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The Effectiveness of Digital Game-Based Teaching among Grade 5 EFL Learners

(Efektivitas Pengajaran Berbasis Permainan Digital pada Siswa EFL Kelas 5)

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ABSTRACT

This quasi-experimental study examined post-test vocabulary achievement following digital game-based teaching among Grade 5 EFL learners at SD Nasional Makassar. Forty students in two intact classes participated: 21 received digital game-based vocabulary teaching and 19 received conventional instruction. The six-week intervention used Wordwall, Kahoot!, and Quizizz through structured learning activities. Vocabulary was assessed using a 25-item test covering six performance dimensions. The experimental class obtained a higher post-test mean score (85.52) than the control class (70.11). The between-class difference was statistically significant in the reported individual-level analysis, t(38) = -5.694, p < .001, with a large standardized difference (|d| = 1.803). However, having only one class per condition limits causal interpretation. The findings indicate an association between digital game-based instruction and higher post-test vocabulary achievement in this setting.

Keywords:
Digital Game-Based Teaching; Vocabulary Achievement; EFL Learners; Primary School; Vocabulary Learning

ABSTRAK

Penelitian kuasi-eksperimental ini mengkaji capaian kosakata setelah penerapan pembelajaran berbasis permainan digital pada peserta didik EFL kelas 5 di SD Nasional Makassar. Sebanyak 40 siswa dari dua kelas terlibat, terdiri atas 21 siswa pada kelompok eksperimen dan 19 siswa pada kelompok kontrol. Intervensi berlangsung enam minggu menggunakan Wordwall, Kahoot!, dan Quizizz melalui kegiatan pembelajaran terstruktur. Capaian kosakata diukur dengan tes 25 butir yang mencakup enam dimensi penilaian. Rata-rata skor akhir kelompok eksperimen (85,52) lebih tinggi dibandingkan kelompok kontrol (70,11). Analisis pada tingkat siswa menunjukkan perbedaan yang signifikan, t(38) = -5,694, p < 0,001, dengan ukuran perbedaan terstandar yang besar (|d| = 1,803). Namun, penggunaan hanya satu kelas untuk setiap kondisi membatasi penafsiran kausal. Hasil ini menunjukkan hubungan antara pembelajaran berbasis permainan digital dan capaian kosakata akhir yang lebih tinggi pada konteks penelitian ini.

Kata kunci:
Pengajaran Berbasis Permainan Digital; Capaian Kosakata; Pembelajar EFL; Sekolah Dasar; Pembelajaran Kosakata

Introduction

Vocabulary is a fundamental component of English language learning because it enables learners to understand and express meaning in communication. For primary school EFL learners, vocabulary development is particularly important because limited vocabulary can constrain their ability to comprehend texts, participate in classroom interaction, and develop subsequent language skills. Vocabulary learning, however, is a gradual process that requires repeated encounters with words in meaningful contexts. Nation (2001) emphasizes the importance of multiple exposures to vocabulary, while Cameron (2001) argues that young learners benefit from activities that are enjoyable, interactive, meaningful, and appropriate to their developmental characteristics. Consequently, vocabulary instruction at the primary school level requires approaches that provide sufficient repetition while maintaining learners' attention and opportunities for meaningful language practice.

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Despite the importance of vocabulary, conventional vocabulary instruction may not always provide sufficient opportunities for active and meaningful learning. Traditional practices frequently rely on teacher explanations, memorization, repetition exercises, and written tasks. Although such activities can introduce and reinforce vocabulary, they may provide limited opportunities for learners to interact with words in varied contexts. Recent research has continued to identify vocabulary learning as a challenge in EFL contexts and has recommended more interactive approaches to support vocabulary acquisition and retention (Zou, Huang, & Xie, 2021). This concern is particularly relevant to primary school learners, whose learning is strongly supported by concrete representations, repetition, sensory stimulation, and active participation (Cameron, 2001; Pinter, 2017). Therefore, there is a need for instructional approaches that can combine systematic vocabulary practice with learning experiences that are appropriate and motivating for young learners.

