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Kahoot-Based Team Quiz Strategy to Improve Elementary School Students' Mathematics Learning Activity and Outcomes

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A B S T R A C T

This research aims to improve the activity and learning outcomes of fifth-grade students at SDN 23 Tanjung Gadang in mathematics through the implementation of the Team Quiz strategy supported by Kahoot. The study used the Classroom Action Research (CAR) method with the Kemmis and Taggart model, conducted in two cycles of two meetings each. The subjects consisted of 17 students. Instruments included observation sheets of student activity, learning achievement tests, and documentation. In the pre-cycle stage, the average student achievement was only 63%, with five students reaching mastery. After the action in Cycle I, improvements appeared: the average score increased to 65% in the first meeting and 75% in the second, with nine and eleven students achieving mastery. More significant progress occurred in Cycle II, where the average scores rose to 79% in the first meeting and 85% in the second, with sixteen students meeting mastery. Observation results showed that initially passive behaviors changed into active and enthusiastic participation in discussions, questioning, and Kahoot-based quizzes. The classroom atmosphere became more lively, competitive, and enjoyable. The study concludes that the Team Quiz strategy using Kahoot effectively enhances motivation, cooperation, and mathematics learning outcomes.

1. Introduction

Education is a structured and planned process aimed at shaping students' character and potential through learning activities. In the context of formal education, elementary school (SD) serves as the earliest stage that lays the foundation of knowledge and basic skills, which will influence success in the next levels of education. One indicator of success in basic education is the achievement of students' academic competence, especially in mathematics. Mathematics is considered a fundamental discipline that is important for training logical, systematic, and analytical thinking patterns. However, mathematics learning

remains a challenge for many students because it is often perceived as abstract, difficult, and less relevant to daily life, which ultimately leads to low learning outcomes (Putri et al., 2022). Other studies have also found that elementary school students often struggle with mathematics due to weak understanding of basic concepts (Wijaya, 2017).

Teacher-centered learning still dominates classroom practices, particularly in mathematics. Teachers often rely on lectures and problem-solving exercises as the main approach to delivering material. Although such methods have practical value, they are less effective in fostering students' critical thinking and creativity. The lack of variety in learning strategies causes students to become passive and less motivated to actively engage in the learning process. This is in line with findings that traditional learning models, which do not provide space for student participation, have a negative impact on learning outcomes (Permana et al., 2021). Other studies also emphasize that instructional innovation is necessary to improve the activeness of elementary school students (Rahman & Astuti, 2019).

In today's digital era, education cannot be separated from the use of technology. The integration of technology in learning is believed to create a more interactive, engaging, and enjoyable learning environment. One form of technology that holds potential in education is game-based applications, such as Kahoot. Kahoot is a digital quiz platform that allows students to answer questions in real time through their electronic devices, either individually or in groups. Its competitive atmosphere and appealing visuals help students stay focused and feel challenged in understanding the material being taught. A study has shown that the use of Kahoot in mathematics learning can improve participation and learning outcomes (Wang & Tahir, 2020). Another meta-analysis also revealed that digital quiz technologies are effective in enhancing learning outcomes (Hunsu et al., 2016).

However, the use of technology alone is not sufficient without being accompanied by appropriate learning strategies. One approach that supports the effective use of Kahoot is the Team Quiz strategy, an active learning method in which students are divided into groups to study the material, design quiz questions, and test each other across groups. This strategy encourages interaction, discussion, and collaboration among students in solving the given problems. In its implementation, students are not only required to understand the material but also to develop communication skills, group responsibility, and competitiveness in an enjoyable atmosphere. Research has shown that the Team Quiz strategy can enhance elementary school students' learning motivation (Rahmatullah & Sutarto, 2022). Cooperative learning theory also explains that group collaboration is effective in improving conceptual understanding (Slavin, 2015).

