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THE EFFECTIVENESS OF KAHOOT AS AN INTERACTIVE LEARNING MEDIA ON STUDENTS' MOTIVATION, ACTIVITIES, AND MATHEMATICS LEARNING OUTCOMES

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Abstract:
The integration of digital learning technologies has become increasingly important for fostering interactive and student-centered learning environments. This study aims to examine the effectiveness of Kahoot as an interactive learning medium in improving students' motivation, learning activities, and mathematics learning outcomes. The research employed a mixed-methods sequential explanatory design involving 32 seventh-grade students and two mathematics teachers. Quantitative data were collected through pre–post tests, motivation questionnaires, and classroom observation sheets, while qualitative data were obtained through semi-structured interviews and documentation. The results showed significant improvements in students' learning outcomes, with the mean score increasing from 52.33 to 78.67 and mastery achievement rising from 33.3% to 90%. Learning motivation increased from a mean score of 61.2 to 82.5, while classroom participation improved from 30% to 100%. These findings indicate that Kahoot effectively enhances cognitive, motivational, and behavioral aspects of learning. The study contributes to the literature by integrating cognitive and engagement dimensions within a mixed-methods framework and recommends integrating gamified digital platforms into mathematics instruction.

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INTRODUCTION

The rapid expansion of digital technology has fundamentally reshaped educational practices worldwide, requiring educators to adopt innovative teaching approaches that align with the learning characteristics of digitally native students. Contemporary learners are increasingly accustomed to interactive and technology-mediated environments, making traditional lecture-based instruction less effective at sustaining their attention and engagement (Kupchyk et al., 2021; Marte, 2024; Markauskaite et al., 2020). Recent global education reports indicate that integrating digital learning tools can increase student participation by approximately 20–35% compared with conventional teaching approaches (OECD, 2022). In addition, interactive learning environments have been reported to foster deeper conceptual understanding and stronger motivation to learn among students (Seyabi et al., 2021; Aaltonen et al., 2023; Benjamin et al., 2023). Consequently, the use of technology-enhanced learning platforms has become an essential strategy in modern education systems. Integrating interactive media into classroom instruction is therefore crucial not only for improving academic achievement but also for cultivating active learning behaviors among students in increasingly digital learning environments.

Despite the growing emphasis on technology integration in education, many classroom practices still rely heavily on teacher-centered instruction. Mathematics classrooms, in particular, often prioritize procedural explanations and repetitive exercises over interactive learning activities (Nurnberger et al., 2023; Chan et al., 2022). Such instructional practices may limit student participation and reduce motivation to learn, ultimately affecting academic performance. National educational statistics indicate that mathematics remains one of the subjects with relatively low mastery levels among junior secondary students, with only around 58–60% of students achieving the expected learning competencies. This condition reflects persistent challenges in designing engaging mathematics instruction (Alghamdi et al., 2024; Conradty et al., 2020; Madden et al.,2021). Moreover, abstract mathematical topics such as Systems of Linear Equations in Two Variables (SPLDV) require conceptual visualization and active problem-solving processes. When these topics are taught through conventional methods without interactive learning media, students often struggle to understand the concepts, which may further decrease their motivation and engagement during the learning process.

Recent studies have explored the potential of digital game-based learning platforms in enhancing student engagement and learning outcomes. Research by Yuenyongviwat et al. (2021) and Ponomarenko et al. (2023) demonstrated that the use of Kahoot in classroom instruction significantly improved students' learning performance and engagement. Similarly, Carrión et al. (2022) and Wayan (2024) found that Kahoot-based quizzes improved classroom participation and increased students' motivation during learning activities. In another study, Neureiter et al. (2020) and Safitri (2024) reported that gamified learning platforms could increase student participation rates by nearly 30% compared to traditional classroom quizzes. Furthermore, Janković et al (2022) and Tomczyk et al. (2022), and Owen et al. (2020) highlighted that digital learning technologies contribute to improved cognitive and emotional engagement among students. Although these studies confirm the benefits of game-based learning platforms, most focus primarily on either learning outcomes or student perceptions. Research on the simultaneous interaction among motivation, learning activity, and academic achievement has been limited within a comprehensive analytical framework.

