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ARTICLE

The Interactive Kahoot Game's Impact on Student Interest and Independence in Mathematics Learning

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Abstract

This study aims to examine the impact of the interactive game-based platform Kahoot on student engagement and learning independence in mathematics instruction at Kebun 2 Elementary School. The study addresses two critical issues: low levels of student engagement and the limited development of independent learning strategies in mastering mathematical concepts, both of which necessitate the adoption of innovative pedagogical approaches to foster active participation. This research offers a novel contribution by exploring the application of Kahoot as an interactive instructional tool in elementary mathematics education within a local context, where such studies remain limited. A quasi-experimental design with a quantitative approach was employed, involving 50 fifth-grade students (classes V-A and V-B) selected through saturation sampling. Data were collected using a structured questionnaire measuring student engagement and learning independence. Statistical analysis was conducted using the Independent Samples t-test with IBM SPSS version 27. The findings reveal that the post-test results for both variables yielded a p-value of 0.000, which is below the established threshold of = 0.05, indicating a statistically significant difference between the experimental and control groups. These results demonstrate that the integration of Kahoot significantly enhances student engagement and promotes greater learning independence in mathematics. In conclusion, this study underscores the pedagogical value of interactive digital platforms as effective alternative strategies for creating more engaging learning environments and fostering student autonomy in elementary mathematics education.

Keywords: Interactive Games; Kahoot; Learning Independence; Learning Interest; Learning Media.

1. Introduction

Student interest and learning independence constitute critical components in mathematics education, as they play a pivotal role in optimizing students' learning potential. However, conventional instructional approaches often encounter challenges in fostering the affective domain, resulting in students' overreliance on teacher guidance and limited active engagement in the learning process. Ki Hajar Dewantara emphasized that education functions as a means of cultivating learners' innate

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potential to achieve balance and fulfilment [1] [2]. Similarly, UNESCO conceptualizes education as a process of liberation that empowers learners to actively engage in addressing societal issues [3]. In addition, the perspective presented in [4] asserts that learning occurs through the reconstruction of experience, enabling individuals to grow and adapt within their social environments. More broadly, education is globally acknowledged as a fundamental human right and a cornerstone for promoting peace and sustainable development [5].

One of the key affective factors influencing the effectiveness of the learning process is students' interest in learning [6]. Beyond reflecting the degree of students' attraction to a subject, learning interest also signifies their enthusiasm and willingness to actively participate in classroom activities. Studies in [7] [8] define learning interest as a strong emotional disposition toward learning activities, characterized by sustained attention and active engagement. Furthermore, learning environments that are engaging, relevant, and meaningful have been shown to effectively stimulate and enhance students' interest in learning [9].

Learning independence refers to students' ability to independently manage their educational journey, which includes setting goals, planning strategies, tracking progress, and evaluating learning independence [10]. Furthermore, [11] defines learning independence as having a positive outlook on education, a sense of responsibility, and the ability to make choices during the learning process. Learning independence is the ability to use resources wisely and take initiative when completing learning activities [12]. Therefore, learning independence is very important in technology-based learning, including the use of interactive game media based on Kahoot [13].

Kahoot is an effective interactive learning medium because it has many advantages [14]. First of all, this platform can create a fun learning environment through game elements, healthy competition, and instant feedback, which increases student motivation and engagement [15]. It also encourages students to learn actively and independently when they engage with material that requires investigation, evaluation, and problem-solving [16]. Besides that, Kahoot can make students learn at their own pace and in their own way using interactive Kahoot-based game media, which also empowers them to have their own learning independence [17]. There is a reciprocal relationship between learning independence and learning interest. Students with high interest are more likely to learn independently, and students who are accustomed to learning on their own will be more easily interested in the subject matter they are studying [18].