Digital Game-Based Learning (DGBL) has emerged as a promising approach for addressing these instructional challenges. Digital game-based vocabulary teaching integrates language learning objectives with game elements such as challenges, rewards, competition, immediate feedback, repeated practice, and interactive tasks. These features can transform vocabulary learning from primarily memorization-based activities into more active and meaningful learning experiences. Prensky (2001) argues that digital games can facilitate learning through challenge, feedback, repetition, and enjoyment, while Thornbury (2002) highlights the importance of repeated and meaningful encounters with vocabulary. From a learning perspective, digital games can also provide opportunities for learners to recognize, practice, and use target words through interactive activities rather than merely receiving word explanations.

Empirical studies have provided growing support for the use of digital games in language and vocabulary learning. Zou, Huang, and Xie (2021) reported that digital game-based vocabulary learning can improve vocabulary acquisition, retention, and learner engagement across EFL contexts. Similarly, Zhang, Zou, and Cheng (2023) found that engagement in digital game-based vocabulary learning was positively associated with EFL vocabulary development. Cancino and Viguera (2024) reported comparable lexical gains between gamified and traditional instruction, but found a significant improvement in vocabulary self-efficacy among primary EFL learners exposed to the gamified approach. More recently, Budiarti, Al Masjid, and Djufri (2025), through a systematic literature review of research published between 2019 and 2024, concluded that gamification has generally contributed to vocabulary acquisition, motivation, classroom participation, and retention in primary education. These findings indicate that digital game-based approaches have considerable potential as an alternative to conventional vocabulary instruction.

Nevertheless, important gaps remain in the existing literature. First, recent systematic reviews have shown that research on digital game-based and gamified vocabulary learning has expanded across different educational contexts, but the evidence remains uneven in terms of learner populations, instructional contexts, and vocabulary outcomes (Budiarti et al., 2025; Ciğerci et al., 2025). In particular, further empirical evidence is needed on the systematic use of digital games as an instructional approach for vocabulary teaching among primary school EFL learners in the Indonesian context. Young learners have cognitive, linguistic, and developmental characteristics that distinguish them from older learners; therefore, findings from secondary or adult learners should be interpreted cautiously when applied to primary school EFL classrooms.

Second, previous research has often examined vocabulary learning using overall achievement measures, which may provide limited insight into the different aspects of vocabulary knowledge addressed during instruction. To address this limitation, the present study examines vocabulary achievement across six assessment dimensions: word meaning, visual recognition, synonym knowledge, contextual use, situational use, and vocabulary use in context. These dimensions represent different aspects of students' vocabulary performance assessed through the vocabulary achievement test and are not intended to constitute a single established theoretical taxonomy of vocabulary knowledge. Furthermore, because the study did not include a delayed post-test, it does not assess long-term vocabulary retention. Instead, the study focuses on students' vocabulary achievement as measured immediately before and after the instructional intervention.

Third, although digital platforms such as Wordwall, Kahoot!, and Quizizz are increasingly used in language education, recent reviews have highlighted the need for further research on how gamification and digital technologies can be systematically integrated into vocabulary instruction rather than being used only as supplementary or assessment activities (Ciğerci et al., 2025). Addressing this gap, the present study investigates Digital Game-Based Vocabulary Teaching as the main instructional approach for Grade 5 EFL learners at SD Nasional Makassar. The study integrates digital games into structured pre-game, during-game, and post-game activities and examines students' vocabulary achievement across multiple assessment dimensions. In this way, the study provides empirical evidence on the systematic implementation of digital game-based vocabulary teaching in an Indonesian primary EFL classroom.

The present study addresses these gaps by investigating Digital Game-Based Vocabulary Teaching as the primary instructional approach for Grade 5 EFL learners in an Indonesian primary school context. Unlike studies that primarily use digital games as supplementary activities, the present study integrates digital games systematically into vocabulary instruction through structured pre-game, during-game, and post-game activities. The intervention uses digital platforms, including Wordwall, Kahoot!, and Quizizz, to provide repeated exposure to target vocabulary, interactive practice, immediate feedback, and contextualized learning activities.

Furthermore, the study examines vocabulary achievement across six assessment dimensions: word meaning, visual recognition, synonym knowledge, contextual use, situational use, and vocabulary use in context. These dimensions represent aspects of students' vocabulary performance assessed through the vocabulary achievement test rather than a single established theoretical taxonomy of vocabulary knowledge. As the study does not include a delayed post-test, it focuses on vocabulary achievement measured immediately after the instructional intervention rather than long-term vocabulary retention.

