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The Effect of Gimkit Media on Elementary Students' Critical Thinking Skills in Science Learning

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Abstract
This study examines the effectiveness of Gimkit, a game-based interactive learning platform, in enhancing the critical thinking skills of fourth-grade elementary students within the context of science education. Addressing the limited development of higher-order thinking skills at the elementary level, this research aimed to determine whether integrating digital media such as Gimkit can significantly improve students' critical thinking performance. Utilizing a quantitative approach and a quasi-experimental design with a nonequivalent control group, the study involved 54 students divided evenly between experimental and control classes. The experimental group received instruction supported by Gimkit, while the control group followed conventional teaching methods. Critical thinking skills were measured using a validated test instrument encompassing four key indicators: analyzing information, formulating problems, drawing conclusions, and evaluating data. Data were analyzed using an independent samples t-test, which revealed a statistically significant difference between the post-test scores of the two groups ($p < .001$). The effect size, as measured by Cohen's $d = 2.118$, reflects a very large impact. Students in the experimental group showed substantial gains across all critical thinking indicators. These results highlight the potential of structured, game-based digital tools to foster cognitive engagement and skill development in elementary science instruction. In short, the findings carry practical implications for the design of instructional strategies that incorporate educational technology to support critical thinking from an early age.

Keywords: digital education, gimkit, critical thinking skills, elementary science

INTRODUCTION

The rapid advancement of science and technology has played a crucial role in driving the progress of education in Indonesia. One of the current challenges faced in this context is improving the quality of learning, particularly through the integration of educational technology. Information and Communication Technology (ICT), in this regard, offers significant potential to support teaching and learning processes by enabling more efficient, relevant, and adaptive instructional methods (Mulyani & Haliza, 2021) At the elementary education level, one of the key challenges is fostering students' higher-order thinking skills. These include the ability to think critically, solve problems, and reason logically and systematically (Mahanal, 2017). Science learning plays a pivotal role in this process. Beyond theoretical understanding, science learning requires students to comprehend concepts, analyze phenomena, and apply knowledge to real-life contexts (Lestari et al., 2024).

As part of the core elementary curriculum, science subjects aim to enhance students' scientific literacy, logical reasoning, and systematic inquiry skills. Science learning involves essential scientific processes such as observation, data collection, hypothesis testing, and conclusion drawing. Consequently, the instructional strategies employed by teachers are fundamental to the development of students' critical thinking abilities (Atiaturrahmaniah et al., 2022). In an era marked by globalization and rapid change, critical thinking has become an essential skill to navigate complex social, economic, and technological issues (Lieung, 2019). Critical thinking skills are essential to training students to solve problems which is relevant not only to learning at school but also to real life problems (Latifah & Suprihatiningrum, 2024).

However, preliminary observations in elementary schools in North Jakarta reveal that many students struggle to develop critical thinking skills. These difficulties are evident in their inability to explore information, construct logical arguments, and draw evidence-based conclusions. This condition is largely attributed to conventional teaching methods that emphasize memorization and provide limited exposure to innovative learning media. Teacher-centered approaches, such as lectures and unstructured discussions, often fail to stimulate students' cognitive engagement. Furthermore, the lack of instructional variety reduces students' motivation and inhibits the development of analytical thinking (Yusnaeni et al., 2017).

To address these issues, the integration of digital technology in classroom instruction is increasingly recognized as essential. One such emerging tool is Gimkit, a game-based learning platform that enables teachers to create interactive quizzes embedded with engaging game mechanics. Unlike traditional assessments, Gimkit promotes an adaptive and competitive learning environment by providing instant feedback and opportunities for answer revision. Through its interactive features, Gimkit is designed not only to increase student engagement but also to foster reflective and critical thinking in subjects such as science (Rohimat, 2023). By engaging in game-based exercises, students are encouraged to analyze questions, make decisions, and refine their reasoning based on feedback (Lee & Yu, 2025).

Although previous research has highlighted the effectiveness of Gimkit in enhancing student engagement and improving academic achievement, most of these studies have primarily focused on secondary or higher education settings, with limited emphasis on critical thinking as a targeted learning outcome (Rahman & Anam, 2024). Specifically, empirical studies examining how Gimkit impacts the development of critical thinking skills particularly in elementary school science instruction remain scarce. This

underexplored area presents a significant research gap, considering the foundational role of critical thinking in early cognitive development. Addressing this gap, the present study seeks to contribute both theoretically and practically by evaluating the extent to which Gimkit can foster core critical thinking components such as information analysis, problem-solving, and evidence-based reasoning among fourth-grade elementary students.

