

Effectiveness of Teams Games Tournament Cooperative Learning with Wordwall Educational Games on Similarity

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ABSTRACT

This research seeks to investigate the effectiveness of integrating the TGT cooperative learning model with Wordwall-based educational games in enhancing students' conceptual understanding of similarity at SMP Abdi Agape Pontianak. A pre-experimental approach was adopted in this study, utilizing a one-group pretest-posttest design, with 28 Grade VII A students selected as the sample. The instruments consisted of tests, questionnaires, and observation sheets, generating data in the form of test results, questionnaire responses, and students' levels of engagement obtained from the observation sheets. The data were analyzed using descriptive and inferential statistical techniques. The findings indicated that the implementation of this approach was effective, as it met the predetermined effectiveness indicators, namely students' mathematics learning outcomes reached the KKTP of ≥ 65 , the classical mastery level was $\geq 75\%$, the improvement in learning outcomes was $\geq 0,3$, student responses met the positive criteria of $\geq 60\%$, and learning activities met the active criteria of $\geq 60\%$. This effectiveness is supported by hypothesis testing results where the average learning outcome was $> 64,9$, classical completeness was $> 74,9$, average learning gain was > 0.3 or moderate category, student responses rated as very positive at 81,47%, and student activity was rated as very active at 95%. This study shows that the TGT cooperative learning model assisted by Wordwall educational games is effective because it meets all indicators of learning effectiveness, including minimum mathematics learning outcomes, classical mastery, meaningful learning improvement, positive student responses, and student activity during the learning process.

ABSTRAK

Penelitian ini bertujuan untuk mengetahui efektivitas model pembelajaran kooperatif TGT berbantuan game edukasi wordwall pada materi kesebangunan di SMP Abdi Agape Pontianak. Metode pre-experimental digunakan dalam penelitian ini dengan one-group pretest-posttest design dan 28 siswa kelas VII A sebagai sampel. Instrumen berbentuk tes, angket, dan lembar observasi dengan perolehan data berupa hasil tes, respons dari angket, dan keaktifan siswa dari lembar observasi. Teknik analisis data yang digunakan yaitu statistik deskriptif dan inferensial. Hasilnya, penelitian ini efektif karena memenuhi indikator efektivitas yakni hasil belajar matematika mencapai KKTP ≥ 65 , ketuntasan klasikal $\geq 75\%$, peningkatan hasil belajar (normalized gain) $\geq 0,3$, respons siswa mencapai kriteria

positif $\geq 60\%$, dan aktivitas mencapai kriteria aktif $\geq 60\%$. Keefektifan terlihat dari hasil pengujian hipotesis yaitu diperoleh kesimpulan rata-rata hasil belajar $> 64,9$, ketuntasan klasikal $> 74,9$, rata-rata peningkatan hasil belajar $> 0,3$ atau kategori sedang, respons siswa memperoleh kriteria sangat positif sebesar $81,47\%$ dan aktivitas siswa memperoleh kriteria sangat aktif sebesar 95% . Penelitian ini menunjukkan bahwa model pembelajaran kooperatif TGT berbantuan game edukasi Wordwall efektif diterapkan, karena memenuhi seluruh indikator efektivitas pembelajaran, meliputi pencapaian hasil belajar matematika minimum, ketuntasan klasikal, peningkatan hasil belajar yang bermakna, respons siswa yang positif, serta keaktifan siswa selama proses pembelajaran.

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INTRODUCTION

The problem of low learning outcomes was found at SMP Abdi Agape, a Junior High School in Pontianak, where students learning outcomes averaged $61,57$, which was below the *KKTP* (≥ 65), and there was a lack of student activity, with only 50% participating actively in learning. The research by Telaumbanua et al. (2024) states that the factors causing low learning outcomes are the lack of variety in learning media and methods, which causes students to become bored and passive. Low learning outcomes can be overcome through the use of technology in learning. Current technological developments have a positive impact on education (Ummi et al., 2023). Students in today's digital age are very interested in the use of technology, making the use of technology in learning the right choice. Learning can be carried out through technology-based games, one of which is educational games (Sulistiyawati et al., 2021). Wordwall is an educational game that can be used to make learning fun (Aghata et al., 2024). One of the advantages of Wordwall is that it has many types of games with attractive templates (Ariyanto et al., 2023). In addition, Wordwall has various kinds of interactive quiz games (Triyani, 2023). Research by Tanthowi et al. (2023) states that there is effectiveness in learning through Wordwall media in improving learning outcomes.