The Kahoot-based Team Quiz strategy combines the collaborative strength of active learning with the visual and competitive elements of digital technology. In its implementation, the teacher delivers learning material in short segments, after which students create quiz questions based on their understanding. These questions are then given to other groups to answer through the Kahoot application. With this

approach, students are not only recalling the material but also analyzing and constructing knowledge independently and collaboratively within their groups. This activity has been proven to create a dynamic learning environment and support meaningful learning (Putra et al., 2023). Other studies have also shown that the application of active learning consistently improves student performance in mathematics and science (Freeman et al., 2014)

At SDN 23 Tanjung Gadang, the problems encountered during mathematics learning include low student engagement, the dominance of one-way instruction, and learning outcomes that have not yet met the mastery criteria. The results of students' daily tests show that only 5 out of 17 students (29%) achieved scores above the Minimum Mastery Criterion (KKM). Students appeared less active in asking and answering questions and were not accustomed to participating in discussions or working collaboratively in groups. In addition, the learning atmosphere tended to be passive and monotonous, which hindered the optimal achievement of learning objectives. These facts indicate an urgent need to transform the learning approach into one that is more participatory, enjoyable, and meaningful (Arikunto, 2019).

The use of the Kahoot-based Team Quiz strategy is expected to be an appropriate solution to improve student engagement and learning outcomes. This approach allows students to learn in a more enjoyable way while still maintaining the expected academic achievement. In the context of mathematics learning, which requires higher-order thinking skills, this strategy can provide a deeper and more contextual learning experience. In addition, teachers can also evaluate students' understanding in real time and provide quick and relevant feedback (Zhao, 2019).

The development of technology-based active learning is also in line with 21st-century education policies, which emphasize digital literacy, critical thinking, creativity, communication, and collaboration. Therefore, the implementation of the Kahoot-based Team Quiz strategy is not only relevant for improving learning outcomes but also represents part of a broader transformation toward learning that adapts to the times and the needs of modern learners. Support for this learning model is further strengthened by the availability of digital devices in elementary schools (Siregar & Prasetyo, 2021). Recent analyses also highlight that the 21st-century skills framework must be integrated into the national curriculum to meet global demands (Voogt & Roblin, 2012).

The purpose of this study is to improve the activity and mathematics learning outcomes of fifth-grade students at SDN 23 Tanjung Gadang through the implementation of the Kahoot-based Team Quiz strategy. Specifically, this research aims to increase student engagement during mathematics learning, enhance their understanding of mathematical concepts, and provide a more dynamic, collaborative, and enjoyable learning environment. Additionally, the study seeks to determine the extent to which the integration of digital quiz technology with cooperative learning can support students in achieving the Minimum Mastery Criterion and promote more effective classroom interactions.

2. Methodology

This research employed a Classroom Action Research (CAR) approach using the Kemmis and Taggart model, which consists of four cyclical stages: planning, action, observation, and reflection. CAR was chosen because it enables teachers to reflect on and improve their teaching practices directly in the classroom based on findings and evaluations conducted systematically (Yusup et al., 2020). This model is considered relevant for improving the quality of learning as it provides opportunities for teachers to continuously refine their teaching strategies until the desired outcomes are achieved (Arikunto, 2019). Classroom action research is also effective in the context of elementary education, as it allows the integration of theory with direct classroom practice (Widayati, 2021).

Subjects and Research Location. This study was conducted at SDN 23 Tanjung Gadang, Sutera Subdistrict, Pesisir Selatan Regency, West Sumatra Province. The subjects were all fifth-grade students, totaling 17 learners, consisting of 10 boys and 7 girls. The research was carried out in the even semester of the 2025 academic year. The selection of this location was based on initial findings that student engagement in mathematics learning was still low, while learning outcomes had not yet reached the expected mastery criteria. The inclusion of an entire class as the research subject aligns with the characteristics of classroom action research, as it allows the teacher to investigate, diagnose, and directly improve teaching practices for the learners under their instruction (Gunawan, 2018).