This research is expected to offer both theoretical and practical contributions to the field of elementary science education. Theoretically, it addresses a gap in the literature regarding the impact of gamified learning platforms on higher-order thinking. Practically, it provides insights into how technology-enhanced instruction, through platforms such as Gimkit can foster more meaningful, engaging, and skill-oriented learning environments that align with 21st-century educational demands.

METHOD

This study employed a quantitative approach using a quasi-experimental design with a nonequivalent control group. In this design, two groups of students were involved: the experimental group, which received instruction using Gimkit as the treatment, and the control group, which underwent conventional learning without any intervention. The structure of the research design is presented in Table 1 below.

Table 1. Research Method

Group	Pre-test	Treatment	Post-test
Eksperimental	01	X*(Gimkit)*	02
Control	03	-(Conventional)	04

Notes
X : Treatment by using *Gimkit* interactive learning media
01 & 03 : Pre-test scores collected before treatment
02 & 04 : Post-test scores collected after the intervention (02 with *Gimkit*, 04 without)

The study was conducted at a public elementary school located in North Jakarta, with the research implementation period spanning from February to May 2025. The participants comprised 54 fourth-grade students, evenly divided into an experimental group and a control group, each consisting of 27 students. The sampling technique used in this study was saturated sampling. This approach was considered appropriate because the entire population of the two comparable fourth-grade classes within the school was included as research subjects. These two classes were selected due to their similar demographic profiles, equivalent academic conditions, and identical learning environments, which helped to minimize potential biases and ensured a fair basis for comparison.

The primary instrument used to measure students' critical thinking skills was a descriptive test developed based on four core indicators: the ability to analyze information, solve problems, draw conclusions, and conduct evaluations. The test comprised ten open-ended questions that were carefully constructed to reflect these four dimensions of critical thinking. The development of the instrument involved a validation process that included input from subject-matter experts and classroom practitioners. This was followed by a trial implementation in a different elementary school within North

Jakarta, which shared similar student characteristics with the study site. The validity of each item was analyzed using the Pearson Product-Moment correlation technique, while the reliability of the entire instrument was assessed through Cronbach's Alpha using SPSS software. The results confirmed that all test items were valid and reliable, with alpha coefficients exceeding the acceptable threshold, ensuring the instrument's suitability for measuring critical thinking in this context.

Data collection was conducted in two phases: the pre-test was administered before the instructional intervention, and the post-test was conducted after the completion of the treatment. All data from student responses were processed and analyzed using SPSS. The data analysis procedures began with a normality test, which was carried out using the Shapiro–Wilk method to determine whether the data were normally distributed. This was followed by a homogeneity test using Levene's test to assess the equality of variances across groups. An independent samples t-test was then conducted to examine whether there were statistically significant differences between the post-test scores of the experimental and control groups. Furthermore, to evaluate the relative effectiveness of the treatment, a normalized gain (N-gain) analysis was applied. In addition, the effect size was calculated using Cohen's to determine the magnitude of the impact of Gimkit on students' critical thinking development.

These steps provided a comprehensive and rigorous analysis of the influence of digital learning media on critical thinking skills, offering insights into both the statistical significance and the educational relevance of integrating Gimkit into elementary science instruction.

FINDINGS AND DISCUSSION

Findings

This section presents and discusses the findings of the study regarding the effect of using *Gimkit* as a digital learning medium on students' critical thinking skills**.** Quantitative results are supported by descriptive data and relevant pedagogical interpretations, based on comparisons between the control and experimental groups.