The learning model is one of the factors that determines whether students are active or not and whether their scores are high or low (Widiawati & Kristin, 2025). Students can feel a positive influence when taught using an appropriate learning model. A learning model that contains game elements, is easy to implement, and encourages students to be active is the cooperative learning model (Sya'adah et al., 2023). A cooperative learning model that can be used to improve student learning outcomes and activities is the teams games tournament (TGT) (Hajar et al., 2022). TGT is a group learning model that divides students into small groups with different abilities, but all students remain involved in learning (Yundianti et al., 2025). TGT makes students active in their groups because they are asked to complete tasks together and participate in tournaments (Maulida et al., 2024). Research by Darmawati et al. (2025) indicates that the use of the Wordwall-based Teams Games Tournament (TGT) model is effective in improving both students' learning outcomes and their classroom engagement.

However, the success of such interactive learning approaches has not fully addressed broader challenges in mathematics learning. Geometry lessons taught from elementary to college levels are often considered difficult for students to understand (Ekasari et al., 2025).

Geometry is also one of the subjects considered difficult for junior high school students, especially the topic of similarity (Fadilah & Bernard, [2021](#)). In fact, similarity is a fundamental concept that plays an important role in various applications of geometry (Maulana & Hakim, [2023](#)). However, to date, many students still find the topic of similarity difficult to understand (Syawala & Auliya, [2023](#)). This condition indicates the need for efforts to provide learning models that can help students understand the material better.

Research by Yundianti et al., [2025](#) shows that the TGT learning model with wordwall media support is effective in improving student learning outcomes. Meanwhile, research by Falni et al. ([2025](#)) states that the TGT learning model with wordwall media has been proven to increase student activity. Although previous findings have shown positive results, there is still a research gap related to sample differences, effectiveness indicators, and material coverage. Based on this, the urgency of this study lies in the need to fill the research gap related to differences in samples, effectiveness indicators, and material coverage that have not been thoroughly examined previously. Previous studies generally only reviewed one or two indicators regarding learning outcomes, responses, and activities. Therefore, this study directly examines three indicators of learning outcomes, responses, and student activities in order to provide a more complete picture of effectiveness. With the limitations of comparable classes and implementation without a control class, this study focuses on determining the effectiveness of the TGT cooperative learning model assisted by Wordwall educational games on similarity material.

METHOD

The research method used was pre-experimental with a one-group pretest-posttest design. Pre-experimental is a type of research design in which the dependent variable is still potentially influenced by external factors (Sugiyono, [2024](#)). The sampling technique used was purposive sampling, which is based on certain considerations (Sartika et al., [2022](#)). The sample was taken from a class with low learning outcomes, namely class VII A, consisting of 28 students. **Table 1** shows the average scores for class VII at SMP Abdi Agape Pontianak.

Table 1. Average Scores of Class VII at SMP Abdi Agape Pontianak

Class	Average
VII A	61,57
VII B	75,97
VII C	70,87

Tests, questionnaires, and observations were used to collect data. This study utilized a learning outcome test instrument consisting of seven essay questions based on Bloom's ([1956](#)) cognitive learning levels, namely C1 to C4. The instrument was validated by three validators and tested on students one grade above the sample, namely class VIII A of SMP Abdi Agape Pontianak. The questionnaire used consisted of 24 statements and was adapted from the instrument by Emilia et al. ([2024](#)) and adjusted based on the model used, namely TGT. The activity observation sheet consisted of 22 activity items that were observed and compiled based on Slavin's ([2021](#)) theory regarding the syntax of the TGT type cooperative learning model.

Descriptive and inferential statistics were used to analyze the research data. Learning outcomes were analyzed descriptively to categorize pretest and posttest scores based on the learning objective achievement criteria (*KKTP*) of SMP Abdi Agape Pontianak, namely \geq

65 . Furthermore, to calculate classical mastery, the mastery percentage formula was used. Learning outcomes were considered classically mastered if $\geq 75\%$ s of students achieved the *KKTP*. Classical mastery was calculated using the mastery percentage formula (Arsyad et al., [2024](#)).

$$\text{Persentase ketuntasan} = \frac{\text{Jumlah siswa tuntas}}{\text{Total siswa}} \times 100$$

Furthermore, learning improvement (normalized gain) is calculated using the N-gain formula (Ladyawati & Fathonah, [2023](#)), namely:

$$N - \text{gain} = \frac{\text{posttest} - \text{pretest}}{\text{total} - \text{pretest}}$$

N-gain is categorized based on the categories in **Table 2**.

