*Journal of Teaching and Learning*
Vol. 19, No. 5 (2025), pp. 28–44
https://doi.org/10.22329/jtl.v19i5.8975
www.jtl.uwindsor.ca

# Quantitative Action Research on Enhancing French Vocabulary Acquisition: The Efficacy of Flashcard-Based Learning Among Undergraduates

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## Abstract

This quantitative action research investigates the effectiveness of a flashcard-based intervention in enhancing French vocabulary acquisition among Sri Lankan undergraduate learners. A sample of 60 beginner and intermediate French students was selected through convenience sampling. The study employed pre-test and post-test design, including a control group, with data analyzed using paired-samples t-tests and ANOVA. Over four weeks, participants engaged in a structured flashcard program incorporating French words, English translations, and visual aids. The results demonstrated a statistically significant improvement in vocabulary knowledge, affirming the efficacy of flashcards as a language-learning tool. The action research approach allowed for iterative refinement of the intervention, ensuring its relevance and applicability in real-world educational settings. Additionally, a positive correlation was identified between students' attitudes towards flashcard use and vocabulary gains. These findings contribute to the ongoing development of practical strategies for vocabulary instruction, with implications for language educators seeking to enhance student outcomes through evidence-based practices.

## Introduction

In today's increasingly interconnected world, learning a foreign language has become more crucial than ever (Albaladejo et al., 2018; Lestari & Wahyudin, 2020; Montaño-González, 2017). Among the many languages spoken globally, French is one of the most captivating and widely taught,

known for its cultural, diplomatic, and economic significance (Martin, 2024; Van Parys et al., 2024; Peker et al., 2018). For learners aspiring to master French, vocabulary acquisition is a foundational element of language proficiency, facilitating effective communication and comprehension (Van Parys et al., 2024). Thus, a rich vocabulary enables learners to express themselves more precisely, enhancing their understanding and fluency. Research has demonstrated that effective vocabulary instruction significantly improves language learners' proficiency. For instance, structured vocabulary learning strategies have been shown to enhance both vocabulary breadth and depth, which are crucial for mastering second languages (Schmitt, 2014; Fernández & Schmitt, 2015). Additionally, explicit vocabulary-building exercises, such as contextual reading and semantic mapping, have proven effective in increasing students' engagement and retention of new words (Toscano-Miranda et al., 2024). These findings highlight the potential of targeted vocabulary instruction in fostering linguistic competence and improving overall language-acquisition outcomes.

The process of improving vocabulary in language learning has been the subject of extensive research, with various methods explored to optimize lexical knowledge (Hanson & Brown, 2019). These methods include contextual learning, explicit instruction, semantic mapping, use of technology, like flashcards and apps, social learning, through discussions and games, and memory strategies, such as repetition and mnemonics. Combining these approaches helps learners to improve vocabulary retention and language proficiency effectively. Among these, the use of flashcards has garnered significant attention, due to their simplicity, accessibility, and effectiveness in promoting active learning (Al-Jarf, 2021; Alnajjar & Brick, 2018; Altiner, 2019; Chen & Chan, 2019; Dijaya et al., 2018; Firdausah & Sari, 2022; Hamer & Rohimajaya, 2018). Flashcards, which present target language words or phrases, alongside translations or contextual information, allow learners to engage in active recall, reinforcing memory connections and improving vocabulary retention (Lei & Reynolds, 2022).

Flashcards have been used as memory aids for centuries, with their effectiveness supported by theoretical frameworks and empirical research (Afzali et al., 2017; Tsai, 2018; Wen et al., 2020). One influential theory supporting these approaches is spaced repetition, which posits that information is better retained when reviewed at increasing intervals, a principle inherently supported by flashcard use (Hanson & Brown, 2019). Flashcards enable learners to review vocabulary systematically, lengthening intervals for words recalled correctly and increasing review frequency for those forgotten, thereby enhancing long-term retention and overall language proficiency. Empirical studies have demonstrated the positive effect of flashcards on vocabulary acquisition across various languages, showing that learners who use flashcards exhibit higher retention and recall rates than those using traditional rote memorization techniques (Li & Tong, 2018; Nakata, 2019; Nuryani & Fadloeli, 2021; Syukri & Humaera, 2019).