Descriptive Results

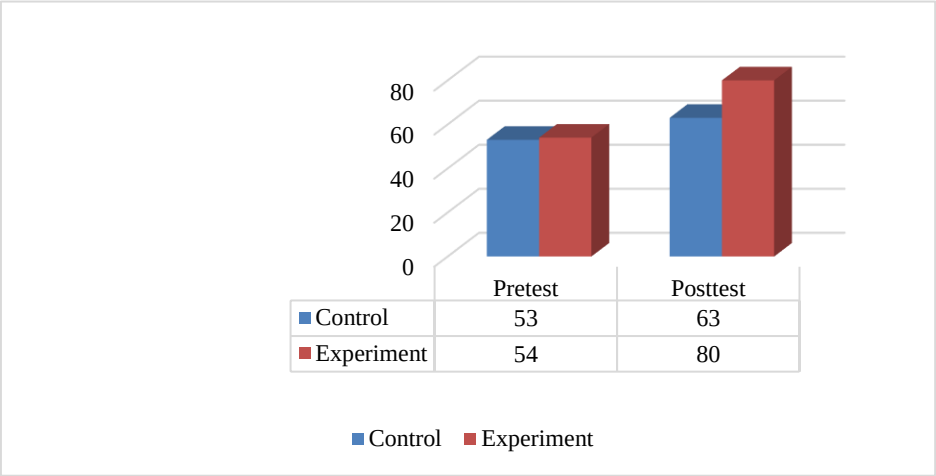

Figure 1. Average Critical Thinking Skills Score (Pre-Test & Post-Test)

Figure 1 explains that at the initial stage (pre-test), the average critical thinking skill score of students in the control class was 53, while in the experimental class, it was 54. The very small difference in numbers indicates that the initial abilities of students from both classes in critical thinking are relatively equal. However, the average value obtained is relatively low, indicating that students from both classes do not yet have optimally developed critical thinking skills. In addition, this condition also shows that before learning is carried out, students do not have enough experience or habituation in solving questions (HOTS) that require critical thinking skills such as analyzing, evaluating, and concluding information. Many students are still accustomed to memorization questions or basic understanding so they have difficulty when they have to think more complexly or logically. This is in line with the opinion of Febrianti et al., (2021) who stated that HOTS questions designed by teachers can improve students' critical thinking skills at various levels.

Treatment as conducted in the control class with conventional teaching media and in the experimental class using Gimkit media for 3 sessions, each lasting 60 minutes. In the implementation in the experimental class, students appeared enthusiastic and actively participated in activities. In addition, because it is a game, students are motivated to continue trying and improving their answers, so that indirectly there is a repetitive learning process and strengthens understanding. Even students who are usually passive become more confident and interested in getting involved because of the pleasant learning atmosphere. Student responses to Gimkit media are also the cause of the increase in the average value of students' critical thinking skills in the experimental class. This is supported by previous research conducted by Amelia, (2024) which resulted in the use of Gimkit significantly increasing students' interest in learning, marked by their high enthusiasm and involvement when using Gimkit.

As seen in Figure 1, the control class post-test score increased from 53 to 63 and the post-test score increased from 54 to 80. This shows a significant increase and reflects the development of students' critical thinking skills significantly. Gimkit presents learning in the form of a competitive quiz game. This creates students' cognitive and emotional involvement to answer seriously and repeatedly try to correct the wrong answers. This is reinforced by the statement of Fiqriah et al. (2025) at the use of game-based learning increases students' cognitive and emotional involvement, which has a positive impact on critical thinking skills and learning outcomes. Repeated practice with a variety of questions that encourage critical thinking. In the Gimkit game, questions can appear randomly and repeatedly. This makes students not only memorize but learn to recognize patterns and analyze the context of the questions, which strengthens critical thinking skills.

Beyond quantitative gains, qualitative classroom observations revealed that students in the experimental group demonstrated heightened levels of engagement, persistence, and self-regulation throughout the intervention. Several students who typically exhibited low participation in traditional settings became more active and enthusiastic, particularly during collaborative quizzes and competitive rounds. The use of game elements such as point accumulation, visual timers, and immediate feedback appeared to generate emotional investment, triggering excitement and a desire to outperform peers in a constructive manner. This emotional engagement was closely linked to cognitive engagement, as students frequently reflected aloud, discussed question strategies with peers, and exhibited metacognitive behaviors such as monitoring and adjusting their reasoning when revisiting similar questions. These patterns suggest that

Gimkit not only influenced what students learned, but also *how* they approached learning tasks transforming passive reception into active knowledge construction. Such behavioral shifts are critical in cultivating long-term habits of inquiry and critical thinking. This supports previous studies (Salsabila et al., 2016) indicating that when learning is emotionally stimulating and cognitively demanding, students are more likely to internalize complex skills. Consequently, the implementation of *Gimkit* contributed not only to performance improvements but also to fostering learner autonomy and intrinsic motivation.