Table 2. Categorization of Learning Outcome Improvement (Ladyawati & Fathonah, [2023](#))

N-Gain Range	Improvement
$> 0,7$	High
$0,3 - 0,7$	Moderate
$< 0,3$	Low

Therefore based on **Table 2**, the criteria for achieving mastery in mathematics learning outcomes are if the mathematics learning outcomes reach the *KKTP* ≥ 65 and classical mastery $\geq 75\%$ with an increase in learning outcomes $\geq 0,3$.

Student responses were measured using a descriptive Likert scale based on four response options. The questionnaire response data was then calculated to determine the percentage of student responses to each questionnaire statement. The response data was calculated using the score percentage formula (Humaidi et al., [2022](#)) as follows:

$$PS = \frac{S}{T} \times 100\%$$

Explanation:

PS = Percentage Score

S = Score Obtained

T = Total Score (Maximum)

To determine the category of student responses for each indicator, the percentage category of student response questionnaires was used, as shown in **Table 3**.

Table 3. Response Questionnaire Percentage Categories (Midroro et al., [2021](#))

Percentage	Percentage Category
$PS \geq 80$	Very Positive
$60 \leq PS < 80$	Positive
$40 \leq PS < 60$	Moderately Positive
$20 \leq PS < 40$	Less Positive
$PS < 20$	Very Less Positive

The criteria for determining that student responses to the learning process are positive is when the percentage score reaches $\geq 60\%$ for all aspects of the responses asked.

Student activities were analyzed descriptively and measured using a Guttman scale with "Yes" and "No" options. Then, activity data was calculated to determine the percentage of activity in each aspect observed in the observation sheet. Activity data was calculated using the following percentage formula (Konitah et al., [2024](#)):

$$\text{Persentase } (x) = \frac{\text{Skor yang diperoleh}}{\text{Skor maksimal}} \times 100$$

Activities were categorized based on **Table 4**, namely the category of student activity percentage.

Table 4. Percentage Categories of Activities (Fadillah et al., 2025)

Percentage	Category
$x > 80$	Very Active
$60 < x < 80$	Active
$40 < x < 60$	Moderate
$20 < x < 40$	Less Active
$x < 20$	Very Inactive

The criteria for determining that student activity is active during learning is when the percentage score reaches $\geq 60\%$ from all aspects of activity observed.

To answer the research question, learning outcomes were analyzed inferentially using IBM SPSS Statistics 26. The data obtained were normally distributed. Furthermore, to test the comparison of means, a one-sample t-test was used because the data was normally distributed. Furthermore, a proportion test was used to determine classical mastery, namely that 75% of students had achieved mastery (Barata et al., [2023](#)). Then, a one-sample t-test was used to measure the increase in learning outcomes/normalized gain (Innawati et al., [2025](#)).

RESULTS AND DISCUSSION

The research data consisted of test results, questionnaire responses, and student activity. Before and after learning, students were given learning outcome tests, and during the learning process, student activity was observed by an observer. After learning was completed, students filled out a response questionnaire to provide feedback on the learning. The learning activities were carried out based on the TGT type cooperative learning model syntax during two meetings and with the help of the Wordwall educational game.

In the first meeting, the learning process began with the class presentation and team stages. During the class presentation stage, the teacher delivered the material on similarity using PowerPoint media. Students were given opportunities to ask questions to clarify any concepts they did not understand related to similarity. After the presentation, the lesson continued to the team stage, where students were divided into small groups consisting of four to five members. At this stage, the teacher provided practice questions to assess students' understanding of similarity and to prepare them for working on LKPD I in the form of a quiz show. The quiz was accessed via mobile phones through the Wordwall platform at <https://wordwall.net/resource/89233149>.