Although the educational potential of Kahoot has been widely recognized, several limitations remain in the current body of literature. Many existing studies tend to emphasize cognitive outcomes, such as test scores or short-term learning gains, while paying less attention to the behavioral and motivational processes that occur during learning activities. Educational research suggests that learning motivation plays a crucial role in shaping students' engagement and persistence in academic tasks (Alberto et al., 2022; Gorbatov et al., 2022). For instance, motivated learners demonstrate approximately 30–40% higher participation in classroom learning activities than students who exhibit low motivation. However, empirical investigations that simultaneously explore the relationships among motivation, classroom activity, and learning outcomes in technology-supported learning environments remain relatively scarce (Liyanawatta et al., 2022; Moon et al., 2020). Moreover, most previous studies rely solely on quantitative methods, which may not fully capture students' learning experiences and classroom interactions. Addressing these limitations requires a more comprehensive methodological approach.

To address the identified research gap, this study adopts a mixed methods approach using a sequential explanatory design that integrates quantitative and qualitative analyses. The quantitative phase examines the extent to which Kahoot-based learning influences students' motivation, classroom participation, and academic achievement in mathematics learning. Meanwhile, the qualitative phase explores

students' perceptions and experiences in using interactive digital media during the learning process. This integrated design enables a more comprehensive understanding of how gamified learning environments influence both the cognitive and affective dimensions of learning. By combining statistical analysis with qualitative insights, this research offers a deeper understanding of the mechanisms by which interactive learning platforms enhance students' engagement. Such an approach represents an important contribution to the growing body of literature on technology-enhanced learning, particularly in the context of secondary school mathematics education.

Based on the issues discussed above, a critical challenge in contemporary mathematics education is designing instructional strategies that effectively integrate digital technology while simultaneously improving students' motivation, classroom engagement, and academic achievement. Therefore, this study aims to investigate the implementation of Kahoot as an interactive learning medium in mathematics instruction and examine its influence on students' learning motivation, learning activity, and learning outcomes. In addition, the study seeks to identify supporting factors and potential obstacles encountered during the implementation of Kahoot-based learning activities. By employing a mixed-methods sequential explanatory design, this research attempts to provide a comprehensive explanation of how gamified learning platforms influence students' learning experiences and academic performance. The findings are expected to contribute both theoretically and practically to the development of innovative and student-centered learning strategies in digital-era education.

RESEARCH METHODS

Research Design

This study employed a mixed-methods, sequential explanatory design, integrating quantitative and qualitative data to obtain a comprehensive understanding of the effectiveness of Kahoot as an interactive learning medium (Feuer et al., 2024). In the first phase, quantitative data were collected and analyzed to measure the impact of Kahoot on students' learning motivation, classroom activity, and learning outcomes in mathematics. In the second phase, qualitative data were gathered to explain and interpret the quantitative findings in greater depth. The sequential explanatory design allowed the researchers first to identify statistical trends and subsequently explore participants' experiences and perceptions that may explain those trends.

Participants

The participants in this study were 32 seventh-grade students selected using a total sampling technique, ensuring that all students in the class were included. The participants comprised 14 male students and 18 female students. In addition to students, two mathematics teachers who taught seventh-grade classes served as key informants, providing professional insights into the implementation of Kahoot in classroom learning. The inclusion of both students and teachers enabled the study to capture multiple perspectives on the use of Kahoot in the learning process.