Inferential Analysis

Before conducting the main statistical analysis using an independent samples t-test, prerequisite tests were carried out to ensure the assumptions of normality and homogeneity of variances were met. These assumptions are critical in determining the validity of the t-test, as parametric tests require the data to approximate a normal distribution and possess equal variances between groups. To ensure data suitability for parametric testing, a Shapiro-Wilk normality test and Levene's test for homogeneity of variances were conducted. The results are presented in the tables below.

Table 2. Normality Test Result

		Levene Statistic	Sig.
Post-test	Based on Mean	3.796	.057
	Based on Median	1.918	.172
Pre-test	Based on Mean	.031	.861
	Based on Median	.034	.855

As shown in Table 2, all significance values are greater than .05, confirming that both pre-test and post-test scores in both groups follow a normal distribution. Meeting this assumption strengthens the legitimacy of further inferential testing and ensures that conclusions drawn from the data reflect true population parameters rather than anomalies arising from skewed distributions.

Table 3. Homogeneity Test Result

Class	Variable	Shapiro-Wilk Sig.	Distribution
Experiment	Pre-test	0.252	Normal
	Post-test	0.395	Normal
Control	Pre-test	0.332	Normal
	Post-test	0.156	Normal

Table 3 indicates that all significance values exceed the .05 threshold, supporting the assumption of homogeneity of variances. Thus, the data from both groups can be

compared using the independent samples t-test with confidence that any differences observed are not due to unequal variability.

Table 4. Independent Samples T-Test Result

Independent Samples Effect Sizes					
			Point	95% Confidence Interval	
		Standardizer[a]	Estimate	Lower	Upper
Post-test	Cohen's d	7.896	2.118	1.441	2.782
	Hedges' correction	8.012	2.087	1.420	2.741
	Glass's delta	9.141	1.829	1.092	2.547
Pre-test	Cohen's d	17.254	.107	-.427	.641
	Hedges' correction	17.508	.106	-.421	.631
	Glass's delta	18.046	.103	-.433	.636

As shown in Table 4, the pre-test effect sizes are negligible (Cohen's d ≈ 0.107), with 95% confidence intervals that include zero, indicating no significant difference between the groups before the intervention. This confirms the initial equivalence between the groups. In contrast, the post-test effect sizes are substantial, with Cohen's d exceeding 2.0, which indicates a statistically and practically significant improvement in the experimental group. These values align with Cohen (1988) interpretation of effect size, where values above 0.80 are considered large, and values above 2.0 reflect a highly robust intervention effect, particularly in educational settings.

Indicator-Wise Comparison

A more granular analysis of critical thinking indicators namely analyzing information, formulating problems, drawing conclusions, and evaluating was conducted to provide insight into specific cognitive domains that benefited from the intervention using Gimkit. By disaggregating the results, it becomes clearer how digital game-based tools impact various aspects of higher-order thinking.

The control group showed varied results across the four indicators: analyzing information obtained an average score of 71, formulating problems scored 73, drawing conclusions reached only 50, and evaluating recorded the lowest average score of 48. Meanwhile, the experimental group, which was exposed to the Gimkit interactive media, demonstrated more balanced and significant improvements across all indicators. Specifically, the experimental group achieved average scores of 78 in analyzing information, 76 in formulating problems, 75 in drawing conclusions, and 72 in evaluating.

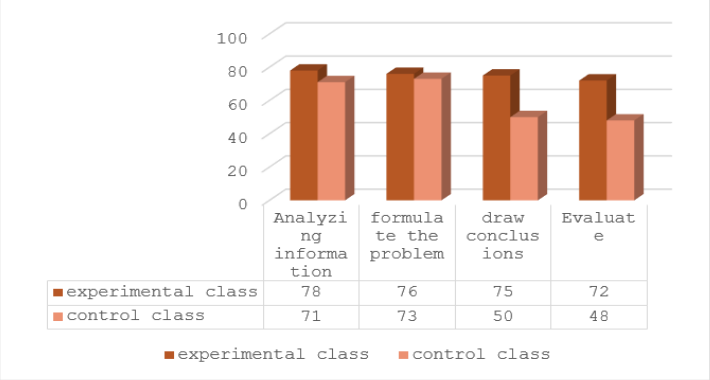

Figure 2. Average Post-Test Score of Critical Thinking Skills Indicators

Analyzing Information

The post-test results show that students in the experimental group obtained an average score of 78, while the control group achieved a slightly lower average of 71. This indicator assesses students' ability to deconstruct information, categorize it based on relevant features, and identify patterns or relationships. The higher score in the experimental group suggests that the use of Gimkit contributed significantly to strengthening analytical abilities. Gimkit design, which integrates real-time feedback, randomized question presentation, and visual reinforcement, facilitates repeated exposure to information processing tasks. These features help students to develop the habit of critically examining and organizing data before responding. The finding aligns with the study of Agustina et al. (2024), who reported that gamified learning environments increase student focus and information analysis through interactive questioning and immediate corrective feedback. Wardani (2023) also emphasized that context-based approaches and the use of authentic cases play an important role in building skills to evaluate information effectively.