. During this activity, each group lined up at a table using one smartphone and took turns answering all the questions until completion. After all groups had finished the quiz, the teacher announced the group that achieved the highest score. The second meeting consisted

of the game stage, tournament stage, and team recognition. In the game stage, students remained seated in their respective groups, and the teacher distributed LKPD II in the form of an individual quiz that could be accessed via <https://wordwall.net/resource/90409290>.

. Students completed the quiz independently using their own mobile phones. Once all students had finished, the teacher determined the names of the students and their group placements based on the scores obtained in this stage. The lesson then proceeded to the tournament stage, where students were seated in groups and the teacher announced the participants and the order of the tournament. Each tournament involved one student representing each group, resulting in six students competing in one tournament. During the tournament, the “Open the Box” questions were displayed via a projector and accessed through Wordwall at <https://wordwall.net/resource/90387109>. The appearance of the “Open the Box” display is shown in **Figure 1**.



Figure 1. Initial display of Open the Box in the Tournament Stage

The boxes contain questions related to similarity. The contents of the boxes are shown in **Figure 2**.



Figure 2. Open the Box questions in the Tournament Stage

The questions were opened based on the agreement of the six students who advanced, and the student who answered was the one who raised their hand first. The tournament continued until all questions were finished, and each correct answer earned points that were added up to determine the winning group. The teacher adds up the scores obtained by the students from the tournament. Next, the teacher gives awards in the form of stationery and invites the students to give applause to the winning group, which is group six. The scores obtained in the tournament stage can be seen in **Figure 3**.

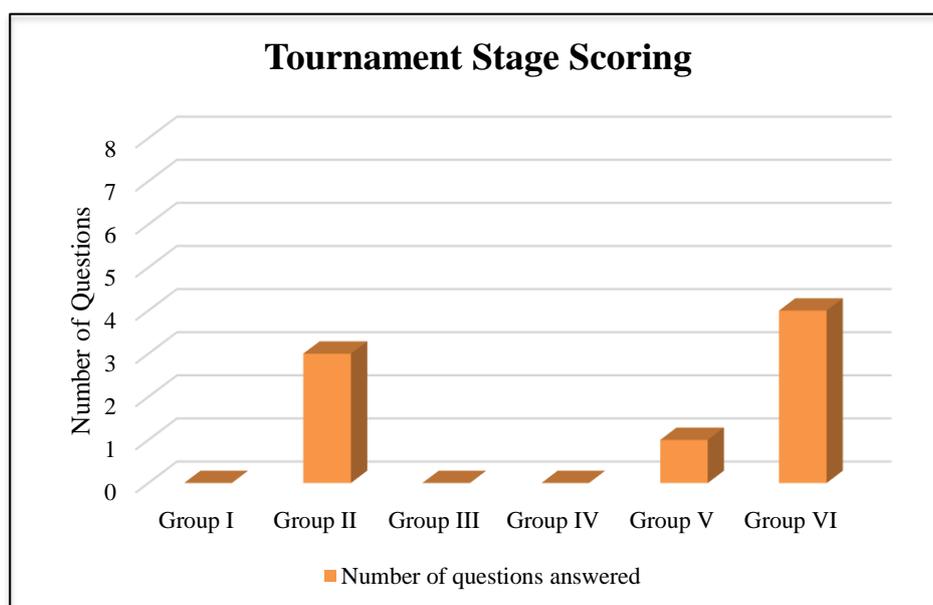


Figure 3. Tournament Stage Score Acquisition Diagram

Several data were obtained from the learning process in the form of learning outcome test data, response questionnaire data, and activity observation sheet data. Before and after the learning process, students were given a learning outcome test consisting of 7 essay questions. During the learning process, student activities were observed by one observer. The observer checked the student activities that occurred during learning on the observation sheet. There were 22 activities observed based on aspects and indicators of student activities. Next, students were given a student response questionnaire containing statements about student responses to the learning process. The questionnaire contained 24 statements, with 12 positive statements and 12 negative statements based on aspects and indicators of the student response questionnaire. The learning outcome tests, response questionnaires, and student activity observation sheets were analyzed to determine the effectiveness of the TGT cooperative learning model assisted by the Wordwall educational game on similarity material at SMP Abdi Agape Pontianak. The learning outcome test data, response questionnaire data, and activity observation sheet data were analyzed. The test data in this study consisted of the pretest and posttest scores of students in class VII A who received the treatment. Based on the descriptive analysis of the learning outcome data for class VII A, there was an increase in the average learning outcome of students, an increase in classical mastery, and an increase in learning outcome (normalized gain).