International literature has been extensively researched on the function of the interactive game Kahoot in mathematics learning. [19] Research and practice in technology-based learning states that the integration of Kahoot substantially improves the motivation and learning outcomes of high school students, thus positively impacting classroom engagement. [20] In the Journal of Innovation and Learning Technology, it is shown that Kahoot-based assessment can increase students' interest in mathematics while creating a more interactive learning environment. In Technology and Multimodal Interaction, [21] shows that using Kahoot with K-12 students not only improves academic performance but also fosters self-management skills in learning. According to research [22] in Education and Information Technologies, Kahoot can promote independent learning through direct and effective feedback mechanisms, thereby increasing intrinsic motivation and active student participation. This study consistently shows that Kahoot is a significant factor in fostering interest in mathematics, while the self-learning aspect is still relatively new and requires further research. As a result, there is potential for scientific novelty in the ongoing research.

The results of previous studies indicate that the focus of previous research has consistently been on learning outcomes and motivation. The research gap is a result of the scarcity of studies that explicitly emphasize Kahoot's potential to enhance students' learning independence, which involves independently managing learning strategies, time, and resources. The current research aims to ad-

dress this gap by highlighting Kahoot's function as an instrument to promote independent learning in the context of mathematics education, in addition to its ability to generate interest. This current research provides a new contribution to the development of interactive technology-based learning strategies by integrating two critical dimensions of interest and learning independence that have not been comprehensively studied in the literature.

Preliminary observations conducted within the context of mathematics education reveal that a majority of students experience difficulties in sustaining their interest in learning and tend to rely heavily on teacher guidance rather than demonstrating autonomous learning behaviors. This condition is reflected in several observable indicators, including low levels of active participation in classroom discussions, limited enthusiasm when engaging in independent tasks, and a persistent tendency among students to wait for teacher explanations instead of attempting to solve problems using their own strategies. Furthermore, the findings from these observations suggest that the predominance of conventional instructional approaches—such as lecture-based teaching and routine written exercises—has not been sufficiently effective in fostering intrinsic motivation or promoting learning independence. This situation underscores the urgent need for the integration of more interactive and engaging instructional media as part of pedagogical innovation.

One potential solution is the utilization of Kahoot, a game-based learning platform that has gained attention for its capacity to provide immediate feedback and to create a learning environment that is both collaborative and competitively stimulating [23]. Such features are considered conducive to enhancing student engagement and encouraging more active participation in the learning process. Based on these preliminary findings, this study is undertaken to systematically examine the role of Kahoot as an interactive game-based medium in fostering students' interest and independence in learning mathematics. Specifically, this research seeks to address the following questions: (1) To what extent does Kahoot, as an interactive game-based medium, influence students' interest in learning mathematics? (2) To what extent does Kahoot, as an interactive game-based medium, influence students' independence in learning mathematics?

2. Methods

2.1 Research Methodology

This study uses a quantitative methodology with a pre-test-post-test control group design. This design was chosen to facilitate a direct comparison between the experimental group, which uses the interactive game media Kahoot, and the control group, which uses traditional methods. This method allows for a more precise measurement of the treatment's impact on interest and learning independence through the examination of pretest and post-test data.

2.2 Research Participants

The study population comprised all fifth-grade students at Kebun 2 Elementary School, totaling 50 individuals, who were organized into two classes: V-A (25 students; 14 female and 11 male) and V-B (25 students; 16 female and 9 male). Class V-A was designated as the experimental group, whereas Class V-B functioned as the control group. The sampling technique employed was saturation sampling, whereby the entire population of fifth-grade students was included in the study [24]. This approach was adopted to ensure comprehensive representation of the target demographic while minimizing selection bias associated with partial sampling. The inclusion of the full population strengthens the internal validity within the specific school context; however, limitations remain concerning the generalizability of the findings to broader educational settings, as well as the potential lack of initial group equivalence inherent in the quasi-experimental design.

2.3 Research Instrument

The research instruments, comprising a learning interest questionnaire and a learning independence questionnaire, were developed using a Likert-scale format. Instrument development involved the systematic selection of indicators grounded in established theories of learning interest and learning independence, followed by the construction of item statements aligned with these indicators. Content validity was established through expert judgment. Subsequently, the instruments were pilot-tested on a small group of students to ensure clarity and comprehensibility. Empirical validity was assessed using item–total correlation analysis, while reliability was evaluated through Cronbach's Alpha coefficients. The results indicate that all items met the criteria for validity and reliability, with coefficient values exceeding 0.70, thereby demonstrating a high level of internal consistency.