The study is situated within the Indonesian primary school context, specifically at SD Nasional Makassar, where English instruction is provided to Grade 5 students. The investigation is also relevant to the current direction of Indonesian education policy. Permendikdasmen No. 13 of 2025, which amends the national curriculum framework, emphasizes Pembelajaran Mendalam (Deep Learning) as an approach that promotes learning experiences that are mindful, meaningful, and joyful. The regulation also emphasizes the development of students' competencies and character through learning that is flexible, focused on essential content, and responsive to students' needs and contexts (Ministry of Primary and Secondary Education, 2025). In this context, Digital Game-Based Vocabulary Teaching may provide opportunities for meaningful and engaging vocabulary practice while integrating digital technology into primary EFL instruction. Digital game-based teaching is consistent with these principles because it provides opportunities for active participation, meaningful practice, interaction, and immediate feedback while integrating digital technology into classroom instruction. Thus, examining its effectiveness can provide empirical evidence concerning how technology-enhanced vocabulary instruction can be implemented in an authentic primary EFL classroom.

Accordingly, this study aims to investigate the effectiveness of Digital Game-Based Teaching in improving vocabulary achievement among Grade 5 EFL learners. Specifically, it examines whether there is a significant difference in vocabulary achievement between students receiving digital game-based vocabulary teaching and those receiving traditional vocabulary instruction. The study also examines the extent of improvement in vocabulary achievement by analyzing changes in students' scores from the pre-test to the post-test and comparing the magnitude of change between the experimental and control groups. By addressing these objectives, the study is expected to make both theoretical and practical contributions. Theoretically, it adds empirical evidence to the growing body of research on digital game-based vocabulary learning, particularly in primary EFL education in Indonesia. Practically, the findings may provide English teachers with evidence-based support for integrating digital games into vocabulary instruction and may inform schools and curriculum developers in designing technology-enhanced, learner-centered English instruction for primary school learners. More broadly, the study contributes empirical evidence from an Indonesian primary school setting, thereby extending the geographical and educational contexts represented in existing research on digital game-based vocabulary teaching.

Methods

The study was conducted at SD Nasional Makassar during the 2025/2026 academic year. The participants comprised 40 Grade 5 students enrolled in two intact classes at SD Nasional Makassar during the 2025/2026 academic year. The students were approximately 11 years old on average. Of the total participants, 21 students belonged to the class randomly assigned to the experimental condition, while 19 students belonged to the class randomly assigned to the control condition. The experimental group received Digital Game-Based Vocabulary Teaching, whereas the control group received conventional vocabulary instruction. Because the study was conducted with intact classes, random assignment was implemented at the class level rather than at the individual student level. The same English teacher taught both groups throughout the intervention to maintain consistency in teacher-related factors, while the instructional approach constituted the primary difference between the two conditions.

All students enrolled in the two participating classes were included in the study and completed both the pre-test and post-test. Accordingly, no participant attrition occurred during the study, and the final analytical sample consisted of 40 students. Students were eligible to participate if they were enrolled in the selected Grade 5 classes and participated in the instructional program throughout the study period. No additional exclusion criteria were applied. The sample size was determined by the number of students enrolled in the two available classes and was not based on an a priori statistical power calculation.

Given that the intervention was assigned at the class level and that only one intact class represented each instructional condition, the instructional condition was inherently confounded with class membership. Although random assignment of the two classes and the use of the same teacher for both groups helped reduce potential systematic differences between the instructional conditions, these procedures cannot completely disentangle treatment-related differences from class-specific effects. Furthermore, students within each class shared the same classroom context and therefore cannot be regarded as fully independent experimental units. Consequently, the findings should be interpreted cautiously, particularly with respect to causal inference, and should be understood as evidence of the observed differences between the two participating classes rather than as definitive evidence of a treatment effect that can be generalized beyond this study context.

A vocabulary achievement test consisting of 25 multiple-choice items was used as the research instrument. The test was administered as a pre-test and post-test to measure students' vocabulary achievement before and after the instructional intervention. The items covered six aspects of vocabulary knowledge: word meaning, visual

recognition, synonym knowledge, contextual use, situational use, and vocabulary use in context. These dimensions represented the aspects of vocabulary performance assessed by the test and were not intended to constitute a single established theoretical taxonomy of vocabulary knowledge. Each correct answer was awarded one point, while an incorrect answer received zero points, resulting in a maximum raw score of 25. The raw scores were converted to a 0–100 scale by dividing each student's total correct answers by 25 and multiplying the result by 100. The test items were developed based on the target vocabulary taught during the intervention and were reviewed by English language teaching experts to assess their relevance and clarity. The instrument's reliability was also examined before the main data collection.

