, students' low learning outcomes in Mathematics are evident. Many students' grades have declined due to these problems, despite the importance of Mathematics in education, especially in elementary school. Mathematics helps students develop critical thinking skills. Ideally, Mathematics learning should be engaging and make students feel comfortable, but many students currently perceive it as boring and intimidating (Nunung & Masri, 2020). Many students still have a negative perception of

Mathematics, viewing it as a subject that is frightening, difficult, boring, and unpleasant (Nisa et al., 2021). The key is to change students' mindset from finding Mathematics uninteresting to finding it enjoyable, so that during lessons, they remain focused and do not engage in distracting activities, thereby improving their learning outcomes (Yasin et al., 2023).

In response, the researcher attempted to integrate learning that actively involves students in the process. Students were taught to engage with one another using the TGT (Team Games Tournament) learning model, supported by Crossword Puzzle media. By using this learning approach, which includes peer tutoring, play elements, and reinforcement, the TGT model becomes highly effective in encouraging students to analyze material deeply and changing their perception of Mathematics from uninteresting to enjoyable, thus improving their learning outcomes and teaching them how to work together.

Based on the explanation above, the purpose of this study is to determine whether there is an effect of the TGT (Team Games Tournament) learning model assisted by Crossword Puzzle media on the learning outcomes of fourth-grade students in Mathematics.

RESEARCH METHODOLOGY

Research Method

This study uses a quantitative experimental method with a quasi-experimental design (Pretest-Posttest) (Sugiyono, 2023). The research involves two groups: the experimental group, which receives the TGT learning model with Crossword Puzzle media, and the control group, which does not receive this treatment. Data were collected through multiple-choice written tests and analyzed to measure the effect of the treatment (Siyoto, S., 2015).

Population and Sample

The population of this study consists of all fourth-grade students at SDN Kapuk 11 Pagi, which includes two classes (IV-A and IV-B) with a total of 60 students. The sample comprises students from class IV-A as the experimental group (30 students) and class IV-B as the control group (30 students). The sampling technique used is purposive sampling.

Research Location and Time

The study was conducted at SDN Kapuk 11 Pagi, West Jakarta, during the second semester of the 2023/2024 academic year. This location was chosen due to the existing issues with less innovative learning models, which have impacted student learning outcomes.

Research Design

The study included three sessions covering the perimeter and area of square and rectangular shapes. The TGT learning model with Crossword Puzzle media will be applied to the experimental class. Data was collected using a multiple-choice written test consisting of 30 questions. This instrument was used to measure students' Mathematics learning outcomes related to the given material.

Data Analysis Techniques

The research instrument's validity was tested using Bivariate Pearson correlation, and its reliability was assessed using the KR-20 formula. The instrument is considered valid if the calculated r-value is greater than the critical r-value, and reliable if the reliability coefficient is greater than 0.60.

Data was analyzed using quantitative analysis. A normality test will be performed using the Kolmogorov-Smirnov test, and homogeneity was tested using Levene's test. The hypothesis will be tested using an independent sample t-test with a 5% significance level. The effect of the treatment was measured using an effect size test to determine the magnitude of the treatment's impact on students' learning outcomes.

The hypothesis being tested was whether there is a significant effect of applying the TGT learning model with Crossword Puzzle media on the Mathematics learning outcomes of class IV-A students. The hypothesis is accepted if the t-value is less than 0.05, indicating that the learning model has a significant impact.

RESULTS AND DISCUSSION

Instrument Analysis

Several prerequisites in data analysis are required before conducting research:

a. The sample was taken comprehensively, consisting of 60 students. The sample in this study includes all students from class IV-A and IV-B at SDN Kapuk 11 Pagi.
b. Calculation of validity and reliability. The research instrument was derived from questions that had undergone a validity test. Out of 30 questions, 20 were found to be valid. Based on the calculations obtained, the correlation coefficient for each question item was determined. Additionally, the point-biserial coefficient was compared with the critical value (rtabel) with n = 30 at a significance level of $\alpha = 0.05$ to determine whether the questions were valid, with a critical value of 0.361 in the rtabel.