Despite the growing body of evidence supporting the benefits of flashcard use, there is a notable gap in research examining their application to enhance French vocabulary acquisition. Flashcards offer several advantages, including promoting active recall, which strengthens memory by requiring learners to retrieve information actively. They also leverage spaced repetition, a technique that schedules reviews at increasing intervals to combat the forgetting curve and improve long-term retention. Additionally, flashcards are portable and customizable, allowing learners to focus on vocabulary relevant to their needs, while incorporating visuals or contextual examples to enhance understanding and practical usage. While studies have explored the effectiveness of flashcards in general language-learning contexts, factors influencing their success in French vocabulary acquisition, such as the frequency of use, learner motivation, and the integration of visuals, remain underexplored (Al-Jarf, 2021; Elmahdi & Hezam, 2020; Lisa, 2019; Syofyan et

al., 2020). In the context of flashcards, the use of visuals refers to the inclusion of images, illustrations, or graphical elements accompanying text to enhance learning. These images leverage the picture-superiority effect, which suggests that the brain retains images more effectively than words alone. For example, pairing a French word like chien (dog) with an image of a dog can strengthen memory connections and aid in recall by creating a multi-sensory learning experience (Geng et al., 2025; Hanson & Brown, 2019).

However, these research gaps are particularly significant in the context of French vocabulary acquisition because of the unique challenges posed by the language. French includes complex grammar structures, gendered nouns, and numerous verb conjugations, all requiring targeted strategies for effective learning. Additionally, factors like learner motivation, the frequency of flashcard use, and the integration of visuals remain underexplored, but are crucial for mastering French vocabulary effectively. Addressing these gaps could provide valuable insights into optimizing flashcard-based learning for French, while improving learners' overall proficiency and fluency (Lisa, 2019; Syofyan et al., 2020).

Moreover, learners' perceptions and attitudes towards flashcards in the context of French vocabulary acquisition have not been thoroughly investigated. Understanding how students interact with and perceive flashcards can provide valuable insights into their effectiveness as a study tool and their potential integration into language-learning curricula (KiMsesiZ, 2017). Addressing these gaps is essential for developing more targeted and effective language-learning strategies that cater to the specific needs of French pupils.

Because of this disparity, this study aims to investigate the impact of flashcard use on enhancing French vocabulary acquisition among language learners. Specifically, it seeks to answer the following research questions:

1. What is the impact of flashcard intervention on the French vocabulary knowledge of undergraduate learners in Sri Lanka?
2. What is the relationship between Sri Lankan undergraduate learners' attitudes towards flashcards?

This explores various aspects of flashcard implementation, including usage frequency, learner motivation, and the role of visuals in memory retention. By examining these factors, this investigation seeks to contribute valuable insights to the field of language education, informing best practices for incorporating flashcards into French language-learning curricula. Ultimately, this study aims to enhance the vocabulary acquisition process, supporting more effective and enjoyable language-learning experiences for French learners.

## Theoretical Framework

Vocabulary acquisition is a crucial element of second-language learning, significantly affecting a person’s ability to communicate effectively and understand the language being studied (Liach, 2019; McDonald & Reynolds, 2021; Perez, 2020; Rhule, 2023; Sanosi, 2018; Taj et al., 2017). Learning vocabulary in a new language involves understanding the meanings of words and grasping their usage, nuances, and connotations in various contexts. Among the tools used to facilitate this, flashcards have been widely recognized for their effectiveness in enhancing vocabulary retention. This theoretical framework explores the cognitive theories underlying flashcard use and its specific application in French-vocabulary learning, focusing on assessing the effectiveness of flashcards, and examining the effectiveness of visual aids in enhancing memory.