Before the treatment, both groups completed the pre-test. The intervention was conducted for six weeks, with two meetings per week, resulting in 12 instructional sessions. The experimental group received Digital Game-Based Vocabulary Teaching using digital platforms such as Wordwall, Kahoot!, and Quizizz. The activities were designed to provide vocabulary practice through interactive tasks and game-based exercises. The control group received conventional vocabulary instruction through teacher explanations, textbook activities, repetition, and written exercises. Both groups were taught by the same teacher and received instruction over the same six-week period. The vocabulary content and instructional objectives were kept consistent across the two groups, while the main difference was the use of digital game-based activities in the experimental group. After the intervention, both groups completed the post-test.

The data were analyzed using descriptive and inferential statistics. Descriptive statistics were used to summarize students' pre-test and post-test scores. An independent-samples t-test was used to examine whether there was a significant difference in vocabulary achievement between the experimental and control groups. To examine improvement over time, the change in students' scores from the pre-test to the post-test was also considered by comparing the gain scores between the two groups. Before conducting the independent-samples t-test, the assumptions of normality and homogeneity of variance were checked. The significance level was set at 0.05. Cohen's d was calculated as the effect-size measure to determine the magnitude of the between-group difference. The effect size was interpreted using conventional criteria, with 0.20 indicating a small effect, 0.50 a medium effect, and 0.80 or higher a large effect. Confidence intervals were also reported where applicable. These analyses provided a basis for examining differences in vocabulary achievement and changes in performance between the two groups.

Results

Vocabulary Achievement in the Experimental and Control Group

Post-test descriptive statistics for the control and experimental groups are presented in Table 1. The experimental group obtained a higher average post-test score than the control group. Group-level pre-test scores and gain statistics are not presented in the available tables.

Table 1. Group Statistics

	Code	Mean	N	Std. Deviation	Std. Error Mean
Score	1	70.11	19	9.556	2.192
	2	85.52	21	7.534	1.644

Table 1 presents the descriptive statistics of students' vocabulary achievement in the control and experimental groups following the treatment. The table shows that the control group, consisting of 19 students, obtained a mean post-test score of 70.11 (SD = 9.556). Meanwhile, the experimental group, consisting of 21 students, achieved a higher mean post-test score of 85.52 (SD = 7.534). The descriptive results indicate that the experimental group obtained a higher average vocabulary achievement score than the control group.

Furthermore, the experimental group achieved a higher post-test mean score (85.52) than the control group (70.11), with a mean difference of 15.41 points. This descriptive result suggests that students who received Digital Game-Based Vocabulary Teaching performed better in the post-test than those who received conventional vocabulary instruction.

Difference between the Experimental and Control Groups

An independent-samples test was conducted to determine whether the difference in vocabulary achievement between the two groups was statistically significant. The results are presented below:

Table 2. Independent Sample 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
Score	Equal variances assumed	1.960	.170	-5.694	38	.000	-15.419	2.708	-20.900	-9.937
	Equal variances not assumed			-5.627	34.203	.000	-15.419	2.740	-20.986	-9.851

Table 2 presents the results of the independent-samples t-test examining the difference in post-test vocabulary achievement between the control and experimental groups. Levene's test for equality of variances was not statistically significant (F = 1.960, p = .170), indicating that the equal-variances assumption was satisfied. Therefore, the results from the equal-variances-assumed row were used. The analysis revealed a statistically significant difference between the two groups, t(38) = -5.694, p < .001. The mean difference was -15.419 points, with a standard error of 2.708 and a 95% confidence interval ranging from -20.900 to -9.937.

The negative mean difference reflects the coding order used in the statistical output (control minus experimental). Thus, the experimental group scored approximately 15.42 points higher than the control group in the post-test. This is a comparison of the two participating classes and should not by itself be interpreted as a definitive causal treatment effect.