Research Procedure

The study was conducted over approximately three months, from September to December 2025, and consisted of several stages. The preparation stage ran from September 1 to September 10, 2025, and involved designing the research instruments,

preparing Kahoot-based learning materials, and validating the instruments. The implementation stage took place from September 13 to October 8, 2025, during which Kahoot was integrated into the mathematics learning process. Data collection was conducted between October 11 and October 22, 2025, including the administration of post-tests, questionnaires, observations, and interviews. Finally, the data analysis stage was conducted from October 25 to December 5, 2025, during which both quantitative and qualitative data were systematically analyzed and interpreted.

Quantitative Instruments

The quantitative data were collected using three main instruments: learning outcome tests, a learning motivation questionnaire, and an observation sheet of student learning activities (Stern et al., 2020). The learning outcome test consisted of a pre-test and a post-test, each containing 20 multiple-choice questions and 5 essay questions related to the basic concepts of systems of linear equations in two variables (SPLDV). The pre-test was administered before the implementation of Kahoot, while the post-test was administered after the intervention to measure students' learning improvement. The validity of the test items was examined using the Pearson Product-Moment correlation, and the reliability analysis using Cronbach's Alpha yielded a reliability coefficient of 0.87, indicating high reliability.

Students' learning motivation was measured using a questionnaire comprising 25 statements on a five-point Likert scale, ranging from strongly agree to disagree strongly. The questionnaire was designed to assess students' interest, engagement, and enthusiasm toward the learning process when Kahoot was integrated into classroom activities. The reliability analysis of the motivation questionnaire produced a Cronbach's Alpha coefficient of 0.83, demonstrating satisfactory internal consistency. Student learning activities were measured through structured classroom observations using an observation sheet that included indicators such as attendance, focus during learning activities, participation in answering questions, and involvement in peer discussions. To enhance data objectivity and reliability, the observations were conducted by two independent observers during the learning sessions.

Qualitative Instruments

Qualitative data were collected through in-depth interviews and documentation (Creswell et al., 2023). Semi-structured interviews were conducted with six students, selected purposively to represent different levels of academic performance: two high-achieving, two medium-achieving, and two low-achieving. The interviews explored students' experiences using Kahoot, perceived changes in learning motivation and participation, and challenges encountered during the learning process. In addition, interviews were conducted with two mathematics teachers to gain insights into the implementation of Kahoot, its observed impact on student engagement and learning outcomes, and the strategies used to address potential challenges during the learning process. Documentation was also employed to support the qualitative findings. The documentation included photographs and videos of classroom learning activities, researcher field notes, and learning reports generated from the Kahoot platform. These documents provided supplementary evidence to strengthen the credibility and richness of the qualitative data.

Data Analysis

The data analysis process used both quantitative and qualitative analytical techniques (Watson, 2022). Quantitative data from the pre- and post-tests were analyzed using descriptive and inferential statistical methods to assess changes in students' learning outcomes following the implementation of Kahoot. Data from the motivation questionnaire and classroom observations were also analyzed descriptively, using percentage distributions to illustrate students' motivation and learning activity during the intervention.

Qualitative data obtained from interviews and documentation were analyzed using an interactive data analysis model, which involved data reduction, data display, and conclusion drawing. Data reduction was carried out by selecting, focusing on, and simplifying relevant information from the interviews and documentation. Subsequently, the data were presented in an organized form to facilitate interpretation and comparison between data sources. Finally, conclusions were drawn through a systematic process of interpreting the patterns and themes that emerged from the data. This analytical process enabled the researchers to integrate the quantitative findings with qualitative explanations, thereby providing a more comprehensive understanding of the impact of Kahoot on students' learning motivation, activity, and learning outcomes.

RESULTS AND DISCUSSION

Results

The results section presents the findings of the study regarding the impact of Kahoot-based learning on students' mathematics learning outcomes, motivation, and classroom engagement. The analysis integrates quantitative data from tests, questionnaires, and observations with qualitative insights from interviews. These results provide a comprehensive understanding of how interactive digital learning platforms influence students' participation, motivation, and conceptual understanding in mathematics learning.