The criteria for achieving learning objectives (*KKTP*) at SMP Abdi Agape Pontianak are ≥ 65 .

Table 5. Descriptive Analysis of Pretest and Posttest Scores

	Minimum	Maximum	Mean	Std. Deviation
Pre-test	21,42	75,00	40,17	13,73
Posttest	57,14	100,00	78,94	11,75

Table 5 shows an increase in the average learning outcomes of students from 40,17 which did not reach the *KKTP*, to 78,94 which reached the *KKTP*. Classical mastery is defined as 75% of students achieving the *KKTP*. **Table 6** and **Table 7** show the pretest and posttest scores that have been categorized.

Table 6. Pre-test Score Categorization Based on *KKTP*

Value Interval	Category	Number	%
$0 \leq x < 65$	Incomplete	27	96,43
$65 \leq x \leq 100$	Completed	1	3,57
Total		28	100

Table 6 shows that the number of students who passed the pretest was less than 75% or did not pass classically.

Table 7. Posttest Score Categorization Based on *KKTP*

Score Interval	Category	Number	%
$0 \leq x < 65$	Incomplete	2	7,14
$65 \leq x \leq 100$	Completed	26	92,86
Total		28	100

Table 7 shows that more than 75% of students passed the posttest or passed classically. A normalized gain test was conducted to determine the improvement in learning outcomes after the treatment.

Table 8. Categorization of Learning Outcome Improvement

Gain	Category	Number	%
$\geq 0,70$	High	12	42,85
$0,30 - 0,69$	Medium	14	50
$< 0,30$	Low	2	7,14
Total		28	100

From **Table 8**, it can be seen that the number of students who achieved learning gains in the high category was 12 students, in the moderate category was 14 students, and in the low category was 2 students. Based on the calculation, the normalized gain of students reached 0,62 (Medium). The prerequisite test used is the normality test. The normality test is used to determine whether the data obtained comes from a normally distributed population or not. The normality test used in this study is the Shapiro-Wilk Test as shown in **Table 9**.

Table 9. Normality Test Results

	Shapiro-Wilk		
	Statistic	df	Sig
Pretest	0,95	28	0,28
Posttest	0,94	28	0,11

Significance values of 0,28 (pretest) and 0,11 (posttest) were obtained, which is $> 0,05$, indicating that the data is normally distributed. Then, the hypothesis was tested using a one-sample t-test. In the statistical test, three hypotheses were tested using IBM SPSS Statistics 26. The three hypotheses tested. The first hypothesis is "The average learning outcomes of students after using the TGT cooperative learning model assisted by the Wordwall educational game on similarity material at SMP Abdi Agape Pontianak $> 64,9$." This hypothesis was tested with a one-sample t-test as shown in **Table 10**.

Table 10. One-Sample t-Test Results

Test Value = 65						
Posttest	t	df	Sig. (2-tailed)	Mean Difference	95% Confidence Interval of the Difference	
					Lower	Upper
	6,27	27	0,00	13,94	9,38	18,50

The result in **Table 10** showed a Sig (2-tailed) value of 0,00. Since a one-tailed test is used, 0,00 is divided by 2, resulting in 0,00 for *Sig* (1 – tailed). Based on the decision criteria for the one-sample t-test hypothesis, the result is *Sig* < 0,05. Therefore, the average learning outcome after the treatment is > 64,9. This is supported by research (Firdaus & Murtafiah, 2024) which shows that the student score increased after implementing the TGT model. The second hypothesis is "Classical mastery after using the TGT cooperative learning model assisted by Wordwall educational games on similarity material at SMP Abdi Agape Pontianak > 74,9%." This hypothesis was tested with a Proportion Test as shown in **Table 11**.

Table 11. Results of the Proportion Test

	Category	N	Observed Prop.	Test Prop.	Exact Sig. (1-tailed)
Posttest	Group 1	1	26	0,93	0,01
	Group 2	0	2	0,07	
	Total		28	1,00	

The result in **Table 11** showed a Sig (1-tailed) value of 0,01. According to the hypothesis testing criteria for proportions, the result obtained was *Sig* < 0,05, meaning that the classical mastery level was after the treatment > 74,9. This is in line with the research by Konitah et al. (2024), which found an increase in classical mastery after applying the TGT model, from 43% to 93%.

