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The Effect of Digital Flashcard Media on Vocabulary Improvement of Elementary School Students

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ABSTRACT

Vocabulary mastery is a fundamental component of language learning that supports students' abilities in reading, writing, speaking, and listening. However, many elementary school students still experience difficulties in understanding and using vocabulary effectively due to limited instructional media and teacher-centered learning approaches. This study aims to investigate the effect of digital flashcard media on vocabulary mastery among elementary school students at SD Negeri 2 Sukoharjo, Pringsewu, Lampung. The study employed a quantitative approach using a pre-experimental one-group pretest–posttest design. The participants consisted of 30 fourth-grade students selected through total sampling. Data were collected using a vocabulary test comprising 20 objective items administered before and after the implementation of digital flashcard-based instruction. The collected data were analyzed using descriptive statistics and inferential analysis in the form of a paired sample t-test. The results showed a significant improvement in students' vocabulary mastery after the use of digital flashcards. The mean score increased from 60.13 in the pretest to 82.47 in the posttest. Indicator-based analysis revealed improvements in word meaning recognition, word–image matching, vocabulary usage in sentences, and vocabulary recall. The paired sample t-test indicated a significant difference between pretest and posttest scores at the 0.05 significance level ($p < 0.05$), confirming the effectiveness of digital flashcard media. The findings suggest that digital flashcards are an effective instructional medium for enhancing vocabulary learning at the elementary school level. Visualized vocabulary presentation and repeated exposure through digital flashcards support students' comprehension and retention. This study provides empirical evidence supporting the integration of digital learning media in elementary language instruction and offers practical implications for teachers seeking innovative strategies to improve vocabulary mastery.

Keywords: digital flashcards, vocabulary, learning media, elementary school students

INTRODUCTION

Language plays a crucial role in human communication and cognitive development, particularly in formal education settings (Alhazmi, 2024; Noviarini, 2025b). In elementary education, language learning serves as the foundation for students to acquire knowledge across various academic subjects (Chen et al., 2019; Fitriana & Noviarini, 2025; Noviarini, 2017). One of the most essential components of language learning is vocabulary mastery, as vocabulary enables learners to understand and produce language meaningfully (Fitriana & Noviarini, 2025; Kamiya & Nakata, 2021; Noviarini, 2025c). Students with adequate vocabulary knowledge are more capable of comprehending texts, expressing ideas, and engaging in classroom interactions (Ning, 2024). In contrast, limited vocabulary mastery often restricts students' academic performance. Vocabulary development is closely related to literacy skills and long-term educational success. Therefore, strengthening vocabulary mastery at the elementary school level is a fundamental educational goal.

Vocabulary mastery supports the development of the four primary language skills: listening, speaking, reading, and writing (Noviarini, 2025a). Learners with rich vocabulary knowledge generally demonstrate stronger reading comprehension and more accurate written expression (Baharuddin et al., 2022; Nikmah et al., 2018; Yanagisawa & Webb, 2019). Conversely, students with insufficient vocabulary frequently struggle to understand learning materials and teacher explanations (Farjami, 2018). According to language acquisition theory, vocabulary learning requires repeated exposure and meaningful contextual use. Young learners particularly need structured and engaging learning experiences to acquire new words effectively

(Alisoy & Sadigzade, 2025; Colenbrander et al., 2016). However, vocabulary instruction in many elementary classrooms remains limited to memorization. This approach often reduces learning effectiveness and student motivation.

In the context of Indonesian elementary education, vocabulary mastery continues to be a significant challenge. Several studies have reported that elementary students possess limited understanding of basic and academic vocabulary (Noviarini, 2017; Sintya Dewi et al., 2020). This condition affects students' ability to comprehend textbooks and instructional content. Vocabulary limitations also hinder students' oral and written language production. Students often find it difficult to explain word meanings or use vocabulary appropriately in sentences. These challenges suggest that vocabulary instruction has not been optimally implemented. As a result, students' language development progresses slowly.

Similar conditions were observed at SD Negeri 2 Sukoharjo, Pringsewu, Lampung. Preliminary observations indicated that many students experienced difficulties in recognizing and using Indonesian vocabulary correctly. Students frequently hesitated when asked to identify word meanings or construct sentences using new vocabulary. Classroom activities were largely dominated by teacher-centered instruction. Vocabulary learning relied heavily on textbooks and verbal explanations. Interactive learning activities were rarely implemented. Consequently, students showed low enthusiasm and limited participation during lessons.