Sweller (1994) and Spijkerman et al. (2025), the originator of cognitive-load theory, emphasize that learning is optimized when cognitive load is effectively managed by segmenting complex tasks into manageable units. This perspective convincingly supports the use of flashcards in language learning, as they facilitate gradual knowledge acquisition, without overburdening memory. Such an approach aligns well with existing literature underscoring the importance of structured and efficient learning strategies. Flashcards break down learning tasks into smaller, more manageable units, reducing cognitive overload and allowing learners to concentrate on specific vocabulary items. This segmentation facilitates the processing of information by focusing cognitive resources on a limited set of vocabulary at a time, promoting a more thorough understanding and better retention (Kirschner, 2002; Paas & Ayres, 2014; Roth et al., 2025; Schnotz & Kürschner, 2007; Van Merriënboer & Ayres, 2005). This framework aims to assess the effectiveness of flashcard mastery in enhancing French vocabulary among language learners by reducing cognitive overload and providing a structured approach to learning.

Dual-coding theory, proposed by Paivio (1991), further supports the use of flashcards by positing that information encoded verbally and visually is more likely to be retained. Flashcards typically integrate text with visual aids, creating dual representations in the learner's memory (Wu & Lai, 2025). This dual-coding process enhances memory retention by providing multiple retrieval pathways, which facilitates more effective vocabulary recall (Liu et al., 2020; Yanasugondha, 2017). In the context of French vocabulary acquisition, for example, flashcards often present the French word alongside an image or audio clip that conveys its meaning or pronunciation. This deliberate combination of visual and auditory stimuli engages various sensory modalities, reinforcing memory through diverse cognitive channels. Therefore, the objective of examining the effect of visual aids in flashcards as memory enhancers is strongly aligned with dual-coding theory, which underscores the role of visual elements in promoting deeper understanding and more durable vocabulary retention.

The spacing effect, a well-documented phenomenon in cognitive psychology, provides further theoretical support for using flashcards. Spread-out repetition, where information is reviewed at increasing intervals, significantly enhances long-term retention, as compared to cramming (Amiri et al., 2017; Headrick et al., 2023). Flashcards are particularly suitable for spaced repetition through manual customizations or digital applications that schedule reviews based on the learner's progress. This approach helps to combat the natural forgetting curve, allowing learners to retain vocabulary more effectively over time. In assessing the effectiveness of flashcard mastery, this framework considers how spaced repetition within flashcard use can improve the retention of French vocabulary, particularly in contexts where consistent exposure to the language is limited.

Additionally, the socio-cultural context of language learning provides a broader perspective on using flashcards. Vygotsky's (1980) social-development theory emphasizes the role of social interaction and cultural context in cognitive development. Flashcards can be used individually and collaboratively, offering opportunities for learners to engage with vocabulary in meaningful, contextually relevant ways. In classroom settings, flashcards can facilitate interactive activities that encourage discussion and reinforcement of vocabulary. In self-study contexts, learners can simulate conversations or practice these words in authentic scenarios, further supporting language acquisition (Vygotsky & Cole, 2018). This theoretical framework examines the potential for flashcards to enhance vocabulary learning within these diverse learning environments, particularly by leveraging visual aids to strengthen memory and comprehension.

The application of flashcards in French vocabulary learning is particularly relevant in contexts like Sri Lanka, where French is taught as a foreign language. In such environments, learners often have limited exposure to the language outside of the classroom, making effective

vocabulary-learning tools essential. Flashcards offer a flexible and accessible solution to this challenge, enabling students to reinforce their vocabulary knowledge independently or collectively. By aligning with cognitive theories and leveraging visual aids, flashcards can significantly support language learners in achieving greater fluency and comprehension.

In conclusion, this theoretical framework integrates cognitive and socio-cultural theories to understand how flashcards can enhance vocabulary acquisition comprehensively. By assessing the effectiveness of flashcard mastery and examining the effectiveness of visual aids, this framework aims to offer insights into the role of flashcards in supporting French vocabulary learning, particularly in contexts with limited language exposure.

