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EFFECT OF THE KAHOOT-ASSISTED TEAM GAMES TOURNAMENT MODEL ON MATHEMATICS LEARNING OUTCOMES OF GRADE XI STUDENTS

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ABSTRACT

Rendahnya hasil belajar siswa, khususnya pada pembelajaran matematika, menunjukkan perlunya penerapan model pembelajaran yang inovatif. Penelitian ini memiliki tujuan yaitu untuk mengetahui pengaruh pengimplementasian model pembelajaran *Team Games Tournament* dengan bantuan Kahoot terhadap hasil belajar matematika siswa kelas XI SMA Negeri 1 Balen khususnya pada materi pokok garis singgung lingkaran. Penelitian ini termasuk dalam model *quasi experiment* dengan menerapkan teknik *cluster random sampling*. Penelitian ini melibatkan siswa kelas XI di SMA Negeri 1 Balen tahun ajaran 2024/2025 sebagai populasi penelitian, yang terdiri dari 6 kelas dengan total keseluruhannya ada 206 siswa. Kelas yang terpilih menjadi sampel penelitian yaitu kelas XI-1 (kelas eksperimen) dan kelas XI-2 (kelas kontrol). Tes dan dokumetasi dipilih sebagai teknik pengambilan data penelitian. Berdasarkan hasil uji t dengan α = 5% dan DK = {t | t < -1,9957 atau t > 1,9557} didapatkan t_{hitung} = 3,251 maka $t_{hitung} \in$ DK, yang menunjukkan H_0 ditolak dan H_1 diterima. Analisis data tersebut menunjukkan adanya pengaruh dalam pengimplementasian model *Team Games Tournament* (TGT) terhadap hasil belajar siswa kelas XI pada materi garis singgung lingkaran di SMA Negeri 1 Balen. Rata-rata nilai posttest siswa di kelas eksperimen adalah 84,056, sedangkan dikelas kontrol adalah 77,706, yang semakin menguatkan adalanya pengaruh positif dari model pembelajaran tersebut. Secara praktikal, hasil penelitian ini dapat dijadikan alternatif strategi pembelajaran bagi pendidik dalam meningkatkan partisipasi aktif dan hasil belajar siswa.

The low learning outcomes of students, especially in mathematics learning, indicate the need to implement innovative learning models. This study aims to determine the effect of implementing the Team Games Tournament learning model with the help of Kahoot on the mathematics learning outcomes of XI grade students of SMA Negeri 1 Balen, especially on the tangent circle. This research is included in the quasi-experimental model by applying the cluster random sampling technique. This study included grade XI students at SMA Negeri 1 Balen in the 2024/2025 school year as the research population, comprising six classes with 206 students. Class XI-1 (experimental class) and class XI-2 (control class) were selected as the research samples. Test and documentation were chosen as the research data collection techniques. Based on the t-test results with α = 5% and DK = {t | t < -1,9957 atau t > 1,9557}, the obtained t_{count} = 3.251. Because the t_{count} falls within the critical region (DK), H_0 is rejected and H_1 is accepted. The

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data analysis shows an influence in implementing the Team Games Tournament (TGT) model on the learning outcomes of grade XI students on the circle tangent at SMA Negeri 1 Balen. The average posttest score for students in the experimental class was 84.056, whereas it was 77.706 in the control class it was 77.706, further confirming the positive influence of this learning model. Practically, the results of this study can be used as an alternative learning strategy for educators to increase active participation and student learning outcomes.

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INTRODUCTION

A school is a place where students can obtain an education and gain knowledge. Mathematics is a fundamental science supporting multiple disciplines and widely applied in everyday life. Learning mathematics involves an interactive process between the teachers and students designed to facilitate understanding abstract concepts, enabling students to apply mathematical reasoning to solve real-world problems (Alim et al., 2023; Indriani, 2022).

However, Indonesia's 2022 PISA results in mathematics decreased compared to the previous year's PISA results, so there is not too wide a range between low and high-ability students. In addition, there was an increase of 5% in the number of students whose abilities were below level 2, and only 18% of students reached that level. At level 2, students can independently understand and identify steps in converting simple situations into mathematical calculations, such as being able to compare the distance between two different paths (OECD, 2023). This condition reflects the challenges faced by the national education system in improving students' mathematical competencies evenly.