2.4 Research Procedure

The study commenced with the administration of a pretest to both the experimental and control groups to assess baseline mathematical proficiency, curiosity, and learning independence. The pretest data were subsequently analyzed using an independent samples t-test to establish the initial equivalence between the two groups. Following this, the experimental group received mathematics instruction through the interactive game-based platform Kahoot, whereas the control group was instructed conventional lecture-based methods supplemented by written exercises. The intervention was implemented over multiple sessions of equal duration for both groups to ensure procedural consistency. Upon completion of the treatment phase, a posttest was administered to evaluate students' learning outcomes. In addition, participants completed a questionnaire measuring interest and learning independence, aimed at capturing potential changes in attitudes, motivational levels, and tendencies toward self-directed learning.

2.5 Data Analysis

Data analysis was conducted through a series of systematic procedures. The research instrument was first evaluated in terms of validity, reliability, homogeneity, and normality. Content validity was established through expert judgment, while instrument reliability was assessed using Cronbach's Alpha, which demonstrated a high level of internal consistency. Homogeneity of variance between groups was examined using Levene's test, whereas data normality was assessed using the Kolmogorov–Smirnov test, yielding significance values greater than 0.05 and thus indicating a normal distribution.

Pretest data were analysed using an independent samples t-test to confirm the absence of statistically significant differences between the experimental and control groups before the intervention. Subsequently, post-test data were analysed using an independent samples t-test with IBM SPSS version 21 to determine the presence of significant differences between the two groups on the variables of learning interest and learning independence. Overall, this analytical framework provides a robust basis for evaluating the effectiveness of Kahoot in enhancing student engagement and fostering learning independence in elementary school mathematics.

3. Results and Discussion

3.1 Results

Table 1. Results of the Normality Test for Learning Independence

One-Sample Kolmogorov-Smirnov Test

		Pretest Learning Independence in Experiment Class	Pretest Learning Independence in Control Class	Posttest Learning Independence in Experiment Class	Posttest Learning Independence in Control Class
N		25	25	25	25
Normal Parameters[a,b]	Mean	.0000000	.0000000	.0000000	.0000000
	Std. Deviation	8.56546001	6.60013021	5.63708300	4.82265038
Most Extreme Differences	Absolute	.194	.084	.107	.099
	Positive	.194	.075	.107	.099
	-.142	-.134	-.084	-.076	-.076
Kolmogorov-Smirnov Z		.969	.418	.536	.496
Asymp. Sig. (2-tailed)		.304	.995	.936	.966
a. Test distribution is Normal.					
b. Calculated from data.					

The results of the normality test for learning independence show that the significance value of the pretest for the experimental class is 0.304, which is higher than the α value of 0.05 (0.304 > α = 0.05), and the significance value of the pretest for the control class is 0.995, which is higher than the α value of 0.05 (0.995 > α = 0.05). Meanwhile, the significance value for the experimental class is 0.936, exceeding the α value of 0.05 (0.936 > α = 0.05), and the significance value for the control class is 0.966, exceeding the α value of 0.05 (0.966 > α = 0.05). Since all significance values of the data instruments are considered normally distributed, this meets the requirements for assessing the data instruments examined in the subsequent tests. The Homogeneity Test on the learning independence variable is as in Table 2.

Table 2. Results of the homogeneity test for the learning independence questionnaire variable

Tests of Homogeneity of Variances

		Levene Statistic	df1	df2	Sig.
Independence Learning	Based on Mean	.057	1	48	.812
	Based on Median	.063	1	48	.804
	Based on Median and with adjusted df	.063	1	43.956	.804
	Based on trimmed mean	.058	1	48	.810

The results of the homogeneity test of the learning interest questionnaire instrument show a significant value of 0.812 > 0.05, indicating that the variances of two or more population groups related to the data can be considered the same. The results of the statistical group test in the independent sample T-test are shown in Table 3.