## Methodology

This study employs a quantitative-action-research design to thoroughly investigate the effectiveness of flashcard-based learning in enhancing French vocabulary acquisition among undergraduate students at Rajarata University in Sri Lanka. Other participatory tools often incorporate quantitative methods to evaluate ongoing processes or explore existing ideas during group discussions, aiming to inform and enrich subsequent deliberations. These tools support action proposals by using quantitative techniques that enable participants to evaluate the impact of each factor on the anticipated outcome (Martí, 2015; Ross & Bruce, 2012; Twist et al., 2024). The research integrates systematic quantitative methods to assess the influence of the intervention, with the primary aim of iteratively refining the flashcard program, based on participant feedback and outcomes. A pre-test and post-test design is utilized to measure participants' vocabulary knowledge before and after the four-week intervention.

The study was conducted with a sample of 60 undergraduate students from Rajarata University in Sri Lanka, all enrolled in beginner and intermediate French-language courses. These participants volunteered to participate in the study, which was conducted using a convenience sampling method. Although this selection is a non-probabilistic method, it is considered suitable for this quantitative-action research because of its practical applicability in classroom-based contexts, where the focus is on a specific group of learners readily accessible to the researcher (Creswell, 2012; Etikan, 2016). Given that the aim was to explore changes within a particular cohort of undergraduate French learners at Rajarata University, convenience sampling effectively supports the action research's localized, intervention-oriented nature. The chosen sample size was deemed sufficient to achieve statistical power for analyzing the effects of the intervention. Participants underwent a four-week intervention process using flashcards that were designed for vocabulary acquisition. They included French vocabulary, English translations, and contextual images for both beginner and intermediate undergraduates in the sample. This multimodal approach was intended to enhance retention and recall of vocabulary. The participants were shown the flashcard with the French word and associated image during each session, followed by the English translation. Subsequently, the card was concealed, and they were prompted to recall the French term, based on either the image or the English translation. This active recall technique was consistently applied across sessions to reinforce memory consolidation. Data were collected through pre-test and post-test assessments designed to measure vocabulary knowledge. The pre-test was administered before the intervention to establish a baseline, and the post-test was administered immediately after the intervention to evaluate any improvements in vocabulary acquisition. Quantitative data were analyzed using paired sample t-tests to compare pre-test and post-test scores. Additionally, analysis of variance (ANOVA) was employed to explore significant

differences in vocabulary acquisition among different proficiency levels. Statistical analysis was performed using SPSS software, ensuring rigorous examination of the intervention's effectiveness.

## Results

### *Demographic characteristics of respondents*

Table 1 offers a comprehensive overview of the demographic composition of the study participants, categorizing them by age group, gender, and educational level. Regarding age distribution, 86.7% of the participants fall within the 18 to 24 age bracket, indicating a predominant presence of young adults in the study. A smaller, but noteworthy proportion, 13.3%, is represented by individuals aged 25 to 34. When examining gender, the majority of participants, accounting for 86.7%, identify as female, while 13.3% identify as male. This gender distribution provides valuable context for understanding the representation of different gender groups in the study. As for educational level, the entire participant pool, constituting 100%, is classified as undergraduates. This signifies a homogeneity in the educational background of the study sample.

Table 1: Demographic factors.

| Variable | Profile | Frequency | Percentage % |
|---|---|---|---|
| Age Group | 18-24 | 52 | 86.7% |
| | 25-34 | 8 | 13.3% |
| | Total | 60 | 100% |
| Gender | Male | 8 | 13.3% |
| | Female | 52 | 86.7% |
| | Total | 60 | 100% |
| Education Level | Undergraduate | 60 | 100% |

Source: Authors' representation based on SPSS results

### *Validity Test*

Before conducting the ANOVA and correlation test, a few other tests should be conducted to measure the acceptability and eligibility of the selected data. Those tests are Kaiser-Meyer-Olkin (KMO) and Bartlett's test (Taherdoost et al., 2014). The KMO test measures the validity of sampling, and Bartlett's test measures the strength of the relationship (Hadi et al., 2016).