Instrument Testing Results

The instrument trial was conducted to assess the feasibility of an instrument in both the experimental and control groups. This trial aimed to evaluate the validity and reliability of the instruments used in this research. The trial was carried out at SDN Kapuk 11 Pagi, involving students from classes IV-A and IV-B, with each class consisting of 30 students, for a total of 60 students combined. The purpose of this study was to evaluate the validity and reliability of the instruments. The results of the instrument trial are described as follows:

Validity Test

The validity of the instrument was calculated using the point-biserial correlation formula. Based on the trial data, 20 out of the 30 questions were found to be valid. A question is considered valid if the calculated r-value (rhitung) is

greater than the critical value (rtabel), and invalid if the calculated r-value is less than the critical value.

Table 1. Classification of Question Items for the Mathematics Learning Outcome Instrument Trial

Classification	Number of Items	Item Numbers
Valid	**20**	1, 2, 4, 5, 8, 9, 10, 11, 12, 13, 16, 17, 18, 20, 21, 23, 26, 28, 29, 30.
Invalid	**10**	3, 6, 7, 14, 15, 19, 22, 24, 25, 27.

In this study, the experimental class used the TGT (Team Games Tournament) learning model assisted by Crossword Puzzle media and conventional control class model. The researcher used the 20 valid questions for pretest and posttest assessments in both the experimental and control classes.

Reliability Test

The reliability test in this study used the Cronbach's alpha technique with a category > 0.60. An instrument is considered reliable if Cronbach's alpha is greater than 0.60 at a significance level of 0.05 with a sample size of n = 30. Based on these calculations, the Cronbach's alpha value was 0.913, which is greater than 0.60 (0.913 > 0.60). Thus, it can be concluded that the instrument is reliable.

Description of Research Data

1. ***Description of Experimental Class Data***
   a. ***Data Hasil Pre-test***

Based on the research conducted in class IV-A at SDN Kapuk 11 Pagi, data were obtained after conducting the Pre-test. The frequency distribution data of the Mathematics learning outcomes for the experimental class (Pre-test) can be represented in the following histogram and polygon graph:

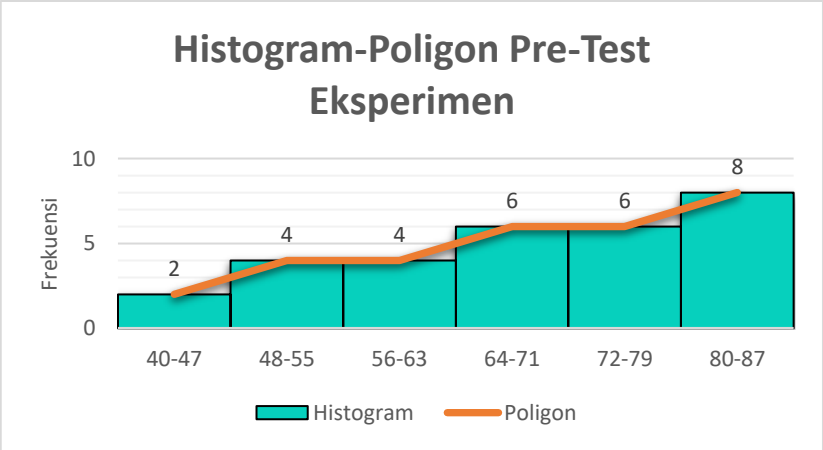

Figure 1. Histogram and Polygon Graph of Frequency Distribution of Mathematics Learning Outcomes in the Experimental Class (Pre-test)