Traditional teaching methods still dominate vocabulary instruction in many elementary schools. Teacher-centered approaches, such as lecturing and drill-based exercises, are commonly used (Alisoy & Sadigzade, 2025). While these methods may introduce new vocabulary, they often fail to maintain students' interest. Elementary school students require concrete and visually supported learning experiences. Constructivist learning theory emphasizes that students learn best when actively involved in the learning process. Passive learning environments limit students' opportunities to engage with new vocabulary. This situation highlights the need for more innovative instructional strategies.

Learning media play an important role in creating effective and engaging learning environments (Alhazmi, 2024; Nikmah et al., 2018; Rahmat et al., 2019). The use of instructional media can enhance students' attention and understanding of learning materials. According to multimedia learning theory, combining verbal and visual information improves comprehension and memory retention. Visual elements help learners process information more efficiently. For young learners, images and illustrations are particularly effective in supporting vocabulary learning. Therefore, integrating appropriate learning media is essential. Teachers must select media that are accessible and suitable for elementary students (Pratiwi & Fransiska, 2022; Teng, 2023; Vargo et al., 2024).

Digital flashcards are one form of instructional media that align with these learning principles (Teymouri, 2024). Digital flashcards present vocabulary items accompanied by visual representations such as images or illustrations. This combination helps students associate words with concrete meanings. Digital flashcards also allow for repetitive exposure, which is crucial for vocabulary retention. Compared to conventional flashcards, digital flashcards offer greater flexibility and interactivity. They can be integrated into various learning activities, including games and quizzes. Thus, digital flashcards have the potential to enhance vocabulary learning outcomes (Cygnet & Sivakumar, 2024).

Previous research has shown that flashcards are effective in improving students' vocabulary mastery. Studies indicate that visual-based learning media significantly support vocabulary retention and recall. Digital learning tools have been reported to increase student motivation and engagement (Gustina Sari, 2023). However, most existing studies focus on vocabulary learning in foreign language contexts. Research on the use of digital flashcards for Indonesian vocabulary learning remains limited. Furthermore, many studies are conducted in urban schools with advanced technological facilities. This indicates a gap in the current literature.

In schools located in rural or semi-urban areas, the use of digital learning media is still relatively limited. Teachers may lack sufficient evidence regarding the effectiveness of such media. As a result, digital flashcards are not widely adopted in classroom instruction. This condition highlights the importance of conducting context-specific research. Empirical findings

are needed to support teachers in selecting effective instructional media. Research conducted in local educational contexts can provide valuable insights. Therefore, investigating digital flashcard implementation in this setting is necessary.

Digital flashcards are proposed in this study as a potential solution to address vocabulary learning challenges (Cabot & Kaldestad, 2019). The use of digital flashcards is expected to increase students' learning motivation and active participation. Visualized vocabulary presentation helps students understand and remember new words more easily. Repeated exposure through digital flashcards can strengthen vocabulary retention. This learning approach encourages student-centered instruction. Students are actively involved in the learning process rather than passively receiving information. Consequently, learning outcomes are expected to improve.

The novelty of this study lies in its focus on Indonesian vocabulary learning at the elementary school level using digital flashcards. Unlike previous research that emphasizes foreign language vocabulary, this study addresses mother-tongue vocabulary mastery. The research is conducted in a public elementary school in Pringsewu, Lampung, providing a distinct educational context. The study employs a quantitative approach to measure learning outcomes objectively. This methodological approach enhances the reliability of the findings. The study contributes to the development of instructional media research. It also offers practical implications for elementary education.

Based on the background discussed above, this study aims to investigate the effect of digital flashcard media on students' vocabulary improvement. The research seeks to provide empirical evidence regarding the effectiveness of digital flashcards in elementary school instruction. The findings are expected to enrich the state of the art in vocabulary learning research. Moreover, the study offers an innovative yet practical solution to vocabulary learning problems. It is expected that the results will encourage teachers to integrate digital media into their instructional practices. Ultimately, improved vocabulary mastery will enhance students' overall language proficiency. Therefore, this study holds both theoretical and practical significance.