The research design followed the spiral model of Kemmis and Taggart, which consisted of two cycles. Each cycle comprised four stages: (1) Planning, preparing learning tools based on the Team Quiz and Kahoot strategy; (2) Action, implementing the Kahoot-based Team Quiz strategy in mathematics learning; (3) Observation, recording students' learning activities and the results of learning evaluations; and (4) Reflection, evaluating the successes and challenges of each cycle. This spiral model provides opportunities for researchers to make continuous improvements, as each cycle generates reflections that serve as the basis for planning subsequent actions (Altrichter et al., 2018).

Data collection was carried out using three main techniques: (1) observation of students' learning activities using an observation sheet; (2) mathematics learning achievement tests administered at the end of each cycle; and (3) documentation in the form of field notes, photos, and students' work. The research instruments were previously validated by experts and tested in another class. These techniques are in line with the principle of triangulation in classroom action research, in which the use of multiple data collection methods aims to enhance the validity of research findings (Creswell & Guetterman, 2019).

Data analysis was conducted using a descriptive quantitative approach by comparing test results and observations across the pre-cycle, Cycle I, and Cycle II. Mastery learning was determined based on the Minimum Mastery Criterion (KKM) of 65. The indicator of successful action was achieved if ≥85% of students scored

above the KKM and there was a significant increase in learning activity. The descriptive quantitative approach is considered appropriate for classroom action research because it can clearly illustrate trends in students' learning outcomes in a simple yet systematic manner (Sugiyono, 2019).

Before the action was carried out, the researcher identified the initial condition of students' mathematics learning outcomes through a daily test. The results showed that the majority of students had not yet achieved the Minimum Mastery Criterion (KKM) and their learning activities were still low. A summary of the initial data can be seen in the following table:

Table 1. Summary of Mathematics Learning Outcomes in the Pre-Cycle

Category	Pre-Cycle Results
Number of Students	17
Students Achieved Mastery	5
Students Not Yet Achieved Mastery	12
Average Score	63%
Mastery Percentage	29%

Based on these data, it can be seen that only 29% of students achieved scores above the Minimum Mastery Criterion (KKM). This situation indicates the need for innovative and engaging actions to improve students' participation and mathematics learning outcomes. Therefore, the Kahoot-based Team Quiz strategy was implemented as an intervention in Cycles I and II to address the identified problems.

3. Results and Discussion

The fifth-grade classroom at SDN 23 Tanjung Gadang has diverse and challenging learning conditions, particularly due to the heterogeneity of students' academic abilities and social backgrounds. From a total of 17 students 10 boys and 7 girls most come from families with varying levels of parental education, resulting in different levels of academic support at home. Many students show enthusiasm for learning; however, a number of them tend to be less active, especially during lessons delivered through conventional lecture-based methods. Mathematics instruction has predominantly relied on traditional approaches such as teacher explanations, board exercises, and homework assignments. The use of digital learning media has been minimal, limiting opportunities for students to engage with interactive technology-based learning experiences. The classroom environment itself is physically conducive, with good ventilation, adequate lighting, and flexible seating arrangements that can be adjusted according to instructional needs. Nevertheless, the availability of technological devices such as projectors or computers is limited, requiring careful management throughout the research implementation.

In addition, the interaction dynamics among students play a significant role in the learning environment. Some students tend to work individually, while others prefer

collaborating in small groups, which can affect the effectiveness of group work if not supported by an appropriate instructional strategy. Students' initial mathematical abilities also vary, with some able to grasp concepts quickly while others require scaffolding and more structured guidance. The teacher previously attempted several instructional variations such as group discussions and question–answer sessions, but the outcomes remained suboptimal due to the lack of engaging and interactive media. Given these characteristics, the fifth-grade classroom has strong potential to improve when provided with more innovative and interactive strategies, particularly those involving gamification such as the Kahoot-based Team Quiz. Therefore, this class serves as an appropriate setting for conducting classroom action research aimed at enhancing student activity and learning outcomes through the integration of technology-enhanced learning.