From the Pre-test histogram and polygon graph of Mathematics learning outcomes in the experimental class above, it can be seen that students scored the lowest in the interval class of 40-47, with 2 students or 7%. Scores in the range of 48-55 were achieved by 4 students or 13%, and 56-63 by another 4 students or 13%. Six students, or 20%, scored in the 64-71 range. Six more students scored in the 72-79 range, also accounting for 20%. The highest score range, 80-87, was achieved by 8 students or 27%. From this data, it can be concluded that the interval class aimed to achieve scores between 72-79, with 6 students or 20% reaching this range. The highest and most frequent scores were in the 80-87 range, achieved by 8 students or 27%.

b. Post-test Results Data

After conducting the Post-test, data were obtained for class IV-A at SDN Kapuk 11 Pagi. The frequency distribution data of the Mathematics learning outcomes for the experimental class (Post-test) can be represented in the following histogram and polygon graph:

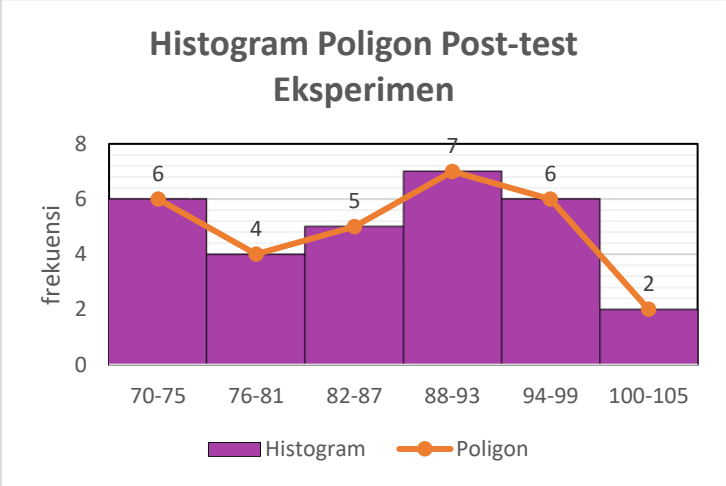

Figure 2. Histogram and Polygon Graph of Frequency Distribution of Mathematics Learning Outcomes in the Experimental Class (Post-test)

From the Post-test histogram and polygon graph of Mathematics learning outcomes in the experimental class above, it is evident that the majority of students scored in the interval class of 88-93, with 7 students or 23%. The highest score range of 100-105 was achieved by 2 students or 7%. Four students, or 13%, scored in the 76-81 range, while 5 students, or 17%, scored in the 82-87 range. Six students scored in the 94-99 range, making up 20%. The lowest scores were in the 70-75 range, achieved by 6 students or 20%.

2. Description of Control Class Data

Based on the research conducted in class IV-A at SDN Kapuk 11 Pagi, data were obtained after conducting the Pre-test. The frequency distribution data of the Mathematics learning outcomes for the control class (Pre-test) can be represented in the following histogram and polygon graph:

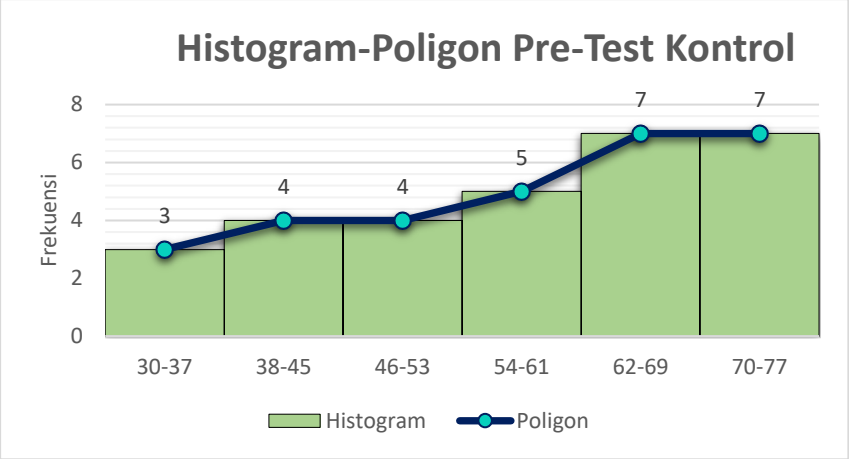

Figure 3. Histogram and Polygon Graph of Frequency Distribution of Mathematics Learning Outcomes in the Control Class (Pre-test)