Improvement in Students' Learning Outcomes

The quantitative analysis revealed a significant improvement in students' mathematics learning outcomes after the implementation of Kahoot-based learning. The comparison between pre-test and post-test scores shows that students experienced substantial academic progress after participating in interactive quiz-based activities. Before the intervention, the average pre-test score was 52.33, indicating relatively low mastery of the SPLDV material. Only 10 out of 32 students (33.3%) achieved the minimum mastery criterion (≥70). After the Kahoot-based learning sessions were conducted, the average post-test score increased to 78.67, and 27 students (90%) reached the mastery criterion.

Table 1. Comparison of Pre-test and Post-test Scores

Indicator	Pre-test	Post-test	Improvement
Mean Score	52.33	78.67	+26.34
Students Achieving Mastery	10 (33.3%)	27 (90%)	+56.7%
Total Students	32	32	—

A paired-samples t-test indicated a p-value < 0.05, demonstrating that the improvement in students' learning outcomes was statistically significant. These findings suggest that Kahoot effectively supports students' understanding of mathematical

concepts by transforming learning activities into engaging, interactive experiences. Further conceptual analysis also showed that students' understanding of SPLDV concepts improved considerably. Prior to the intervention, only 50% of students understood the basic SPLDV concept, whereas after the implementation, the percentage increased to 93%. Similarly, understanding of elimination and substitution methods increased from 43% to 87%, while the ability to apply SPLDV in real-life contexts improved from 37% to 90%.

Enhancement of Students' Learning Motivation

The results of the motivation questionnaire indicate that Kahoot significantly improved students' motivation to learn. Before the intervention, the average motivation score was 61.2, placing it within the moderately motivated learners category. After the implementation of Kahoot-based activities, the average score increased to 82.5, indicating a high level of learning motivation.

Table 2. Changes in Students' Learning Motivation

Motivation Indicator	Before Implementation	After Implementation	Increase
Mean Motivation Score	61.2	82.5	+21.3
Intrinsic Motivation Increase	—	40% of students	—
Extrinsic Motivation Increase	—	50% of students	—
Students Enjoying Mathematics More	—	90% of students	—

The improvement in motivation can be attributed to the gamification elements embedded in Kahoot, including a leaderboard, real-time scoring, and instant feedback. These features create a sense of excitement and competition among students, which encourages them to participate more actively in the learning process. Qualitative findings from student interviews further supported these results. Many students reported that using Kahoot made learning mathematics more enjoyable and less stressful. Students felt motivated to answer questions quickly and accurately to achieve higher leaderboard rankings, which, in turn, encouraged them to understand the material more deeply.

Increase in Students' Learning Activities

Observational data also revealed significant improvements in students' classroom engagement after the introduction of Kahoot. Several indicators of learning activity, such as attendance, learning focus, participation, and peer discussion, showed notable progress compared with conventional classroom conditions.

Table 3. Transformation of Students' Learning Activities

Activity Indicator	Conventional Learning	Kahoot-Based Learning	Improvement
Attendance	86.7%	100%	+13.3%
Learning Focus	53.3%	93.3%	+40%
Participation in Answering Questions	30%	100%	+70%
Peer Discussion	40%	85%	+45%

The results indicate that Kahoot significantly enhanced classroom interaction and student engagement. During traditional lessons, participation was limited to a small number of active students. However, with the integration of Kahoot, all students were encouraged to participate through digital quiz responses. Classroom observations also

revealed that the learning atmosphere became more dynamic and collaborative. Students frequently discussed quiz answers with their peers after each question session, particularly when analyzing incorrect responses. This process fostered peer learning and collective problem-solving among students.