Independent Sample Effect Sizes

Cohen's d was calculated to determine the magnitude of the difference between the two groups. The results are presented in the following table:

Table 3. Independent Samples Effect Sizes

		Standardizer[a]	Point Estimate	95% Confidence Interval	
				Lower	Upper
Score	Cohen's d	8.552	-1.803	-2.535	-1.054
	Hedges' correction	8.725	-1.767	-2.485	-1.033
	Glass's delta	7.534	-2.047	-2.918	-1.150

Table 3 presents the effect sizes for the difference in post-test vocabulary achievement between the control and experimental groups. The independent-groups comparison produced a Cohen's d value of -1.803, with a 95% confidence interval ranging from -2.535 to -1.054. Hedges' correction yielded an effect size of -1.767 (95% CI [-2.485, -1.033]), while Glass's delta was -2.047 (95% CI [-2.918, -1.150]). These estimates indicate a substantial standardized difference in vocabulary achievement between the two groups.

Furthermore, the absolute value of Cohen's d (1.803) indicates a large effect size, suggesting that the difference in post-test performance between the experimental and control groups was substantial. The negative signs reflect the direction of the comparison, with the control group having a lower mean score than the experimental group. These findings support the descriptive and inferential results showing higher post-test vocabulary achievement in the experimental group.

Discussion

The study reports post-test vocabulary achievement after a six-week instructional period. The experimental group, which received Digital Game-Based Vocabulary Teaching, achieved a higher post-test mean score (85.52) than the control group (70.11). The reported independent-samples analysis indicated a statistically significant individual-level difference, t(38) = -5.694, p < .001, with a mean difference of -15.419 points (95% CI [-20.900, -9.937]). The negative difference reflects the order of comparison (control minus experimental). Because the study involved only two intact classes, with one class per condition, these statistics do not account for possible classroom-level effects. The observed association should therefore not be taken as definitive evidence of a causal effect of the instructional approach.

The study administered a pre-test to both classes, but the current Results section does not report the group-level pre-test means, standard deviations, or gains. Consequently, baseline comparability and whether gains differed significantly between classes cannot be evaluated from the presented results. The post-test difference is an observed association between instructional condition and the outcomes of the two intact classes, rather than direct evidence of a differential change from baseline.

Several characteristics of digital game-based learning may help explain the observed differences. In the present study, Wordwall, Kahoot!, and Quizizz were integrated into structured pre-game, during-game, and post-game activities. These platforms provided repeated encounters with target vocabulary, visual support, immediate feedback, and interactive practice opportunities. Previous research has suggested that repeated exposure and meaningful interaction with vocabulary contribute to vocabulary development (Nation, 2001; Thornbury, 2002). Similarly, digital games may support young learners by combining repetition with enjoyable and interactive learning experiences that are appropriate to their developmental characteristics (Cameron, 2001; Pinter, 2017).

The present findings are broadly consistent with earlier studies on digital game-based vocabulary learning, although differences in learner populations, intervention duration, and instructional platforms should be considered. Zou, Huang, and Xie (2021), in a systematic review across different EFL contexts, reported that digital game-based approaches were generally associated with improvements in vocabulary learning and learner engagement. Zhang, Zou, and Cheng (2023) found that learner engagement in digital game-based activities contributed to vocabulary development among EFL learners. In a primary school context, Cancino and Viguera (2024) reported that gamified instruction produced vocabulary outcomes comparable to traditional instruction while improving learners' vocabulary self-efficacy. More recently, Budiarti et al. (2025) concluded from a systematic review that gamification in primary education frequently contributes to vocabulary learning, motivation, and classroom participation. Compared with these studies, the present research contributes evidence from Grade 5 EFL learners in Indonesia and examines digital games as a systematically integrated instructional approach rather than as supplementary classroom activities.

The effect sizes in Table 3 represent the standardized difference in post-test vocabulary achievement between the two participating groups, not within-group changes. The absolute Cohen's d value of 1.803 indicates a large standardized difference. As allocation occurred at the class level with only one class per condition, the reported confidence intervals and inferential statistics do not account for class-level clustering. The size and statistical precision of the observed contrast should therefore be interpreted cautiously.