From the table and histogram and polygon graph of Mathematics learning outcomes in the control class above, it can be seen that students scored the lowest in the interval class of 30-37, with 3 students or 10%. Four students, or 13%, scored in the 38-45 range, and another 4 students scored in the 54-61 range, also 13%. The most frequent scores were in the 62-69 and 70-77 ranges, with 7 students or 23% in each range.

a. Post-test Results Data

The frequency distribution data of the Mathematics learning outcomes for the control class (Post-test) can be represented in the following histogram and polygon graph:

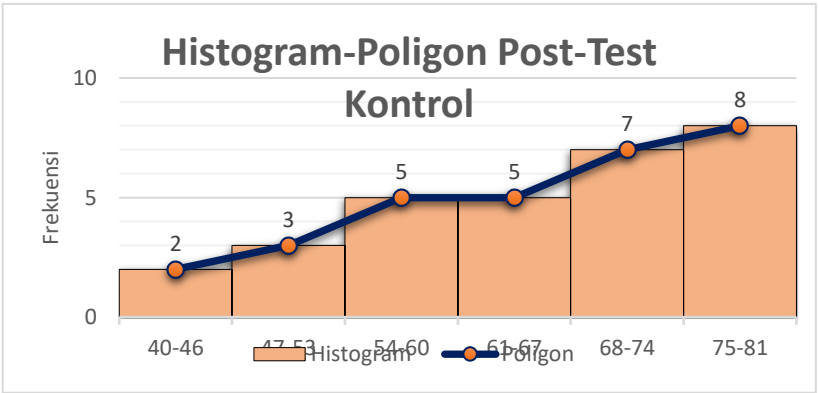

Figure 4. Histogram and Polygon Graph of Frequency Distribution of Mathematics Learning Outcomes in the Control Class (Post-test)

From the table and histogram and polygon graph of Mathematics learning outcomes in the control class above, it can be seen that the majority of students scored in the interval class of 75-81, with 8 students or 27%. The lowest scores were in the 40-46 range, achieved by 2 students or 7%.

Results of the Prerequisite Analysis Test

This study was conducted on two groups: the experimental class, referred to as class IV-A, and the control class, referred to as class IV-B. Both classes do not possess unique characteristics, so the researcher combined the data from both classes to obtain the research results. Both classes were given the same material, but the method of delivery was different. The experimental class was taught using the TGT (Team Games Tournament) learning model with the assistance of Crossword Puzzle media, while the control class was taught using a conventional method.

After obtaining the research data, a normality and homogeneity test was conducted. The prerequisites for analyzing the research results are as follows:

1. **Normality Test**

The normality test used the Kolmogorov-Smirnov test. The results of the normality test are presented in the table below:

Table 2. Normality Test Criteria

Learning Outcome	Class	Sig.	Criteria	Description
Pre-test	Experimental	0,073	Sig. > 0,05	Normal
Post-test		0,090		
Pre-test	Control	0,065		
Post-test		0,084		

Based on the results of the calculation of the normality test in the table above, from the results of learning Mathematics using the TGT *(Teams Games Tournament)* learning model assisted by *Crossword Puzzle* media in the pre-test results, Sig. values were obtained > 0.05, and in the post-test results 0.090 > 0.05 while the test in the control class obtained pretest results of 0.065 > 0.05 and post-test results of 0.84 > 0.05.

Based on the results obtained, it can be concluded that the sample is normally distributed.