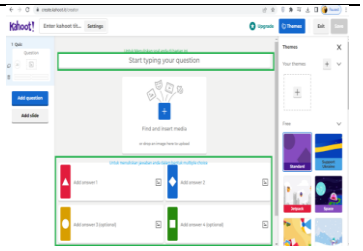
Supporting Factors and Challenges in Kahoot Implementation

The qualitative findings also revealed several supporting factors that contributed to the successful implementation of Kahoot in the classroom. One of the most important factors was the well-designed quiz structure that aligned with students' cognitive levels. The quizzes were enriched with multimedia elements such as images, visual prompts, and time-limited responses, which helped students better understand abstract mathematical concepts. In addition, the availability of technological infrastructure, including computer laboratory facilities and relatively stable internet connectivity, supported the smooth execution of Kahoot-based learning activities. Students' familiarity with digital devices also facilitated their participation, while teacher guidance during quiz discussions clarified misconceptions and strengthened conceptual understanding.

The implementation of Kahoot in this study followed several systematic stages, beginning with registering teacher accounts and developing quizzes. As illustrated in Figure 2.1, the Kahoot platform interface displays the Kahoot logo and the main access page for users. Teachers first accessed the official platform via the Kahoot website and selected the "Sign Up" option in the top-right corner of the homepage. During the registration process, teachers selected the "Teacher" account category as shown in Figure 2.2, which allows educators to create interactive quizzes and manage classroom learning activities.

Kahoots Logo

Kahoot App Registration



Dashboard

The registration process was completed by logging in through a Google account or an active email address. Teachers were then asked to fill in several pieces of information, such as the school name and username. After agreeing to the platform's terms and conditions, the account registration was finalized, and the teacher gained full access to the Kahoot dashboard. After account registration, teachers proceeded to the quiz-creation stage. As presented in Figure 2.3, the Kahoot dashboard provides a "Create" menu that allows educators to design learning quizzes. On this page, teachers can either create a quiz from scratch or select a template provided by the platform. Kahoot offers several types of interactive questions, including multiple-choice quizzes, true-or-false questions, short-answer questions, puzzles, polls, slides, and word cloud activities.

During the quiz development process, teachers could add question text, answer options, images, and time limits for each question. These features enabled teachers to design interactive and visually engaging quizzes that supported students' learning experience. Once the quiz was completed, the teacher selected the "Done" option and

chose the desired game mode, either Classic Mode, where students compete individually, or Team Mode, where students collaborate in groups. After selecting the game mode, the system automatically generated a Game PIN, allowing students to join the quiz session via the Kahoot participation page.

Despite the positive outcomes, several challenges were identified during implementation. Some students lacked personal smartphones, so they had to share devices with peers or use school computers. In addition, occasional internet connectivity issues disrupted the quiz sessions and delayed responses to questions. Teachers also reported that preparing Kahoot-based learning activities required additional preparation time compared with conventional teaching methods, particularly in designing quizzes and selecting appropriate multimedia elements. Overall, the findings suggest that integrating Kahoot as a game-based learning platform can significantly enhance students' learning outcomes, motivation, and classroom engagement. However, effective implementation requires adequate technological infrastructure, careful instructional planning, and flexible classroom management strategies to address potential technical limitations.

Discussion

The findings of this study demonstrate that integrating the Kahoot platform significantly improved students' mathematics learning outcomes, motivation, and classroom engagement. The substantial increase in the mean score from 52.33 on the pre-test to 78.67 on the post-test indicates that interactive digital learning environments can facilitate deeper conceptual understanding of mathematical topics, such as systems of linear equations in two variables (SPLDV). This result aligns with Gamification principles, which suggest that incorporating game elements such as competition, rewards, and immediate feedback can enhance cognitive engagement and knowledge retention. The statistically significant improvement ($p < 0.05$) suggests that the observed progress was not merely incidental but was closely associated with the implementation of the Kahoot-based learning strategy. These results indicate that gamified digital platforms can transform traditionally abstract mathematical learning into more accessible and engaging learning experiences for students.