Formulating Problems

In this indicator, the experimental group achieved an average score of 76, while the control group recorded 73. Although the difference is relatively small, the consistent improvement in the experimental group demonstrates the positive influence of interactive media on students' ability to identify key problems and articulate them clearly. This skill involves recognizing the core issue within a given context, isolating relevant variables, and hypothesizing potential solutions. Gimkit facilitated this process by incorporating contextual and scenario-based questions, which require students to interpret information and determine the central problem before selecting an answer. According to Afandi et al. (2024), the use of multi-step, real-world questions in digital learning platforms encourages learners to think systematically and critically, thereby supporting their problem formulation abilities. The modest gap between the two groups may also reflect the students' pre-existing proficiency in this area, as indicated by relatively higher pre-test scores.

Drawing Conclusions

The drawing conclusions indicator revealed the most significant contrast: the control group scored only 50, whereas the experimental group reached 75. According to Daniar & Sari, (2022), the ability to draw conclusions entails synthesizing evidence to form logical judgments, not merely stating opinions. The low performance in the control group suggests that traditional instruction failed to provide sufficient scaffolding for this skill. Conventional approaches, such as lecture-based delivery or textbook drills, often do not promote reflective and inferential reasoning, emphasized that without interactive or feedback-rich tasks, students may view evaluation exercises as tedious obligations rather than meaningful learning opportunities. Conversely, Gimkit fostered a more engaging and competitive atmosphere. Through features like team-based quizzes and leaderboards, students were motivated to engage in data-driven decision-making. Zairozie (2025) noted that such competitive game mechanics can elevate extrinsic motivation, which in this study likely contributed to an increase in students' willingness to draw reasoned, evidence-based conclusions.

Evaluating

The evaluation indicator, the control class scored 48, while the experimental class achieved 72. This indicator assesses students' ability to assess the credibility of information, critique arguments, and justify claims using scientific logic and data (Rahmawati et al., 2023). For example, students were asked to evaluate proposed solutions to environmental problems, providing justification supported by facts. In the control class, many responses lacked scientific grounding, often relying on vague or emotional statements like "I disagree because it's too much," without citing data or theories. These shortcomings reflect the limitations of passive learning models in developing evaluative thinking. In contrast, students in the experimental class frequently encountered cross-referenced questions requiring them to weigh opposing viewpoints or analyze scenarios with multiple variables. Gimkit interactive quiz format with randomized but thematically consistent questions encouraged students to revisit concepts and refine their arguments. Evaluative tasks included data-based judgment, argument comparison, and evidence validation, all of which aligned with the highest levels of Bloom's taxonomy. The findings of Wulandari et al. (2024) argue that regular exposure to reflective and analytical questioning can strengthen students' evaluative reasoning over time.

In conclusion, the indicator-wise comparison clearly demonstrates the pedagogical value of Gimkit in improving all domains of critical thinking. Its interactivity, real-time feedback, and gamified structure effectively address the cognitive and motivational needs of elementary learners, enabling them not only to absorb knowledge but also to process, analyze, and apply it critically. This finding is in line with the view expressed by Al Asadullah & Nurhalin (2021) who highlighted the importance of learning strategies that actively involve students and encourage the formation of reflective thinking as a foundation for developing critical thinking skills. Passive learning models, such as one-way lectures, are considered less effective in honing students' abilities to analyze, evaluate, and construct logical arguments independently. In this context, the use of Gimkit becomes very relevant because this platform can present questions with an attractive and challenging appearance while providing instant feedback that allows students to learn directly from their mistakes. Therefore, the effectiveness of Gimkit in improving critical thinking skills lies not only in its technological aspects but also in the pedagogical approach it carries. Gimkit has succeeded in integrating elements of quizzes, games, competitions, and reflections into one integrated learning system. This kind of approach is very much in line with the characteristics of students at the elementary school level, who tend to be more responsive to activity-based learning methods, social interactions, and challenges that are packaged in a fun way. Thus, Gimkit is not only a learning aid but also an effective medium for forming critical thinking habits from an early age.