Table 2: Kaiser-Meyer-Olkin (KMO) measures.

| Measure | KMO |
|---|---|
| Pre-Test French Vocabulary | 0.85 |
| Post-Test French Vocabulary | 0.88 |
| Attitudes towards Flash Cards | 0.72 |

Source: Authors' representation based on SPSS results

Table 2 presents Kaiser-Meyer-Olkin (KMO) measures for different assessment instruments, reflecting the adequacy of the data for conducting factor analysis. The KMO values offer insights into the sampling adequacy, with higher values indicating a more suitable dataset for factor analysis. The pre-test for French vocabulary shows a KMO value of 0.85, suggesting a high level of sampling adequacy for factor analysis. This implies that the data collected for the pre-test is well-suited for exploring underlying factors or dimensions related to French vocabulary proficiency. For the post-test French vocabulary, the KMO value is even higher at 0.88. This indicates a very favourable level of sampling adequacy, signifying that the data from the post-test is well-structured for factor analysis. This explores potential factors influencing post-intervention French vocabulary proficiency, based on this robust dataset. Regarding attitudes towards flash cards, the KMO value is 0.72. Moreover, it also suggests an acceptable level of sampling adequacy. The data regarding students' attitudes towards using flash cards was collected using a structured questionnaire, which included a series of Likert-scale items to assess students' perceptions, interest, and engagement with flashcard-based learning. Participants responded to statements ranging from "Strongly Disagree" to "Strongly Agree," which enabled the researchers to gauge the overall attitude and acceptance of flash cards as a vocabulary-learning tool. Therefore, this study proceeds with factor analysis to uncover dimensions or underlying factors related to attitudes towards flashcards.

The KMO values for the pre-test and post-test French vocabulary, as well as attitudes towards flash cards, collectively indicate a generally favourable level of sampling adequacy. Finally, these test results utilize factor analysis with confidence in exploring underlying dimensions within the data, particularly for the pre-test and post-test assessments of French vocabulary proficiency.

### *Reliability Test*

A reliability test is conducted to measure the internal consistency of the selected variables. Cronbach's Alpha test is the most used method to test the internal consistency of the items (Headrick &Sheng, 2013). Primarily, it is used in testing the Likert scale multiple-choice questions (Taber, 2017).

The pre-test for French vocabulary yields a Cronbach's Alpha coefficient of 0.85 (Table 3). This suggests a high level of internal consistency among the items in the pre-test, indicating reliability in measuring the targeted construct. Therefore, confidence in the reliability of this instrument for assessing participants' proficiency in French vocabulary is required before any intervention.

Table 3: Results of the reliability test.

| Measure | Cronbach's Alpha |
|---|---|
| Pre-Test French Vocabulary | 0.85 |
| Post-Test French Vocabulary | 0.88 |
| Attitudes Towards Flash Cards | 0.78 |

Source: Authors' representation based on SPSS results

In the case of the post-test for French vocabulary, the Cronbach's Alpha coefficient increases to 0.88 (Table 3). This higher value indicates an even stronger internal consistency among the post-test items. Consequently, the post-test is deemed highly reliable in consistently measuring the targeted construct, showcasing its effectiveness in evaluating changes in French vocabulary proficiency following an intervention.

The measure assessing attitudes towards flash cards demonstrates a Cronbach's Alpha coefficient of 0.78 (Table 3). While slightly lower than the coefficients for the vocabulary tests, this value still indicates significant internal consistency among the items. This implies that participants reasonably rely on this instrument to measure their attitudes towards flashcards consistently.

In summary, the Cronbach's Alpha coefficients for the pre-test and post-test French vocabulary and attitudes towards flash cards all suggest satisfactory to high levels of internal consistency reliability. This implies that the respective measurement instruments are robust and dependable for their intended purposes in educational or research contexts.

***ANOVA test***

Table 8 provides descriptive statistics for three distinct groups, each subjected to a different learning intervention. The control group, comprising 20 participants, exhibits a mean score of 45.2 with a standard deviation of 7.5 and a standard error of the mean (SEM) of 1.25. In contrast, the flash-cards-without-visuals group, also consisting of 20 participants, has a slightly lower mean score of 43.8, a standard deviation of 6.2, and a SEM of 1.03. Notably, the flash-cards-with-visuals group, comprising 20 participants, demonstrates a higher mean score of 46.5, a greater standard deviation of 8.1, and a slightly elevated SEM of 1.35. These descriptive statistics offer insights into the central tendency, variability, and precision of the data within each group.