In line with these conditions, learning achievement data at the school level also show a similar picture. For example, at SMA Negeri 1 Balen, specifically in grade XI, 50.49% of students (104) were declared to have completed the final semester summative exam for Mathematics, while 49.51% (102) had not yet achieved completion. The initial observation results showed that the learning activities at SMA Negeri 1 Balen were still relatively monotonous because the teacher was still the center of the learning activities, and the students tended to be passive, so the learning was less effective. This causes some students to struggle when learning, especially when attending math classes.

Based on the above data, student learning outcomes in mathematics are still low. Learning outcomes are students' academic achievements obtained by taking assessments and class activities, such as asking and answering questions. (Dakhi, 2020) explains that several aspects that impact student learning outcomes are teacher proficiency when teaching, the level of learning effectiveness, and active parental involvement. This is in line with the notion (Hafid & Mayasari, 2023) that the learning outcomes of students are influenced by their enthusiasm for learning and the learning model implemented in class.

The use of teacher-centered learning methods and the lack of emphasis on active student participation have created an urgent need for significant changes in teaching methods. These changes could include the implementation of learning models or teaching techniques that encourage active student involvement in the ongoing learning process. One potential alternative is the Team Games Tournament (TGT) learning model. Priansa (Lestari et al., 2022) maintains that the purpose of this learning model is to create a proactive learning environment via robust

teamwork among students, foster positive dispositions during learning, encourage receptivity to peer opinions, and educate students in collaborative problem-solving.

The utilization of attractive digital media in mathematics learning also has a significant impact on student learning outcomes (Azkia et al., 2023). This is because the application of gamification in mobile-based learning applications is able to increase students' active participation in the mathematics learning process (Atin et al., 2022). Kahoot is one of the digital media that can be used in this activity. Kahoot is an online learning tool that relies on games to add excitement to learning activities, evaluate students' level of comprehension, and provide a variety of learning activities (Wang & Tahir, 2020). This platform has various interesting features, one of which is an interactive quiz feature that can be operated with smartphones, laptops, and tablets (Hariyati et al., 2024). These features make Kahoot an ideal learning medium for creating interactive learning activities.

Many studies corroborate this research, especially by (Magfirah et al., 2023), who found that the sig. (2-tailed) value of 0.002 < 0.05. These findings indicate that implementing the Team Games Tournament model by integrating Kahoot can improve students' sociology learning outcomes. Furthermore, research by (Fadly et al., 2020) obtained findings, namely obtained $z_{count} > z_{tabel}$, namely 3.69 > 1.64, so there is an effect of integrating Quizizz in the Team Games Tournament model on student learning outcomes on the topic of buffer solutions. Along with this research, in the study of Niri et al., (2023), the findings were that the average posttest value of the experimental class was 85.33, but the average posttest value of the control class was only 61.97. The results suggest that incorporating the Team Games Tournament model supported by visual aids such as posters improves student achievement inscience classes.

Based on research conducted by (Mustofiyah et al., 2025), it was found that implementing the Kahoot application and the Team Games Tournament model strengthened learning motivation with a percentage of 86%. In addition, the learning outcomes obtained by students have also increased; this can be seen from the percentage of completeness of the posttest results, which reached 81.62%. Another study conducted by (Umboh et al., 2021) found that student learning outcomes as well as teacher and student activities increased in each cycle. This is due to the application of Kahoot in the learning process (alsswey & Malak, 2024). also stated that the implementation of Kahoot can improve academic achievement, reduce stress and anxiety during the learning process, and increase self-efficacy levels.

Although various studies have shown that the integration of digital gamification—such as Kahoot and Quizizz—into the TGT learning model has a positive impact on student learning outcomes and motivation in various subjects, research specifically highlighting its impact on mathematics learning, particularly on abstract topics such as tangents to circles, is still limited. Therefore, this study aims to fill this gap by examining the effectiveness of the Kahoot-assisted TGT model in improving students' mathematics learning outcomes in this material.

This study's problem formulation is essentially the question of whether implementing the Team Games Tournament learning model with Kahoot has a noticeable impact on the mathematics learning outcomes of grade XI students, particularly with regard to the tangent line of a circle. The sense of urgency behind this research arises from the necessity for solutions to enhance teaching quality, particularly on subjects that have frequently been cited as challenging for students. This research is expected to provide practical contributions in the form of more interactive and enjoyable learning strategies for students, as well as theoretical contributions in enriching studies related to the application of digital gamification-based learning models integrated with a constructivist approach in mathematics learning.