Table 3. Mean Student Learning Independence Score with Statistical Analysis

Group Statistics					
Pretest	Experiment Class	25	34.40	6.892	1.378
	Control Class	25	32.72	8.537	1.707
Posttest	Experiment Class	25	62.04	5.770	1.154
	Control Class	25	48.84	9.672	1.934

The results of the statistical test for learning independence show that at the pretest stage, the experimental group achieved an average score of 34.40 (SD = X), slightly exceeding the average score of the control group at 32.72 (SD = Y), with standard deviations of 6.892 and 8.537, respectively. The difference is minimal, indicating that the initial conditions of both groups are largely equivalent. In the post-test phase, the average score of the experimental group significantly increased to 62.04 (SD = A), while the control group only reached 48.84 (SD = B). The standard deviation of the experimental group (5.770) is lower than that of the control group (9.672), indicating better result consistency. The explanation for the comparison of the independence questionnaire scores obtained in the experimental and control classes is shown in Figure 1.

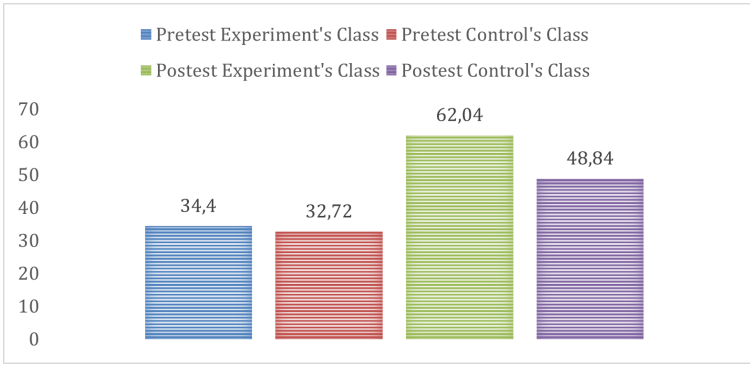

Figure 1. Comparison of results for the learning independence question between the experimental group and the control group

The results of the N-Gain Score test on the learning independence variable can be seen in Table 4.

Table 4. Results of the N-Gain Score test on the variable of learning independence

Descriptive Statistics	N	Minimum	Maximum	Mean	Std. Deviation
Ngain_{Score}	50	.00	.58	.3353	.15663
$\text{Ngain}_{Percent}$	50	.00	57.89	33.5276	15.66254
Valid N (listwise)	50				

The average N-Gain Score for learning independence is 0.3353, which is categorized as medium, indicating that the intervention successfully increased learning independence. The minimum score of 0.00 and the maximum of 0.58 show variation in student achievement. The average percentage of 33.53% indicates that the improvement in learning independence is about one-third of the potential. As a result, the experimental group showed better improvement compared to the control group. The results of the independent sample t-test are presented in Table 5.

Table 5. Data from the Independent Samples T-Test regarding learning independence

Independent Samples Test										
		Levene's Test for Equality of Variances		t-test for Equality of Means						
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
									Lower	Upper
Pretest	Equal variances assumed	3.321	.075	1.771	48	.083	4.040	2.282	-.547	8.627
	Equal variances not assumed			1.771	42.219	.084	4.040	2.282	-.564	8.644
Posttest	Equal variances assumed	.057	.812	6.958	48	.000	10.960	1.575	7.793	14.127
	Equal variances not assumed			6.958	46.877	.000	10.960	1.575	7.791	14.129

The findings of the independent sample t-test showed no significant difference between the experimental and control classes in the pretest (Sig. 2-tailed = 0.083 > 0.05), indicating that the initial conditions of both groups were generally comparable. In the post-test, a significance value of 0.000 < 0.001 was recorded, indicating a substantial difference between the two groups after the treatment. The average difference of 10.96, with a 95% confidence interval between 7.79 and 14.12, proves that the experimental group showed a greater improvement in learning independence. The results of the effect size test on the learning independence variable are shown in Table 6.

Table 6. Results of the Effect Size Test for the variable of learning independence

Independent Samples Effect Sizes					
				95% Confidence Interval	
		Standardizer[a]	Point Estimate	Lower	Upper
Pretest	Cohen's d	8.066	.501	-.065	1.062
	Hedges' correction	8.195	.493	-.064	1.045
	Glass's delta	9.442	.428	-.144	.991
Posttest	Cohen's d	5.569	1.968	1.282	2.641
	Hedges' correction	5.658	1.937	1.262	2.599
	Glass's delta	5.984	1.832	1.064	2.578

The reported effect size indicates that the Cohen's d value for the post-test reached 1.968, which falls within the large effect category. This finding is further corroborated by comparable estimates

obtained through Hedges' correction and Glass' delta, collectively suggesting that the treatment exerted a substantial positive impact on students' learning independence. In contrast, the pretest results yielded effect sizes within the small to medium range and were not statistically significant, indicating no meaningful difference before the intervention. Therefore, it can be concluded that the implemented treatment was highly effective in significantly enhancing students' learning independence.