The third hypothesis is "The average increase in learning outcomes (normalized gain) after using the TGT cooperative learning model assisted by the Wordwall educational game on similarity material at SMP Abdi Agape Pontianak is > 0,3. This hypothesis was tested with a one-sample t-test as shown in **Table 12**.

Table 12. One-Sample t-Test Results

Test Value = 0.3						
	t	df	Sig. (2-tailed)	Mean Difference	95% Confidence Interval of the Difference	
					Lower	Upper
Gain	7,133	27	0,000	0,318	0,227	0,410

The result in **Table 12** showed a Sig (2-tailed) value of 0,00. Since a one-tailed test was used, 0,00 was divided by 2, resulting in a one-tailed t-test (*Sig* (1 – tailed)) of 0,00. Based on the decision criteria for the one-sample t-test hypothesis, the result obtained was *Sig* < 0,05 , meaning that the average increase in learning outcomes (normalized gain) after treatment was > 0,3. This is supported by Baharullah's (2022) research, which found an increase in learning outcomes after the application of the TGT model based on a normalized gain of 0,3 or a moderate category.

Based on data analysis, the average learning outcomes of students after using the TGT cooperative learning model assisted by the Wordwall educational game on similarity material at SMP Abdi Agape Pontianak were obtained $> 64,9$, the classical mastery after using the TGT cooperative learning model assisted by the Wordwall educational game on similarity material at SMP Abdi Agape Pontianak was obtained $> 74,9\%$, The average increase in learning outcomes (normalized gain) after using the TGT cooperative learning model assisted by the Wordwall educational game on similarity material at SMP Abdi Agape Pontianak was $> 0,3$. This increase indicates that the TGT learning model assisted by Wordwall provides opportunities for students to work together in groups to obtain maximum scores. This is in line with the opinion of (Qurrotu'ain et al., 2024) that this increase in learning outcomes shows that the TGT cooperative learning model assisted by the Wordwall educational game can improve students' understanding of the material being taught and that interactive games such as Wordwall can help students understand the material more easily. This is also in line with the research by Rosyidi et al. (2025) that the TGT learning model can improve student learning outcomes. These findings reinforce that TGT can emphasize cooperation and group competence, which can encourage students to achieve good learning outcomes.

The questionnaire data in this study consisted of the scores from the student response questionnaire. The questionnaire contained the students responses after being taught using the TGT cooperative learning model assisted by the Wordwall educational game on the subject of similarity. The diagram of the response data processing results can be seen in **Figure 4**.