METHOD

This study uses a type of research known as quantitative research. As explained by Creswell (Ali et al., 2022), quantitative research involves finding information through the analysis of numerical data to explain the topic being studied. This research relies on a quasi-experimental design. The primary aim of this research is to assess the impact of integrating the Team Games Tournament learning model with Kahoot on the mathematics learning outcomes of grade XI students, particularly about the tangent circle topic.

This study involved the XI grade students at SMAN 1 Balen in the academic year 2024/2025 as the research population, which consisted of 6 classes with 206 students. Then, two classes were taken to be the research sample: class XI-1 (36 students) became the experimental class while class XI-2 (34 students) became the control class. The cluster random sampling approach was chosen for this study's sampling technique because all classes were considered equal in several aspects, such as curriculum and grade level, and there was no superior class grouping.

Learning in the experimental class was conducted through several meetings: (a) In the first meeting, the researcher administered a pretest to measure the students' initial abilities. In the second meeting, learning was conducted using Kahoot's Team Games Tournament learning model. In the fifth meeting, the researcher administered a posttest to measure the final abilities of the students.

The implementation of the Team Games Tournament learning model, assisted by Kahoot, was carried out through several stages. The teacher first presented the material to the class. Next, the teacher divided the students into groups. To ensure that each group had equal abilities, groups were formed on the basis of each student's individual abilities. Next, students were invited to engage in in-depth discussions on the previously explained material. Students were given practice questions using Kahoot. The teacher could view each student's score via Kahoot. This stage was conducted during the second and third meetings. However, in the fourth meeting, the teacher added a stage: a tournament. The tournament questions covered material from the second to the fourth meetings and were presented via Kahoot. After the tournament, each student's score was tallied to determine their group's score. The teacher announces the winner of the tournament and rewards the winning group.

Meanwhile, the implementation of learning in the control class was carried out through several meetings, namely (a) The first meeting, the researcher conducted a pretest with the aim of measuring the students' initial abilities; (b) The second to fourth meetings, learning was carried out using a conventional learning model; (c) The fifth meeting, the researcher conducted a posttest with the aim of measuring the students' final abilities.

This study used tests and documentation as the primary data collection methods. Students took a pre-test before the treatment and then a post-test after the treatment. The test items consisted of six essay questions covering C1-C5, which were tested for validity, reliability, difficulty level, and discriminatory power.

The validity test involved three validators: two lecturers with mathematics backgrounds and one mathematics teacher at the school. The validators assessed the suitability of the test items to the learning indicators. Based on the validation results, six items were deemed "very valid" with an average Aiken V index of 0.804 > 0.8. The reliability test was calculated using the Cronbach's Alpha formula and obtained a value of 0.722. These results indicate that the six items are reliable, as 0.722 > 0.600. The pilot test results indicated that the six items were classified as moderately reliable, falling within the range of 0.31–0.70. Then, based on the discriminatory power analysis, 5 items had good discriminatory power (0.40 ≤ DP ≤ 0.69) and 1 item had very good discriminatory power (0.70 ≤ DP ≤ 1.00). Based on the test results, the 6 items were declared suitable for use as research instruments.

The collected data will be tested using prerequisite, balance, and hypothesis tests. A normality and homogeneity test is used to conduct a prerequisite test on the pretest and posttest results. The balance test is applied to the pretest results to identify both classes' initial ability level. A hypothesis was tested using a posttest with an independent sample t-test.

RESULTS

The pretest was conducted before the treatment of both classes to identify the students' initial ability level. Table 1 displays the pretest results for both classes.

Table 1. Pretest result

Class	Statistic					
	N	Mode	$\bar{X}$	S	Xx	X_{min}
Experiment	36	65	53,139	10,829	68	31
Control	34	64	50,618	12	67	30

Based on Table 1, the pretest data obtained with the maximum value of the experimental class 68 and the control class 67, while the minimum value of the experimental class 31 and the control class 30. The average values of the experimental and control classes were 53,139 and 50,618, respectively. The mode of the experimental class was 65, and that of the control class was 64. The standard deviation of the experimental class was 10,829, whereas that of the control class was 12.

Conducting a prerequisite and balance test on the pretest data is necessary to determine whether the initial ability category of the student is the same or different. The normality test is the first prerequisite test conducted. This test uses the Lilliefors method with α = 5% and DK = $\{L \mid L > L_{\alpha;n}\}$. The test results are presented in Table 2.