Next, a normality test was conducted on the learning interest variable, with the results as in Table 7.

Table 7. Results of the Normality Test for Learning Interest

One-Sample Kolmogorov-Smirnov Test

		Pretest Learning Independence in Experiment Class	Pretest Learning Independence in Control Class	Posttest Learning Independence in Experiment Class	Posttest Learning Independence in Control Class
N		25	25	25	25
Normal Parameters[a,b]	Mean	.0000000	.0000000	.0000000	.0000000
	Std. Deviation	8.63360345	6.27885140	8.82532307	5.26441527
Most Extreme Differences	Absolute	.180	.080	.139	.114
	Positive	.180	.080	.139	.114
	Negative	-.099	-.075	-.077	-.091
Kolmogorov-Smirnov Z		.899	.399	.697	.571
Asymp. Sig. (2-tailed)		.394	.997	.715	.900
a. Test distribution is Normal.					
b. Calculated from data.					

The results of the normality test of learning interest show that the significance value of the pretest for the experimental class is 0.394, which is higher than the α value of 0.05 ($0.394 > \alpha = 0.05$), and the significance value of the pretest for the control class is 0.997, which is higher than the α value of 0.05 ($0.997 > \alpha = 0.05$). Meanwhile, the significance value of the experimental class is 0.900, exceeding the α value of 0.05 ($0.900 > \alpha = 0.05$), and the significance value of the control class is 0.715, exceeding the α value of 0.05 ($0.715 > \alpha = 0.05$). Since all significance values of the data instruments are considered normally distributed, this meets the requirements for assessing the data instruments examined in the subsequent tests. The next test is the homogeneity test with the results as in Table 8.

Table 8. Results of the homogeneity test for the learning interest questionnaire variable

Tests of Homogeneity of Variances

		Levene Statistic	df1	df2	Sig.
Learning Interest	Based on Mean	1.492	1	48	.228
	Based on Median	1.456	1	48	.234
	Based on Median and with adjusted df	1.456	1	41.917	.234
	Based on trimmed mean	1.479	1	48	.230

The results of the homogeneity test of the learning interest questionnaire instrument showed a significant value of 0.228 > 0.05, indicating that the variances of two or more population groups related

to the data can be considered the same. The findings of the independent t-test for the hypothesis test on learning independence are presented in Table 9.

Table 9. Mean student learning interest score with statistical analysis

Group Statistics					
Pretest	Experiment	25	34.36	6.402	1.280
	Control Class	25	32.96	11.714	2.343
Posttest	Experiment	25	63.36	5.626	1.125
	Control Class	25	55.76	8.089	1.618

The findings of the statistical test for the learning interest variable indicate that at the pre-test stage, the average score of the experimental group was 34.36 (SD=X) and the control group was 32.96 (SD=Y), which were very comparable, while the control group showed greater variability (Std. Dev. 11.714 compared to 6.402). This condition indicates that both groups started from a comparable baseline. At the post-test stage, the average score of the experimental group increased to 63.36 (SD=A), while the control group only reached 55.76 (SD=B). The standard deviation of the experimental group (5.626) is lower than that of the control group (8.089), indicating greater consistency in the experimental results. The explanation of the comparison of the learning interest questionnaire results obtained in the experimental and control classes is shown in Figure 2.