Discussion

The findings of this study suggest several important implications for educational practice, particularly in elementary-level science instruction. The significant improvement in students' critical thinking skills in the experimental group especially in drawing conclusions and evaluating information highlights the pedagogical value of integrating game-based digital media such as Gimkit into the learning process. First, interactive gamified platforms like Gimkit can serve as effective alternatives to conventional learning methods that often rely on rote memorization and passive content

delivery. The increase in students' ability to draw conclusions (from 50 to 75) and evaluate arguments (from 48 to 72) suggests that Gimkit question repetition, randomized item delivery, and immediate feedback mechanisms provide meaningful opportunities for practice and metacognitive reflection. These mechanisms help students internalize critical thinking processes such as analyzing data, comparing options, and formulating logical arguments skills that are often underdeveloped in traditional classrooms (Wardani, 2023).

Second, the design of contextual and competitive learning environments, as demonstrated by Gimkit use of leaderboards and point-based feedback, appears to enhance both student motivation and cognitive engagement**.** These elements contributed to greater involvement among typically passive learners, who showed improved performance across all critical thinking indicators. This aligns with findings by Zairozie (2025), who observed that emotionally engaging game elements significantly contribute to developing higher-order thinking skills. Third, the study supports the importance of designing instruction that embeds reflection and decision-making**,** rather than solely focusing on correct answers. The types of questions that encouraged students to evaluate data or formulate solutions based on scientific reasoning (such as environmental case analysis or scenario-based problem solving) were particularly effective in strengthening critical thinking. Thus**,** integrating authentic, real world problem contexts into digital quiz formats should be considered a core feature of instructional media aimed at improving these competencies.

Lastly, these results suggest that digital learning tools should be incorporated early in formal education to cultivate critical thinking as a habitual cognitive skill, not an occasional task. Especially at the elementary level, students are developmentally responsive to learning approaches that are active, visual, and socially interactive. As demonstrated in this study, when appropriately designed and implemented, platforms like Gimkit are not merely supplementary tools, but central instruments that can transform classroom culture toward inquiry, reflection, and active knowledge construction.

In implementing this research, there were several obstacles faced both technically and non-technically that affected the course of research activities and the data collection process. The limited time for implementing the research meant that each learning session had to be optimized for a dense duration. This was a challenge, especially in delivering the material and providing space for students to explore comprehensively, especially in the experimental class using Gimkit. The duration of each session, which was only 60 minutes, was sometimes not enough to review HOTS questions or discuss critical thinking strategies in depth. The learning process was sometimes disrupted by environmental conditions outside the classroom, such as sounds from other classes or concurrent school activities. This condition slightly affected students' focus, especially when the game or reflection session was taking place.

Furthermore, these findings indicate that the integration of technology in learning not only has an impact on learning motivation but can also significantly improve high-level thinking skills if used appropriately and in a structured manner (Salsabila et al. 2016). Therefore, the implementation of media such as Gimkit deserves serious consideration as part of the science learning strategy and other subjects at the elementary school level.

CONCLUSION

Based on the results of this study, it can be concluded that the use of Gimkit as an interactive learning medium has a statistically significant and practically meaningful

effect on enhancing elementary students' critical thinking skills in science education. This conclusion is supported by the experimental group's substantially higher post-test scores compared to the control group and a large effect size (Cohen's d = 2.118), indicating strong cognitive gains. The findings directly address the research objectives by demonstrating improvements across four key indicators of critical thinking, analyzing information, formulating problems, drawing conclusions, and evaluating data thereby affirming Gimkit potential to support higher-order thinking when integrated into science instruction. Beyond the empirical findings, the results carry pedagogical implications for the integration of structured, game-based learning platforms in the elementary classroom. Features such as adaptive repetition, real-time feedback, and gamified challenges may promote active engagement and deeper cognitive processing aligned with 21st-century educational goals. However, while the study offers evidence of short-term effectiveness, future research should explore the long-term retention of critical thinking skills fostered through Gimkit, its applicability in other subject areas beyond science, and its influence on student motivation and classroom engagement. Employing longitudinal or mixed-method approaches could provide more comprehensive insights into how gamified digital tools contribute to learning outcomes and inform curriculum development, instructional strategies, and education policy.

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