Table 2. Normality test result of the pretest

Class	L_{count}	L_{table}	Distributed Data
Experiment	0,085	0,148	Normal
Control	0,123	0,152	Normal

Referring to Table 2, the calculation results for the experimental class show that $L_{count} < L_{tabel}$, namely 0,085 < 0,148. It is known that the value of L ∉ DK, then H_0 is accepted and it can be said that the research sample was taken from a normally distributed population. The same thing happened in the control class where $L_{count} < L_{tabel}$, namely 0,123 < 0,152, because L ∉ DK, then H_0 is accepted and it is concluded that the research samples were taken from a normally distributed population.

The homogeneity test is the second prerequisite test, which determines whether the variance of the population is uniform or different. The F test was performed using α = 5% and DK = $\{F \mid F_{count} > F_{table}\}$. Table 3 presents the results.

Table 3. Homogeneity test result of the pretest

Class	F_{count}	F_{table}	Conclusion
Experiment	1,228	1,768	Homogeneous
Control			

Referring to Table 3, the results of the pretest data homogeneity test were obtained with $F_{count} < F_{tabel}$, namely 1,228 < 1,768, because F ∉ DK, H_0 is accepted. The variance between sample groups is derived from a uniform or homogeneous population.

The balance test on pretest data is the next stage to identify the initial ability level of both classes. The balance test was conducted using the t-test with α = 5%. Table 4 presents the test results.

Table 4. Balance test result

Class	t_{count}	t_{table}	Conclusion
Experiment	0,921	2,306	Balanced or equal ability
Control			

Referring to Table 4, the results of the pretest data balance test were obtained with t_{count} = 0,921 while t_{table} = 2,306, because DK = {t | t < -2,306 or t > 2,306}, then t_{count} ∉ DK. Therefore, the test decision is H_0 accepted. It can be said that the initial abilities of the two classes are at the same level.

In addition to the pretest conducted before treatment, a posttest is performed after treatment. The following are the results of the posttest for both classes.

Table 5. Posttest result

Class	Statistic					
	N	Mode	$\bar{X}$	S	X_{max}	X_{min}
Experiment	36	100	84,056	8,741	100	66
Control	34	80	77,706	7,510	100	60

According to Table 5, posttest data revealed that the highest score in both the experimental and control classes was 100, with the lowest score in the experimental class being 66 and in the control class being 60. The experimental class had an average value of 84,056, while the control class averaged 77,706. The experimental class mode was 100, while the control class mode was 80. The experimental class had a standard deviation of 8,741, in contrast to a standard deviation of 7,510 in the control class.

Before the posttest data is tested using hypothesis testing, a prerequisite test is carried out using the normality and homogeneity tests. A normality test was conducted using the Lilliefors method with α = 5% and DK = {L | L > $L_{\alpha;n}$}. The results are shown in Table 6.

Table 6. Normality test result of the posttest

Class	L_{count}	L_{table}	Distributed Data
Experiment	0,090	0,148	Normal
Control	0,095	0,152	Normal

Based on Table 6, the results obtained for the experimental class with $L_{count} < L_{table}$, namely 0,090 < 0,148, because L ∉ DK, then H_0 is accepted and it can be said that the research samples were taken from a normally distributed population. In the control class, $L_{count} < L_{table}$, namely 0,095 < 0,152, because L ∉ DK, H_0 is accepted and it can be said that the research samples were taken from a normally distributed population.

The next step is to test homogeneity using the F test with α = 5% and DK = {F | $F_{count} > F_{table}$}. Table 7 presents the test results.

Table 7. Homogenity test result of the posttest

Class	F_{count}	F_{table}	Conclusion
Experiment	1,355	1,777	Homogeneous
Control			

Based on Table 7, the results of the posttest data homogeneity test with $F_{count} < F_{table}$, namely 1,355 < 1,777, because F ∉ DK, If H_0 is accepted, it is concluded that the variance between sample groups comes from a uniform or homogeneous population.

Posttest data that were declared normal and homogeneous were then subjected to hypothesis testing using an independent sample t-test with α = 5%. The following is a hypothesis test table.

Table 8. Hypothesis test results

Class	t_{count}	t_{table}	Conclusion
Experiment	3,251	1,99547	There is an effect
Control			

Based on Table 8, the results of the posttest data hypothesis test with t_{count} = 3.251 while t_{table} = 1,99547, because DK = {t | t < -1,99547 atau t > 1,95547} then t ∈ DK or $t_{count} > t_{table}$. In conclusion, the test results indicate that the null hypothesis (H0) is rejected, thus confirming that the implementation of the Team Games Tournament learning model with Kahoot has a substantial impact on the mathematics learning outcomes of class XI students at SMA Negeri 1 Balen, particularly concerning tangent lines of circles.