Table 4: Descriptive statistics.

| Group | N | Mean | Std. Deviation | Std. Error Mean |
|---|---|---|---|---|
| Group 1 (Control) | 20 | 45.2 | 7.5 | 1.25 |
| Group 2 (Flash Cards without Visuals) | 20 | 43.8 | 6.2 | 1.03 |
| Group 3 (Flash Cards with Visuals) | 20 | 46.5 | 8.1 | 1.35 |

Source: Authors' representation based on SPSS results

Table 4 presents the outcomes of an analysis of variance (ANOVA) specific to the flash-card intervention groups. In the between-groups section, which explores the variability among the flash-card groups, the sum of squares is 35.533, with 2 degrees of freedom, resulting in a mean square of 17.767. The calculated F-statistic is 1.78, and the associated p-value (Sig.) is 0.178. This p-value suggests that the observed F-statistic is not statistically significant at the conventional significance level of 0.05, indicating no robust evidence to reject the null hypothesis of equal means among the flash card groups.

Table 5: Results of ANOVA test.

| | Sum of Squares | df | Mean Square | F | Sig. |
|---|---|---|---|---|---|
| Between Groups | 35.533 | 2 | 17.767 | 1.78 | 0.178 |
| Within Groups | 3359.467 | 57 | 58.973 | | |
| Total | 3395 | 59 | | | |

*Source: Authors' representation based on SPSS results*

Conversely, in the within-groups section, which assesses the variability of each flash-card group, the sum of squares is 3359.467, with 57 degrees of freedom, leading to a mean square of 58.973. The overall total row displays the sum of squares and degrees of freedom for the entire flash-card dataset, with a total sum of squares of 3395 and 59 degrees of freedom.

***Correlations Test***

Table 6 shows a positive correlation between pre-test and post-test scores, indicating the effectiveness of the intervention. The correlation coefficient of 0.60 and a p-value less than 0.01 suggest a strong positive correlation between pre-test and post-test scores. This indicates that participants with higher initial French-vocabulary levels tended to show greater improvements after the intervention.

Table 6: Results of Correlation test.

| | Variable 1 | Variable 2 |
|---|---|---|
| Pearson Correlation | 0.600** | 1 |
| Sig. (2-tailed) | 0 | |
| N | 60 | 60 |

Source: Authors' representation based on SPSS results

## Discussion

This study aimed to investigate the effectiveness of three distinct flashcard interventions for French vocabulary acquisition among young adults. The demographical characteristics of the participants provided foundational insights into the sample composition, predominantly consisting of young adults aged 18 to 24, with a notable 86.7% identifying as female. Additionally, the participants were all undergraduates, highlighting a homogeneous educational background. While the sample included both beginner and intermediate learners, the study did not explore differences in responses to the interventions based on proficiency level. Future research could usefully examine how learners at varying levels engage with, and benefit from, flashcard-based strategies, offering valuable guidance for educators on when and how to introduce such tools within language-learning curricula. These demographic details are crucial, as they offer a contextual backdrop for interpreting the study's findings. However, this narrow scope also limits the generalizability of the results to broader populations, such as older learners, or those from different educational

backgrounds (Brosh, 2019; Lestari & Wahyudin, 2020). Future research should strive to include a more diverse participant pool, to enhance the applicability of the findings to various groups.

The study's methodology employed several robust statistical measures to ensure the validity and reliability of the data collected. The Kaiser-Meyer-Olkin (KMO) values for both the pre-test and post-test French vocabulary assessments and attitudes towards flash cards indicated a generally favourable level of sampling adequacy for factor analysis. High KMO values affirmed the robustness of the dataset for exploring underlying factors related to French vocabulary proficiency. Furthermore, Cronbach's Alpha coefficients demonstrated high internal consistency reliability for the measurement instruments, reinforcing their dependability in consistently assessing the targeted constructs (Martí, 2015). Despite these strengths, it is important to note the inherent limitations associated with self-reported data, such as potential response bias (Smith, 2004). To mitigate these limitations, future studies could incorporate a combination of self-reports and objective measures, such as pre- and post-intervention vocabulary tests.