In addition to observational data, students' learning outcomes were assessed through evaluation tests administered at the end of each meeting, ensuring that cognitive achievement could be directly measured after the implementation of each action. Student responses toward the learning experience were also collected using structured questionnaires distributed at the end of all cycles, allowing researchers to understand students' attitudes, motivation levels, and perceptions of the Kahoot-based strategy. Documentation was carried out through various methods, including photographs of classroom activities, teacher and researcher field notes, and reflective discussions held at the end of each cycle. These forms of documentation provided additional qualitative evidence that the implementation of the Kahoot-based Team Quiz strategy adhered to the principles and procedures of classroom action research. The appearance of the Kahoot interface used during the learning sessions is shown in Figure 1.

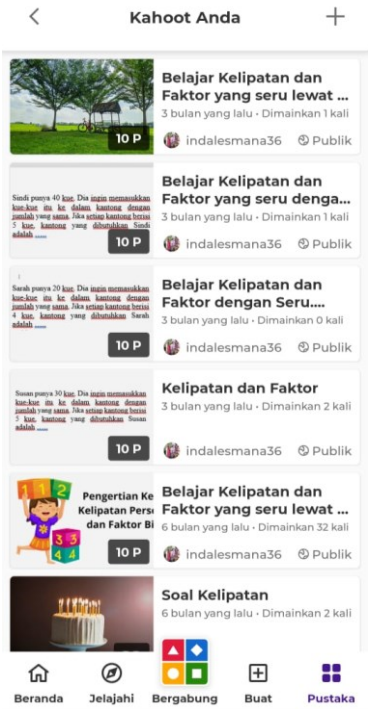

Figure 1. Kahoot Application Interface

Results

This research was carried out in two cycles, each consisting of two meetings. The aim of the action was to improve the learning activities and mathematics achievement of fifth-grade students at SDN 23 Tanjung Gadang through the implementation of the Kahoot-based Team Quiz strategy. Learning outcomes were assessed through evaluation tests administered after each meeting. Mastery learning was determined based on the Minimum Mastery Criterion (KKM), which was set at 65. In addition, the success of the action was also measured by the increase in the class average score and the number of students who achieved mastery. The following is a summary of the learning outcomes at each stage of the action.

Table 2. Summary of Student Learning Outcomes at Each Stage

Stage	Average Score	Students Achieved Mastery	Mastery Percentage
Pre-Cycle	63	5	29%
Cycle I Meeting 1	65	9	53%
Cycle I Meeting 2	75	11	65%
Cycle II Meeting 1	79	13	76%
Cycle II Meeting 2	85	16	94%

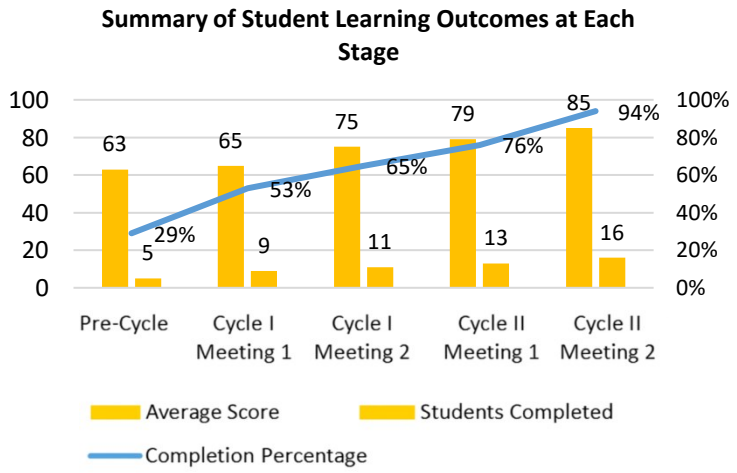

Figure 1. Summary of Student Learning Outcomes at Each Stage

a) Analysis of Pre-Cycle Results

The initial stage indicated that mathematics learning had not yet been optimal. Out of 17 students, only 5 (29%) achieved the Minimum Mastery Criterion (KKM), while the remaining 12 did not reach mastery. The class average score was 63. These results suggest that the previous learning strategies had not successfully activated students either cognitively or psychomotorically. The learning process was still conventional, dominated by lectures with minimal interaction. Low student participation and the lack of variety in instructional media are presumed to be the main factors contributing to the unsatisfactory learning outcomes.