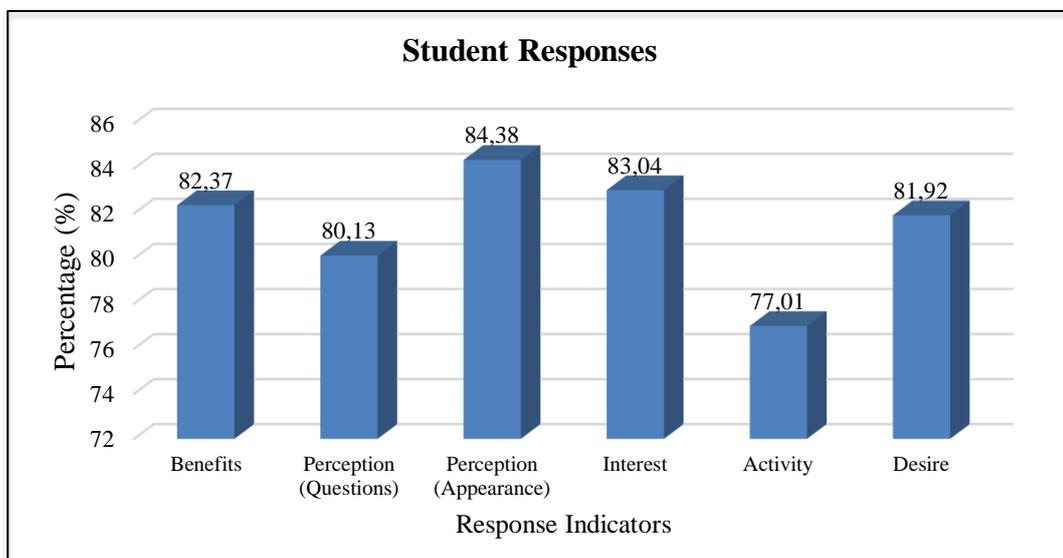


Figure 4. Diagram of Student Responses Based on Response Indicators

Based on **Figure 4**, a very positive response of 81.47% was obtained. It can be concluded that the response of students in class VII A reached the criteria of very positive towards learning. The very positive response of students towards learning is an indicator that students like the TGT learning model and the wordwall media used. This is in line with the research by Baharullah (2022) which shows that students respond positively to the TGT model, and the research by Emilia et al. (2024) on the Wordwall educational game, in which students responded very positively. In accordance with the conditions of students in the technological era, where most of them like games, the use of Wordwall in the learning

process is the right solution in mathematics learning. This aligns with the opinion of Emilia et al. (2024) that wordwall is a new innovation in creating engaging learning, considering that most students enjoy games.

The observation sheet contains scores regarding student activities during the treatment. **Figure 5** shows the results of processing the data from the activity observation sheet.

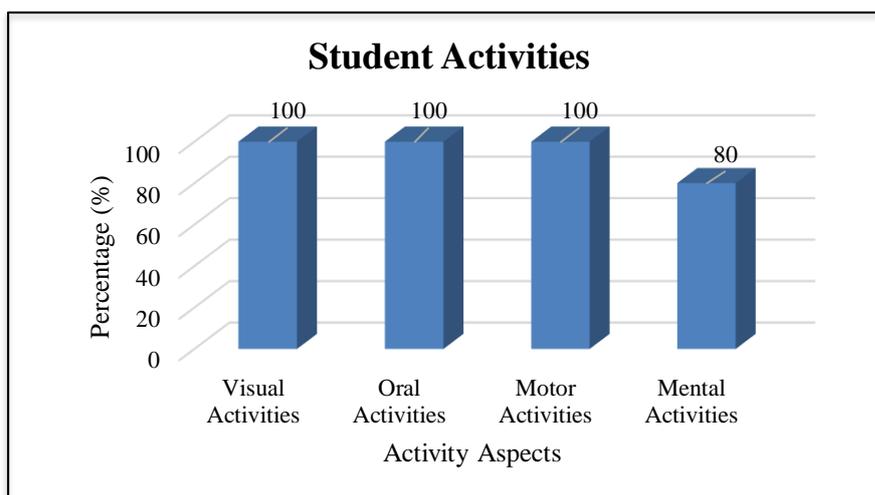


Figure 5. Diagram of Student Activities Based on Observed Aspects

Based on **Figure 5**, it was found that 95% of activities were very active. It can be concluded that the activities of class VIIA students met the criteria for very active learning. During the learning activities, students appeared enthusiastic about learning, from the time the teacher explained the material to the tournament stage. Student activities during the learning process indicated that they liked the TGT learning model and the wordwall media used. This is supported by the research of Dalimunthe et al. (2024) which found an increase in student activity after the TGT model was implemented. This learning provides opportunities for students to be active and work together in groups to complete their tasks, especially in the game and tournament stages. This is in line with the opinion of Rosyidi et al. (2025) who stated that the TGT learning model involves learning that aims to encourage the activity of all students. The implication of this study is that it provides an alternative for teachers to improve student learning outcomes and activity.

CONCLUSION

In conclusion, this study is considered effective because it fulfills the established effectiveness indicators. These indicators include the achievement of minimum mathematics learning outcomes, the attainment of classical mastery, meaningful improvement in learning outcomes, positive student responses, and active student participation during the learning process. The effectiveness of the study was demonstrated through statistical analysis, which showed that the average learning outcomes exceeded the minimum mastery criteria, classical mastery was achieved at the class level, and there was an observable improvement in students' learning outcomes. Furthermore, the analysis of questionnaire data indicated that students provided very positive responses to the learning process, while the analysis of observation data showed that student activities during learning were categorized as very active. The limitations of this study were the absence of a control class or only researching one class and the scope of the similarity material in this study was only the similarity in

triangles, rectangles, and trapezoids. Further research is recommended to use a comparison class or control class and to conduct research on a broader scope of similarity material, covering various types of flat shapes other than triangles, rectangles, and trapezoids.

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