The findings are consistent with several previous studies that highlight the effectiveness of game-based learning platforms in education. For instance, research conducted by AlSabban et al. (2020) and Bai et al. (2020) reported that the use of Kahoot significantly increased students' academic achievement and classroom engagement in mathematics and science learning contexts. Similarly, Assefa et al. (2024) and Munadi et al. (2023) work demonstrated that interactive quiz platforms promote active learning by encouraging students to participate more frequently in classroom activities. The improvement in conceptual understanding observed in this study, particularly the increase in students' comprehension of elimination and substitution methods, supports these earlier findings. However, this study contributes additional evidence by combining quantitative improvements with qualitative insights from interviews and classroom observations, thereby providing a more comprehensive understanding of how Kahoot supports both cognitive and behavioral aspects of learning.

Beyond learning outcomes, the findings also indicate a substantial improvement in students' motivation to learn. The increase in the average motivation score from 61.2 to 82.5 suggests that gamified learning environments can positively influence both intrinsic and extrinsic motivational factors. This finding is consistent with John Falgoust et

al. (2022) and He et al. (2021) motivational theory, which emphasizes the role of achievement-oriented environments in motivating learners. The leaderboard system, instant feedback, and competitive elements embedded in Kahoot appear to have stimulated students' curiosity and enthusiasm during the learning process. These features created a sense of excitement that encouraged students to participate actively and to strive for higher performance (Lechner et al., 2021; Knippenberg et al., 2020). The qualitative interview results further support this interpretation, as most students reported that mathematics learning became more enjoyable and less stressful when Kahoot was integrated into classroom instruction.

The improvement in classroom engagement observed in this study also supports the broader literature on technology-enhanced learning. Observational data showed that students' participation in answering questions increased from 30% to 100%, while peer discussions increased from 40% to 85%. These findings align with Deterding's research, which shows that game elements can stimulate collaborative learning and social interaction among learners. The integration of Kahoot not only increased individual participation but also fostered collaborative learning dynamics, as students often discussed quiz answers with peers after each question session. This collaborative interaction allowed students to reflect on their mistakes and collectively refine their understanding, thereby promoting deeper learning. The results, therefore, indicate that Kahoot does not merely function as an assessment tool but also as a pedagogical strategy that promotes interactive and student-centered learning environments.

From a theoretical perspective, the findings reinforce the relevance of gamification and digital learning theories in contemporary education, particularly in mathematics instruction, where abstract concepts often pose challenges for learners. Practically, the study suggests that teachers can effectively integrate Kahoot into classroom instruction to improve students' motivation, engagement, and academic performance. However, successful implementation requires adequate technological infrastructure, careful instructional planning, and well-structured quiz content that aligns with students' cognitive levels. Schools and educators should therefore consider integrating gamified digital platforms as complementary tools within traditional teaching methods. By combining pedagogical innovation with technological support, educational institutions can create more interactive and inclusive learning environments that better align with the learning preferences of digital-age students.

CONCLUSION

This study demonstrates that the use of Kahoot as an interactive learning medium significantly enhances students' mathematics learning outcomes, motivation, and classroom engagement, as reflected in the substantial improvement of academic achievement, increased motivation scores, and higher levels of active classroom participation. The most important finding is that the gamification features embedded in Kahoot, including real-time feedback, competitive leaderboards, and interactive quizzes, create a more engaging learning environment that strengthens students' cognitive understanding as well as their affective and behavioral involvement in mathematics learning. Scientifically, this study contributes to the growing body of research on digital game-based learning by providing empirical evidence, through a mixed-methods approach, that the effectiveness of technology-enhanced instruction is influenced not only by the platform itself but also by supporting factors such as well-structured quiz design, adequate technological infrastructure, and active teacher facilitation. However,

this study also has several limitations, including restricted access to personal devices, unstable internet connectivity, the additional preparation time required for designing interactive quizzes, and the short-term focus of the intervention, which leaves opportunities for future research to examine the long-term effects of gamified learning on students' critical thinking, collaborative learning behaviors, and sustained academic achievement.

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