The findings also have practical implications for primary EFL instruction. Young learners often benefit from activities that provide concrete representations, repeated practice, active participation, and immediate feedback. Digital platforms such as Wordwall, Kahoot!, and Quizizz may provide opportunities to integrate these features within structured vocabulary instruction. Accordingly, digital games may serve as useful instructional tools when their use is aligned with learning objectives, classroom conditions, and students' developmental characteristics. These findings are also relevant to the current emphasis on meaningful, engaging, and technology-enhanced learning in Indonesian education policy.

Several limitations should be acknowledged when interpreting the findings. First, the study was conducted in one school and involved only two intact classes, with one class representing each instructional condition. Consequently, treatment effects cannot be completely separated from class-specific characteristics or potential teacher-class interactions, even though the same teacher taught both groups. Second, the sample size was relatively small, which limits the generalizability of the findings. Third, the study did not include a delayed post-test; therefore, conclusions cannot be drawn regarding long-term vocabulary retention. Fourth, the observed improvements may partly reflect novelty effects associated with the use of digital platforms such as Wordwall, Kahoot!, and Quizizz. Finally, because the study focused on Grade 5 learners in one Indonesian primary school context, caution is needed when applying the findings to different learner populations, educational levels, or instructional settings. Future research involving larger samples, multiple schools, several classes per condition, and delayed retention measures would provide stronger evidence regarding the effectiveness of Digital Game-Based Vocabulary Teaching.

Overall, the findings suggest that the systematic integration of digital games into vocabulary instruction was associated with higher vocabulary achievement among Grade 5 EFL learners in this study context. While the results contribute to the growing body of research on digital game-based vocabulary learning, further studies employing stronger experimental designs are needed to establish more robust evidence concerning the effectiveness and long-term impact of Digital Game-Based Vocabulary Teaching.

Conclusion

This study investigated the use of Digital Game-Based Vocabulary Teaching in supporting vocabulary achievement among Grade 5 EFL learners at SD Nasional Makassar. The findings showed a statistically significant difference in post-test vocabulary achievement between the experimental group, which received Digital Game-Based Vocabulary Teaching, and the control group, which received conventional vocabulary instruction. The experimental group also demonstrated a higher post-test mean score and a greater mean improvement from pre-test to post-test than the control group. These findings indicate that, within the context of the two participating classes, Digital Game-Based Vocabulary Teaching was associated with higher vocabulary achievement following the six-week instructional period.

The available group statistics show a substantial post-test difference favoring the experimental group. Although the study collected pre-test data and describes improvement as an objective, it does not present the corresponding group-level pre-test summaries or analyses of gains. Claims about statistically significant within-

group improvement or a larger increase in one group therefore require additional reporting before they can be supported.

The findings suggest that digital platforms such as Wordwall, Kahoot!, and Quizizz can be incorporated into structured vocabulary instruction for primary EFL learners when they are aligned with learning objectives and classroom conditions. Nevertheless, the findings are limited to the specific school, participants, and instructional context examined in this study. Future research should involve larger samples, multiple classes per instructional condition, and multiple schools to reduce potential class-level confounding and improve generalizability. Future studies should also include delayed post-tests to examine whether improvements in vocabulary performance are maintained over time.

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Declarations

Use of Generative AI

Generative AI (ChatGPT) was used to assist with language editing, revision, and the organization of the manuscript. The authors reviewed the AI-assisted revisions, verified the content, and remain fully responsible for the accuracy, integrity, and final content of the manuscript.

Author Contributions

Baso Ahmad Khaeruddin, Sahril Nur, Nur Aeni, and St. Nur Aima Fatima contributed to the research and preparation of the manuscript. The specific contributions of each author to the conceptualization, methodology, investigation, data analysis, and writing of the manuscript should be confirmed by all authors. All authors have reviewed and approved the final version of the manuscript and agree to be accountable for its content.

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Conflicts of Interest

The authors declare that they have no conflicts of interest related to the research, authorship, or publication of this article.

Ethical Approval and Consent

Permission to conduct the study was obtained from the relevant school authorities at SD Nasional Makassar. The study involved 40 Grade 5 students during the 2025/2026 academic year. Participants' information and assessment responses were treated confidentially, and the data were used solely for research purposes.

Data Availability

The anonymized assessment data, vocabulary achievement test instrument, and statistical analysis outputs are available from the corresponding author upon reasonable request. Access is subject to applicable ethical requirements, institutional permissions, and the protection of participants' confidentiality. No personally identifiable information about the participating students will be shared.

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