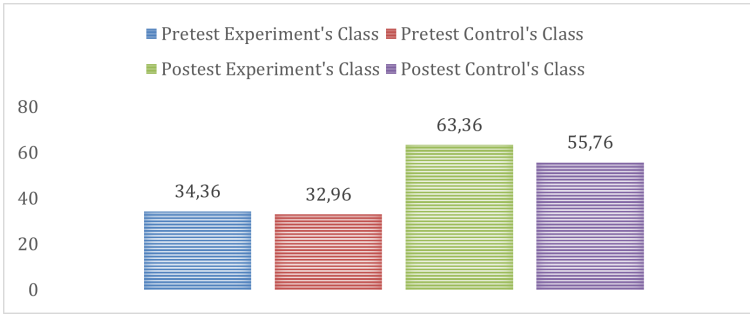

Figure 2. Comparison of results for the learning interest question between the experimental group and the control group

The results of the N-Gain Score test on the learning interest variable can be seen in Table 10.

Table 10. Results of the N-Gain Score test on the variable of learning interest

Descriptive Statistics					
	N	Minimum	Maximum	Mean	Std. Deviation
Ngain$_{Score}$	50	.00	.58	.3574	.14022
Ngain$_{Percent}$	50	.00	46.00	25.2400	10.73533
Valid N (listwise)	50				

The average N-Gain Score for learning interest in the studied class is 0.3574, categorizing it as medium, thus indicating that the applied intervention successfully increased learning interest. The minimum value of 0.00 and the maximum of 0.58 indicate differences in student achievement; however, with a standard deviation of 0.14022, the data distribution is quite moderate. The average percentage of 25.24% indicates that the increase in learning interest is still at a quarter of its maximum potential. This data shows a favourable increase. The results of the independent sample t-test are presented in Table 11.

Table 11. Data from the Independent Samples T-Test regarding learning interest

Independent Samples Test										
		Levene's Test for Equality of Variances		t-test for Equality of Means						
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
									Lower	Upper
Pretest	Equal variances assumed	4.316	.043	2.068	48	.094	5.120	2.476	.141	10.099
	Equal variances not assumed			2.068	41.936	.095	5.120	2.476	.123	10.117
Posttest	Equal variances assumed	6.925	.011	5.860	48	.000	13.200	2.253	8.671	17.729
	Equal variances not assumed			5.860	39.160	.000	13.200	2.253	8.644	17.756

The findings of the independent sample t-test showed a significant difference between the experimental and control groups in the pretest (Sig. = 0.094 > 0.05). This indicates that the initial conditions of both groups were comparable. The post-test had a significance value of < 0.001 and a mean difference of 13.20, indicating a substantial difference post-treatment, with the experimental group showing a greater increase in learning interest compared to the control group. The results of the effect size test on the learning interest variable are presented in Table 12.

Table 12. Results of the Effect Size Test for the variable of learning interest

Independent Samples Effect Sizes					
				95% Confidence Interval	
		Standardizer[a]	Point Estimate	Lower	Upper
Pretest	Cohen's d	8.755	.585	.015	1.148
	Hedges' correction	8.895	.576	.015	1.130
	Glass's delta	10.286	.498	-.079	1.065
Posttest	Cohen's d	7.964	1.657	1.006	2.297
	Hedges' correction	8.091	1.631	.990	2.260
	Glass's delta	9.672	1.365	.681	2.029

The effect size, represented by Cohen's d value in the pretest, is 0.585 (medium category), indicating a large initial difference. In the post-test, the Cohen's d value is 1.657 (large category), with comparable

results in Hedges' correction and Glass' delta, confirming that the treatment significantly increased learning interest.

3.2 Discussion

Statistical analyses indicate a significant difference between the experimental and control groups during the post-test phase. The mean score of the experimental group was higher than that of the control group, and the independent samples t-test confirmed that this difference was statistically significant ($p < 0.05$). In contrast, the pre-test results revealed no statistically significant difference between the two groups, suggesting that the initial conditions were comparable. These findings provide robust empirical evidence that the use of the interactive game-based platform Kahoot exerts a positive effect on students' learning motivation and independence.

The results further suggest that Kahoot creates a dynamic and competitive learning environment that enhances students' self-regulation. Its game-based mechanics—emphasizing speed, accuracy, and immediate feedback—appear to foster active engagement and reflective learning processes. These outcomes can be theoretically grounded in Vygotsky's social constructivism [25], which highlights the central role of social interaction in knowledge construction. The interactive features of Kahoot facilitate collaborative dialogue and peer discussion, thereby reinforcing learning through social engagement. Moreover, the observed improvement in the experimental group's performance can be interpreted through the lens of the Self-Directed Learning (SDL) framework [26] [27] and Knowles' theory of andragogy [28]. Kahoot enables learners to adopt individualized learning strategies while simultaneously strengthening their responsibility for learning outcomes [29].