2. **Homogeneity Test**

The homogeneity test, or the test for equality of population variances between the two groups, was conducted using Levene's Test. The results of the homogeneity test are shown in the table below:

Table 3. Homogeneity Test Criteria

Class	Levene Statistic	Sig.	Criteria	Description
Experimental	5,140	0,270	*Sig. > 0,05*	Homogen
Control	2,173	0,146		

From the results of the homogeneity significance test, the experimental class had a Sig. value of 0.270 > 0.05, indicating that the variable is homogeneous with a Levene statistic of 5.140. In the control class, the Sig. value was 0.146 >

0.05, indicating that the variable is homogeneous with a Levene statistic of 2.173. Therefore, it can be concluded that both data sets are homogeneous.

3. Hypothesis Test

Based on the normality and homogeneity tests, it was found that both classes are normally distributed and homogeneous. Therefore, the hypothesis testing for the study can proceed using a t-test and effect size test.

Based on the research data, the average Mathematics learning outcome using the TGT (Teams Games Tournament) model with Crossword Puzzle media was 86.00, while the average outcome was 64.83. To determine whether this difference in averages was due to the different treatments or merely by chance, further analysis was conducted.

The results of the prerequisite analysis tests, including the normality and homogeneity tests, showed that both groups are normally distributed and homogeneous. This allowed the researcher to test the hypothesis using the t-test.

Table 4. Hypothesis Test

Class	Average	t-Value	t-Table	Description
Experimental	86,00	9,49	2,003	Significant Effect
Control	64,83			

The t-test calculation in this study yielded a t-value of 9.49 at a significance level of $\alpha = 0.05$ with degrees of freedom (df) = 58, where the t-table value is 2.003. Since the t-value (9.49) is greater than the t-table value (2.003), it can be concluded that H0 is rejected.

Therefore, it can be concluded that there is a significant effect of using the TGT (Team Games Tournament) cooperative learning model with Crossword Puzzle media on the Mathematics learning outcomes of fourth-grade students at SDN Kapuk 11 Pagi in West Jakarta.

1) **Effect Size Test**

The effect size test calculation yielded the following:

$$ES = \frac{Average\ of\ Experimental\ Class - Average\ of\ Control\ Class}{standard\ deviation}$$

The ES value was 1.47. According to the interpretation classification, this effect size is considered high. Therefore, it can be concluded that this study has a high effect on Mathematics learning outcomes.

Discussion of Research Results

Based on the analysis of the data from the research titled "The Effect of the TGT (Team Games Tournament) Learning Model Assisted by Crossword Puzzle Media on Mathematics Learning Outcomes," two classes were used in this study. Class IV-A served as the experimental class, which was treated with the cooperative learning model TGT (Team Games Tournament) assisted by Crossword Puzzle media, and Class IV-B served as the control class that used a conventional method.

Before the research was conducted, validity and reliability tests were performed on the test instruments. The validity test involved 30 questions, of which

20 were deemed valid and 10 invalid. The 20 valid questions were used in the study, and a reliability test was then conducted on these questions. The reliability test yielded a Cronbach's alpha of 0.726, which is greater than the threshold of 0.60. Thus, it can be concluded that the instrument for measuring Mathematics learning outcomes on the topic of Perimeter and Area of Squares and Rectangles is reliable and suitable for use in the study.

The researcher then conducted the study at SDN Kapuk 11 Pagi in West Jakarta using two classes: Class IV-A as the experimental class, which received treatment using the TGT (Team Games Tournament) learning model assisted by Crossword Puzzle media, and Class IV-B as the control class, which did not receive this treatment.

The research data showed that the average Mathematics learning outcome in the experimental class, which used the TGT (Team Games Tournament) learning model assisted by Crossword Puzzle media, was 86.00. In contrast, the control class, which used conventional model, had an average score of 64.83. The study results indicate that using the TGT (Team Games Tournament) learning model assisted by Crossword Puzzle media positively affected students' Mathematics learning outcomes.