METHOD

This study employed a quantitative approach using a pre-experimental one-group pretest–posttest design to examine the effect of digital flashcard media on students' vocabulary mastery. The research was conducted at SD Negeri 2 Sukoharjo, Pringsewu Regency, Lampung, selected based on preliminary findings indicating students' limited vocabulary mastery and minimal use of instructional media. The participants consisted of 30 fourth-grade students, selected through total sampling, as the class size was manageable and allowed full participation. The independent variable was the use of digital flashcard media, while the dependent variable was students' vocabulary mastery, measured through indicators including word meaning recognition, word–image matching, correct vocabulary usage in sentences, and vocabulary recall. Data were collected using a vocabulary test comprising 20 objective items in the form of multiple-choice and matching questions, administered as both a pretest and posttest to ensure consistency.

The research procedure consisted of three stages: administering a pretest, implementing digital flashcard-based instruction over four learning sessions, and conducting a posttest to measure learning outcomes. During the treatment phase, students engaged in interactive activities such as identifying word meanings, matching vocabulary with images, and constructing simple sentences using digital flashcards. Data analysis involved descriptive statistics to identify mean scores and score distribution, followed by inferential analysis using a paired sample t-test to determine the significance of score differences before and after the intervention. Normality testing was conducted prior to hypothesis testing to meet statistical assumptions. The hypothesis was tested at a 0.05 significance level, where a p-value below 0.05 indicated a significant effect of digital flashcard media on students' vocabulary mastery.

FINDINGS AND DISCUSSION

Findings

This section presents the results of the study investigating the effect of digital flashcard media on students' vocabulary mastery at SD Negeri 2 Sukoharjo. The findings are organized into descriptive statistics, assumption testing, and hypothesis testing to answer the research question: Is there a significant effect of digital flashcard media on elementary students' vocabulary mastery?

Descriptive Statistics of Pretest and Posttest Scores

Descriptive analysis was conducted to examine students' vocabulary mastery before and after the implementation of digital flashcard media. The pretest results represent students' initial vocabulary ability, while the posttest results reflect learning outcomes after the intervention.

Table 1. Descriptive Statistics of Vocabulary Test Scores

Test Type	N	Minimum	Maximum	Mean	Standard Deviation
Pretest	30	45	75	60.13.00	07.24
Posttest	30	65	95	82.47.00	06.18

Table 1 shows a clear increase in students' vocabulary mastery after the use of digital flashcards. The mean score improved from 60.13 on the pretest to 82.47 on the posttest. This improvement indicates that students demonstrated better vocabulary recognition, recall, and usage after the treatment. In addition, the decrease in standard deviation suggests more consistent performance among students in the posttest.

Improvement in Vocabulary Mastery Based on Indicators

To provide a more detailed description of students' vocabulary improvement, the results were analyzed based on the established vocabulary indicators.

Table 2. Mean Scores of Vocabulary Indicators

Vocabulary Indicator	Pretest Mean	Posttest Mean	Improvement
Word meaning recognition	61.20.00	84.10.00	0,97916667
Word–image matching	63.40.00	86.50.00	23.10
Vocabulary usage in sentences	58.30.00	80.20.00	0,9375
Vocabulary recall	57.60	79.10.00	21.50

As shown in Table 2, all vocabulary indicators experienced substantial improvement after the implementation of digital flashcards. The highest improvement occurred in word–image matching, indicating that visual support strongly enhanced students' understanding. Vocabulary usage and recall also showed meaningful progress, suggesting that repeated exposure through digital flashcards contributed to long-term retention.

Normality Test Results

Before conducting inferential analysis, a normality test was performed to ensure that the data met the assumptions for parametric testing. The Shapiro–Wilk test was applied to both pretest and posttest scores.

Table 3. Normality Test Results

Test	Statistic	Sig. (p-value)	Conclusion
Pretest	0,66805556	0,14861111	Normal
Posttest	0,66319444	0,12361111	Normal

The results in Table 3 indicate that the significance values for both pretest and posttest scores were greater than 0.05. Therefore, the data were normally distributed, and a paired sample t-test was appropriate for hypothesis testing.

Hypothesis Testing Using Paired Sample t-Test

To determine whether the observed improvement was statistically significant, a paired sample t-test was conducted.