b) Results of Cycle I Meeting 1

After implementing the Kahoot-based Team Quiz strategy in the first meeting of Cycle I, the average score increased to 65, with the number of students achieving mastery rising to 9 students (53%). Although this improvement was not yet significant, it indicated the initial impact of using a more participatory and technology-based strategy. In this meeting, students began to show interest in learning due to the more engaging and competitive classroom atmosphere created through the Kahoot quiz game. However, some students still needed time to adapt to the quiz system and their roles within the group.

c) Results of Cycle I Meeting 2

A more significant improvement occurred in the second meeting. The class average score increased to 75, and 11 students (65%) had achieved the minimum mastery criteria (KKM). This indicates that with continuous practice and experience from the previous meeting, students became more accustomed to and confident in participating in the quiz activities. Team interactions also improved, especially during discussions before answering the quiz. The teacher began to observe changes in students' learning behavior, shifting from passive to active participation, both individually and in groups. Nevertheless, some students were still less active in discussions and tended to rely on their groupmates.

d) Results of Cycle II Meeting 1

The first meeting of Cycle II showed a positive trend. The class average score increased to 79, with 13 students (76%) achieving mastery. At this stage, students appeared more enthusiastic, not only in answering questions but also in creating questions and planning quick-response strategies in the Kahoot application. The teacher also refined the approach by giving more specific guidance to students who had not yet reached mastery, such as providing additional time for discussion before answering. Collaborative learning patterns developed further, and students demonstrated improvement in understanding mathematical concepts rather than merely memorizing them.

e) Results of Cycle II Meeting 2

In the final meeting, there was a very significant improvement. The average score reached 85, with 16 out of 17 students (94%) achieving scores above the mastery threshold (KKM). Only one student had not yet fully met the criteria, but still showed notable progress compared to previous results. This outcome indicates that the learning process was effective and successfully met the predetermined success targets. Students were highly engaged in each session, both during group discussions and while answering quizzes. The classroom atmosphere became more lively, competitive, and enjoyable. Beyond learning outcomes, students also demonstrated clear growth in self-confidence and communication skills.

f) General Evaluation

Overall, the Kahoot-based Team Quiz strategy successfully improved the mathematics learning outcomes of fifth-grade students. The improvement was evident across all indicators, namely average scores, the number of students achieving mastery, and the mastery percentage. From only 29% in the initial stage, mastery increased to 94% by the end of the cycle. The average score also rose from 63 to 85. The consistent improvement from one cycle to the next demonstrates that this learning model can effectively address challenges related to student engagement and low comprehension in mathematics learning. These findings are consistent with previous studies showing that the Team Quiz strategy and the integrated use of the Kahoot platform can create an active, enjoyable learning environment and enhance students' academic performance (Putra et al., 2023).

Discussion

The findings of this study show that the implementation of the Kahoot-based Team Quiz strategy consistently improved the mathematics learning outcomes of fifth-grade students at SDN 23 Tanjung Gadang. This improvement was reflected in the increase of class average scores, the number of students achieving mastery, and the percentage of overall mastery from the pre-cycle to Cycle II. This demonstrates that interactive, collaborative, and technology-based learning strategies have a significant impact on student motivation and comprehension.

The gradual increase in learning outcomes confirms the effectiveness of the strategy. Initially, students' achievement was still low, with an average score of 63 and only 29% reaching mastery. However, after the intervention, the average score increased to 85, with 94% of students achieving mastery by the end of Cycle II. This progress did not occur instantly, but rather through a gradual process as students became more engaged and adapted to the applied learning strategy.