DISCUSSION

Analysis of pretest and posttest data reveals a disparity in learning outcomes between the experimental and control groups. Table 1 indicates that there was no significant difference between the average pretest scores of the experimental class (53.139) and those of the control class (50.618). In addition, the balance test obtained the results of $t_{count} < t_{table}$, namely 0.921 < 2.306, indicating that the two classes' initial abilities were at the same level. In Table 5, the average posttest value of the experimental class (84.056) is higher than that of the control class (77.706). Although the two classes' initial abilities were at the same level, the experimental class showed a significantly increased the learning outcomes they obtained after treatment.

In addition to the data above, the posttest data hypothesis test shows the value of $t_{count} > t_{table}$, namely 3.251> 1.99547. Based on the criteria used, H_0 will be rejected if the value of $t_{count} > t_{table,}$ so that t_{table} ∈ DK with DK = {t | t < -1.99547 or t > 1.95547}. This shows that implementing the Team Games Tournament learning model with the help of Kahoot greatly influences the mathematics learning outcomes of SMA Negeri 1 Balen grade XI students, especially on circles' tangent lines. In its implementation, this approach makes learning student-centered, and using the Kahoot platform can increase student engagement in the classroom. The findings of this study align with those of (Magfirah et al., 2023) who showed that the TGT model can improve students' conceptual understanding and cooperation in problem-solving. However, their study did not incorporate digital platforms such as Kahoot. In contrast, the present study integrates gamification elements through Kahoot, creating a more interactive and competitive learning environment. This

integration is a significant distinction, as the use of visual stimuli, instant scoring, and leaderboards can further enhance students' motivation and engagement of students.

This research is also supported by (Mustofiyah et al., 2025), who found that implementing Kahoot alongside the TGT model made learning more enjoyable and interesting. Nonetheless, their study was conducted at the elementary school level, whereas the current study was conducted at the junior high school level. These different educational levels involve varying student characteristics, particularly in terms of learning independence and competitiveness. This suggests that the TGT-Kahoot approach is adaptable and potentially practical across different educational stages.

In addition, the effectiveness of the Kahoot platform in enhancing student learning outcomes was demonstrated by (Umboh et al., 2021), particularly in mathematics lessons involving integer operations. Their findings showed improvements in both learning outcomes and student engagement across each research cycle. The use of Kahoot stimulated students' enthusiasm and active participation, while also encouraging teacher creativity and innovation in integrating technology into mathematics instruction.

These findings are consistent with (Wirani et al., 2021), who noted that Kahoot fosters healthy competition among students, as they are motivated to achieve high rankings. Although the focus of Umboh et al.'s study was mathematics, and the present research emphasizes science, the results highlight Kahoot's versatility across disciplines. Nonetheless, the design of quiz content and question types must be adapted to the specific needs and characteristics of each subject area.

Other studies have examined the use of the TGT model with alternative learning media. For example, (Fadly et al., 2020) implemented the TGT model using Quizizz, a platform that also offers gamified quizzes with music, animations, and quiz scores. Compared to Kahoot, Quizizz emphasizes a more relaxed and self-paced atmosphere, while Kahoot focuses more on real-time competition and time pressure. These differences in features can lead to different student engagement patterns. Although both platforms are effective, the psychological effects and student participation levels may vary depending on the media used.

In another study, (Niri et al., 2023) integrated the TGT model with poster media in science learning. While posters helped increase group collaboration and visual understanding, the approach is relatively static and lacks the interactive, real-time feedback offered by digital platforms like Kahoot. Therefore, the present study highlights how using Kahoot provides a more dynamic form of gamification that directly stimulates student participation and healthy competition.

In its application, the Team Games Tournament learning model is organized based on five stages. Slavin (Hartono & Sufyan, 2024) explained that the five stages in this learning model are (1) Presentation in class, at which stage the teacher delivers material in class and groups students into several study groups; (2) Learning in groups, in which students can conduct discussion sessions with their group mates as a form of preparation for the next stage; (3) Game, at this stage students are given several questions through a game and by the material that has been delivered; (4) Tournament, at the end of each week or after one unit is completed; (5) Team recognition, at this stage the teacher determines the winning team and awards each team. Meanwhile, the Kahoot-assisted Team Games Tournament learning model combines inter-group tournament-based learning models that integrate Kahoot digital quizzes in the implementation stage.