From a motivational perspective, these findings are also consistent with Self-Determination Theory (SDT) [30]. The significant improvement in the experimental group's performance appears to be associated with the fulfilment of the three basic psychological needs identified by Deci and Ryan—autonomy, competence, and relatedness [31] [32]. Autonomy is reflected in students' ability to determine their response strategies; competence is enhanced through increased confidence resulting from scoring and immediate feedback; and relatedness emerges through social interaction fostered by both competitive and collaborative elements. Thus, the findings not only support established motivational theories but also demonstrate how Kahoot effectively operationalizes these psychological constructs in practice.

Nevertheless, several methodological limitations should be acknowledged. The use of saturation sampling, encompassing the entire school population, may constrain the generalizability of the findings. However, the absence of significant differences in the pre-test results reduces the probability of bias due to baseline disparities. Consequently, the findings can be considered internally consistent and supportive of the conclusion that Kahoot is effective in enhancing both learning interest and independence. This study contributes to the existing body of literature by integrating two relatively underexplored constructs—learning interest and learning independence—demonstrating that interactive media not only enhances motivation but also bridges motivational theory with self-directed learning approaches.

These findings are consistent with prior studies [33] and [34], which report that Kahoot improves motivation and academic performance through immediate feedback, as well as with research by [35] and [36], which emphasizes the importance of engaging learning experiences in fostering student interest. Furthermore, a study published in Computers & Education [37] confirms that Kahoot enhances intrinsic motivation by promoting a sense of competence and active participation, aligning with the present findings on increased learning interest [38]. Notably, this study offers a novel contribution by emphasizing the interaction between learning interest and learning independence—an area that remains relatively underexplored. The integration of these two dimensions

provides a more comprehensive understanding of how Kahoot enhances intrinsic motivation and self-regulation, thereby extending the literature with a more nuanced and integrative perspective.

The practical implications of these findings warrant further emphasis. Kahoot can be effectively utilized as a formative assessment tool, providing immediate feedback that enables instructors to adjust instructional strategies in real time based on students' levels of understanding. Additionally, Kahoot promotes active participation by encouraging students to compare responses, engage in peer discussion, and reflect on their learning processes [39]. It can also be implemented in remedial instruction to support students experiencing difficulties, particularly through interactive and engaging problem-solving activities. Within the context of self-directed learning, Kahoot serves as a valuable self-assessment tool, allowing students to continuously evaluate their understanding and refine their learning strategies [40]. Therefore, Kahoot functions not only as an engaging platform but also as a pedagogically meaningful tool that can be systematically integrated into diverse educational contexts.

4. Conclusion

This study demonstrates that the integration of Kahoot as an interactive learning tool significantly enhances student engagement and learning autonomy. The experimental group outperformed the control group, thereby indicating that Kahoot constitutes an effective pedagogical intervention for fostering a more dynamic classroom environment and strengthening student accountability in the learning process. Accordingly, educators are encouraged to incorporate Kahoot into instructional practices to enhance intrinsic motivation, promote learner independence, and facilitate active student participation.

Nevertheless, several limitations warrant further consideration. First, the relatively small sample size—comprising only 50 students from a single institution—constrains the generalizability of the findings to broader educational contexts. Second, the short duration of the intervention (four weeks) may not sufficiently capture the long-term effects of Kahoot on sustained learning interest or the development of learner autonomy. Third, the study's exclusive focus on mathematics limits the scope of its applicability, thereby leaving uncertainty regarding whether comparable outcomes would be observed across other subject domains.

Future research should address these limitations by employing larger and more diverse samples, extending the duration of the intervention to assess longitudinal impacts, and broadening the disciplinary scope to include multiple subject areas. Such efforts would enable more robust validation of the findings while providing deeper insights into the effectiveness of interactive digital media in enhancing student engagement and autonomy across varied educational settings.

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