The Team Quiz strategy enabled students to learn in an environment that was both competitive and cooperative. Within small groups, students were encouraged to work together to understand the material and prepare responses for the quiz questions. This not only improved their mathematical conceptual understanding but also fostered social skills such as communication and teamwork. The strategy shifted the focus from individual, passive learning toward a more active and participatory process. As noted by Rahmatullah and Sutarto (2022), the Team Quiz model increases student engagement in learning, as students become more active in discussions and in testing one another's understanding within the team.

The integration of Kahoot as a learning medium reinforced the effectiveness of the strategy. Kahoot presents quizzes in an attractive visual format, incorporating colors, music, and real-time scoring. This gamified learning atmosphere made the classroom environment more enjoyable and motivating for students. Wang and Tahir (2020) concluded that Kahoot enhances students' enthusiasm, provides quicker feedback on learning outcomes, and strengthens cognitive engagement in

class. Similarly, Zhao (2019) found that Kahoot significantly boosts student motivation and classroom participation by creating an engaging and interactive learning experience**.** The success of this strategy was also evident in the increase of student activity during lessons. Previously passive students began actively participating in group discussions, asking questions to the teacher, and enthusiastically answering quiz items.

Another important factor was the teacher's role in designing and facilitating the strategy. Teachers were not merely transmitters of content, but also facilitators who managed group dynamics and provided guidance during the quiz activities. Clear instructions, effective time management, and the selection of questions aligned with basic competencies were key to the successful implementation of the strategy. The results of this study reinforce previous findings. Putri et al. (2022) reported that using Kahoot in mathematics learning significantly improved student achievement, especially in topics requiring conceptual understanding. Similarly, Putra et al. (2023) concluded that integrating active learning with digital media is highly relevant in elementary schools, as it aligns with students' natural preference for interaction and visual challenges.

Theoretically, the success of this strategy aligns with the Constructivist Learning approach, which emphasizes the active role of students in building knowledge through contextual learning experiences. In this context, Kahoot serves as a medium that provides challenge-based and immediate-response learning experiences, while the Team Quiz strategy offers a collaborative space for processing and testing students' understanding. Furthermore, this approach supports digital literacy and 21st-century skills such as collaboration, communication, and critical thinking. In modern education, these skills are essential learning outcomes. Therefore, the Kahoot-based Team Quiz strategy can be considered a viable alternative for implementation in elementary school learning, as part of efforts to create classrooms that are more adaptive, engaging, and effective. Nevertheless, the implementation of this strategy also poses certain challenges, such as the need for digital devices and stable internet connectivity. Additionally, teachers' skills in managing technology-based classrooms and designing high-quality quiz questions are crucial determinants of its effectiveness. Therefore, teacher training and adequate school facilities are needed to ensure this strategy can be implemented optimally and sustainably.

4. Conclusion

Based on the findings of this study conducted over two cycles, it can be concluded that the implementation of the Kahoot-based Team Quiz strategy proved effective in improving the mathematics learning outcomes of fifth-grade students at SDN 23 Tanjung Gadang. This strategy not only increased the class average score and mastery percentage but also created a more active, enjoyable, and collaborative learning atmosphere. Before the intervention, initial conditions showed that mathematics learning was still dominated by conventional methods, leading to low

student engagement and poor learning outcomes, with an average score of 63 and only 29% mastery. After applying the strategy in Cycle I, a gradual and significant improvement was observed, reaching an average score of 85 and 94% mastery by the end of Cycle II. This increase demonstrates that the Team Quiz strategy combined with Kahoot successfully encouraged greater student engagement in the learning process. Overall, the Kahoot-based Team Quiz strategy had a positive impact on students' cognitive improvement while also fostering social skills development through group work and active participation in quizzes. This strategy also met the learning needs of elementary school students, who tend to prefer visual, competitive, and technology-based activities. Therefore, this model is relevant as an alternative innovative learning strategy for teaching mathematics at the elementary school level.

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