The hypothesis testing results showed that H0 was rejected, meaning there is an effect of using the TGT (Team Games Tournament) learning model assisted by Crossword Puzzle media on students' Mathematics learning outcomes. This finding proves that the use of the TGT learning model assisted by Crossword Puzzle media leads to better results compared to the conventional method without this model.

The research findings demonstrate that implementing the TGT (Team Games Tournament) learning model assisted by Crossword Puzzle media in Mathematics lessons in the experimental class made students more active in learning and changed the teaching style, which previously relied heavily on textbooks. As explained by (Merti, 2020), the TGT (Team Games Tournament) model is a type of cooperative learning that is easy to use, involves the participation of all students regardless of status, includes peer tutoring, and incorporates game aspects.

This approach helps students better understand and retain the material taught because the TGT (Team Games Tournament) model makes learning more engaging and interactive, reducing boredom during the lesson.

The success or failure of classroom learning is not solely dependent on the use of the TGT (Team Games Tournament) model but also on several other factors, such as the teacher's ability to manage the class, the teacher's creativity in presenting the material, the students' initial abilities, and the teacher's ability to motivate students to be more enthusiastic about learning.

The factors that contributed to the higher Mathematics learning outcomes in students taught using the TGT (Team Games Tournament) model include better comprehension and the ability to practice generating new ideas, which fosters critical thinking and encourages students to confidently express their opinions, making the learning process more enjoyable (Malau et al., 2023). In contrast, students who only used conventional model were limited to listening and completing tasks, leading to boredom, frustration, and difficulty understanding the material.

The research also confirmed that the significant effect observed with the TGT (Team Games Tournament) model assisted by Crossword Puzzle media resulted from the different treatments between the experimental and control classes. The experimental class was taught using the TGT model, while the control class was taught using conventional method. Therefore, it can be concluded that the implementation of the TGT (Team Games Tournament) model assisted by Crossword Puzzle media positively influences students' Mathematics learning outcomes. This model not only enhances learning outcomes but also fosters teamwork, communication skills, and confidence in expressing new ideas (Suardin et al., 2023).

This conclusion also indicates that the TGT (Team Games Tournament) model assisted by Crossword Puzzle media is more effective and helpful in delivering content. However, challenges in the learning process with this model include the time required and the difficulty of forming well-cooperating groups. Nevertheless, the TGT (Team Games Tournament) model assisted by Crossword Puzzle media is more effective than traditional lecture-based methods, which involve only listening and completing tasks, leading to a lack of student engagement in the learning process. Therefore, it can be concluded that one of the factors influencing learning outcomes is the positive impact of the TGT (Team Games Tournament) model assisted by Crossword Puzzle media on the Mathematics learning outcomes of fourth-grade students at SDN Kapuk 11 Pagi, West Jakarta.

CONCLUSION

Research shows that the TGT (Teams Games Tournament) learning model assisted by Crossword Puzzle media significantly improves student learning outcomes in Mathematics lessons. The average score of students who used this method was 86.00, while those who did not use this method was 64.83. The t-test produced a tcount of 9.49 which was greater than the ttable 2.003, with an effect size of 1.47, indicating a high influence.

The application of the TGT learning model with Crossword Puzzle media has a positive impact on students' Mathematics learning outcomes. This model improves student cooperation, motivation, and skills, and makes learning more engaging and interactive. Crossword Puzzle as an additional medium is effective in attracting students' interest and encouraging active participation in solving mathematical problems.

Based on the results of the research conducted, the researcher proposed several suggestions as follows: 1. Effectiveness of Model Use: Teachers should use the Crossword Puzzle-assisted TGT model effectively in accordance with the teaching materials to increase students' active participation. 2. Communication and Interaction: The importance of communication between students and between students and teachers to create a conducive and enjoyable learning environment. 3. Variety of Teaching Methods: Teachers should not only rely on material from textbooks and monotonous learning models, but use a variety of methods that suit the needs of students. 4. Next Researcher: Researchers who use this learning model

are expected to be able to create a conducive learning atmosphere and manage time well.

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