Table 4. Paired Sample t-Test Results

Variable	Mean Difference	t-value	Sig. (p-value)	Decision
Pretest – Posttest	-22.34	-15.27	0.000	Significant

Table 4 shows that the significance value (p = 0.000) was lower than the 0.05 significance level. This result indicates a statistically significant difference between students' vocabulary scores before and after the use of digital flashcard media. Therefore, the null hypothesis was rejected, and the alternative hypothesis was accepted.

The results demonstrate that digital flashcard media had a significant positive effect on students' vocabulary mastery. Students showed notable improvement in all vocabulary indicators, particularly in recognizing word meanings and matching words with images. The findings confirm that digital flashcards are an effective instructional medium for enhancing vocabulary learning in elementary school settings.

Discussion

The findings of this study indicate that the use of digital flashcard media significantly improved students' vocabulary mastery at SD Negeri 2 Sukoharjo. The increase in posttest scores compared to pretest results demonstrates that students benefited from vocabulary instruction supported by visual and interactive media. This result confirms that vocabulary learning becomes more effective when students are actively engaged and provided with meaningful learning experiences. Digital flashcards facilitated repeated exposure to vocabulary items, which is essential in vocabulary acquisition. The improvement observed supports the research question, indicating that digital flashcard media positively affects elementary students' vocabulary learning outcomes.

The significant improvement in students' vocabulary mastery aligns with multimedia learning theory, which emphasizes that learners process information more effectively when verbal input is combined with visual representations. The use of images in digital flashcards helped students associate words with concrete meanings, reducing cognitive load and enhancing memory retention. This finding supports Mayer's theory of multimedia learning, which states that visual and verbal integration enhances comprehension. For elementary school students, who tend to think concretely, visualized vocabulary presentation is particularly beneficial (Alhazmi, 2024). Therefore, the results suggest that digital flashcards are developmentally appropriate for young learners.

Furthermore, the indicator-based analysis revealed that word–image matching showed the highest improvement among students. This finding supports previous studies that highlight the effectiveness of visual-based learning media in vocabulary instruction (Gustina Sari, 2023). Research conducted by earlier scholars reported that flashcard-based learning significantly improves vocabulary recall and recognition. Similar results were also found in studies focusing on digital learning tools, which showed increased student motivation and engagement. The consistency between this study and previous research strengthens the validity of the findings and demonstrates that digital flashcards are an effective medium for vocabulary instruction.

In addition to improving vocabulary mastery, the use of digital flashcards contributed to increased student participation and learning motivation. During the treatment sessions, students were more actively involved in classroom activities, such as identifying vocabulary items and constructing simple sentences. This active participation reflects constructivist learning principles, which emphasize learner-centered instruction and active knowledge construction. Previous studies have shown that interactive learning environments promote deeper understanding and

sustained learning. Thus, digital flashcards not only improve cognitive outcomes but also enhance affective aspects of learning.

Despite the positive findings, this study has certain limitations that should be acknowledged. The research employed a pre-experimental design without a control group, which limits the generalizability of the results. Additionally, the study was conducted in a single elementary school with a relatively small sample size. However, the findings provide valuable insights into vocabulary instruction in a local educational context. Future research is recommended to use experimental designs with control groups and larger samples to strengthen the evidence. Nevertheless, this study contributes to the state of the art by providing empirical support for the use of digital flashcards in Indonesian elementary vocabulary learning.

CONCLUSION

This study concludes that the use of digital flashcard media has a significant positive effect on students' vocabulary mastery at the elementary school level. The quantitative findings demonstrate a substantial improvement in students' vocabulary scores after the implementation of digital flashcards, indicating that visual and interactive learning media effectively support vocabulary acquisition. Students showed progress across all assessed indicators, including word recognition, word–image matching, vocabulary usage, and recall. These results confirm that digital flashcards provide meaningful learning experiences that enhance students' understanding and retention of vocabulary.

Furthermore, this study highlights the importance of integrating appropriate digital learning media into elementary language instruction. Digital flashcards promote student-centered learning by increasing engagement, motivation, and active participation during lessons. Although the study was limited to a single school and used a pre-experimental design, the findings offer valuable practical implications for teachers and schools with similar characteristics. Future research is recommended to involve larger samples and experimental designs to strengthen the generalizability of results. Overall, digital flashcards represent an effective and practical instructional medium for improving vocabulary mastery in elementary education.

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