The integration of Kahoot in the Team Games Tournament learning model can be done at the game and tournament stages. A slight difference was observed between the game implementation and the tournament stage. Each group will work together to solve the given problem in the game stage. However, each group member will work on the questions during the tournament stage. The questions at both stages remain the same, that is, they are presented using the Kahoot platform. The purpose of using Kahoot in learning is to increase students' engagement

in class, motivation to learn, and concentration so that their learning performance can improve (Wang & Tahir, 2020). In line with (Daryanes & Ririen, 2020), integrating Kahoot increases student motivation to achieve victory in each game session. This can help students become more focused during the learning process and encourage them to actively find additional material to broaden their understanding.

Kahoot has several advantages as a digital learning media: (1) it can provide answer choices in various colors and directly to students' cellphones; (2) There is a timer when working on questions because the score is not only based on the accuracy of the answer but also on the speed of answering, so that students become more challenged; (3) This application can display students who manage to answer quickly and correctly; (4) Student scores can be accessed through the reports menu, as a teacher assessment; (5) the available quiz feature offers four answer options and the presentation of quizzes can use text, images, videos, and songs; (6) the use of this application can increase student activeness and motivation; (7) the gamification feature can stimulate student curiosity through the problem-solving process and provide appropriate feedback (Daryanes & Ririen, 2020). With these advantages, Kahoot plays an important role as a medium for presenting digital quiz-based questions and is suitable for implementation in the Team Games Tournament learning model.

According to (Wulandari et al., 2024), the Team Games Tournament learning model supported by Kahoot has several benefits, including enhanced student group interaction, increased student learning motivation, simplified material comprehension, a more enjoyable learning experience, and the introduction of digital technology to students. On the other hand, the successful implementation of the Kahoot-assisted Team Games Tournament learning model is inseparable from several obstacles in its implementation. Unstable internet makes it difficult for students to participate in the quiz and constrains their ability to choose answers. Students who have never accessed Kahoot tend to feel confused when they first access the platform. Therefore, teachers must be skillful in setting the time or rhythm of the class so that the stages of the Team Games Tournament learning model are well implemented. This is in line with (Wulandari et al., 2024) shortcoming of the Kahoot-assisted Team Games Tournament learning model, which is the limited learning time. In addition, Wulandari explained other shortcomings in this learning model, such as the potential for noise in the classroom and the risk of technology misuse, such as accessing other applications during the learning process.

Based on the findings and their alignment with previous studies, this research contributes both theoretically and practically to the field of education. Theoretically, the study strengthens the evidence on the effectiveness of the Team Games Tournament (TGT) learning model when combined with digital gamification tools such as Kahoot, particularly in enhancing student engagement and conceptual understanding in science learning. Although previous studies have shown positive outcomes of TGT in various contexts, this research confirms its relevance in a digitally enriched environment and supports the integration of cooperative learning with gamification principles.

Practically, this study offers an alternative instructional strategy for teachers by demonstrating how the use of Kahoot within the TGT framework can create a more interactive, enjoyable, and competitive classroom atmosphere. The findings can serve as a reference for educators seeking to improve student motivation, participation, and learning outcomes through innovative and technology-assisted cooperative learning methods.

CONCLUSION

The results of this study demonstrate that the Team Games Tournament (TGT) learning model assisted by Kahoot significantly improves the mathematics learning outcomes of Grade XI students at SMA Negeri 1 Balen, particularly in the topic of tangent circles. This finding reinforces

the effectiveness of digitally assisted TGT as an engaging and impactful learning approach in high school mathematics. Theoretically, the study strengthens the evidence that integrating game-based digital media can enhance student understanding and participation. Practically, educators are encouraged to adopt the TGT model, which is supported by interactive tools like Kahoot, to create more dynamic and effective classroom learning. Future research should explore applying the TGT model with other digital platforms across different subjects and educational levels, considering additional factors such as learning motivation and critical thinking skills.

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The authors declare that generative AI or AI-assisted technologies were not used in any way to prepare, write, or complete this manuscript. The authors confirm that they are the sole authors of this article and take full responsibility for the content therein, as outlined in COPE recommendations.

INFORMED CONSENT

The authors have obtained informed consent from all participants.

CONFLICT OF INTEREST

The authors declare that there is no conflict of interest.

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