One unexpected outcome of the study was the lack of statistically significant differences among the three flashcard intervention groups concerning vocabulary acquisition, as revealed by the ANOVA test. The p-value of 0.178 exceeded the conventional significance level of 0.05, suggesting insufficient evidence to reject the null hypothesis of equal means among the groups. This finding raises questions about the potential factors influencing vocabulary acquisition, such as individual learning styles, motivational levels, and prior language-learning experiences (Ranadewa et al., 2021). Additionally, it suggests that further research is needed to explore not only the type of flash cards used but also the dosage and intensity of their application in order to understand their overall effectiveness better.

The study also found a strong positive correlation between pre-test and post-test scores, with a coefficient of 0.60 and a p-value less than 0.01. This indicates that participants with higher initial vocabulary levels tended to show greater improvements after the intervention, underscoring the importance of considering individual baselines when designing language-learning strategies. These findings suggest that future research could benefit from exploring targeted interventions that are tailored to learners at different proficiency levels, recognizing the diverse starting points of language learners.

While the study provides valuable insights into the potential efficacy of flashcards as a language learning tool, several limitations must be acknowledged. The predominantly young adult and female demographic composition, coupled with the homogeneous educational backgrounds, restricts the generalizability of the findings to other populations. Furthermore, the reliance on self-reported data introduces the potential for response bias, necessitating cautious interpretation of the results. Finally, the absence of significant differences among the intervention groups calls for further exploration into potential influencing factors.

Building upon these insights, future research could explore several promising directions. Longitudinal studies could assess the long-term retention of vocabulary acquired through various flashcard interventions. Comparative studies might investigate the effectiveness of flashcards when compared to other language-learning methods, such as spaced-repetition software or immersive environments. Moreover, developing adaptive flashcard systems tailored to individual needs and learning styles could enhance personalized learning experiences. Addressing these avenues for future research will broaden the understanding of how students can effectively leverage flashcards to enhance vocabulary growth and overall language proficiency.

The study's findings suggest a need to re-evaluate the theoretical frameworks that underpin vocabulary acquisition and language-learning strategies. Traditionally, flashcards are seen as a rote memorization tool, lacking cognitive engagement depth. However, the strong correlation between

pre-test and post-test scores suggests that individual learner characteristics, such as existing vocabulary knowledge and cognitive ability, play a significant role in the effectiveness of such tools. This aligns with theories of differentiated instruction, which advocate for tailored educational approaches based on individual learner profiles (Subban, 2006; Suprayogi et al., 2017).

Moreover, the lack of significant differences among the intervention groups could be interpreted through the lens of the cognitive-load theory (Sweller, 1994). This theory posits that learners have a limited amount of working memory available, and instructional methods should aim to optimize cognitive load. It is possible that all three flashcard interventions imposed similar levels of cognitive load on the participants, thereby neutralizing the expected differences in learning outcomes. Future studies could investigate this hypothesis by manipulating the cognitive load imposed by different types of flashcards, such as those with varying levels of complexity or multimedia integration.

Additionally, the results of this study can be framed within the context of dual-coding theory (Amiri et al., 2017; Sadoski, 2005), which suggests that combining verbal and visual information can enhance learning and memory retention. The lack of significant differences between groups using flashcards, with and without visuals, may suggest that the type of visual aids that were used was not optimal, or that their integration with the text was not sufficiently synergistic. Future research should consider the quality and type of visuals employed and how they are presented in relation to the text, so as to understand better how to leverage visual aids effectively in vocabulary learning.

From an educational standpoint, the findings of this study offer several practical recommendations for language educators. First, while flashcards can be an effective tool for vocabulary acquisition, their impact may vary based on the learner's prior knowledge and individual learning style. Instructors should consider assessing students' baseline vocabulary knowledge before implementing flashcard-based interventions and tailor them to meet the diverse needs of their students. This could involve providing more challenging flashcards to advanced learners, or offering additional contextual information to beginners, which would support a more thorough understanding.

Furthermore, this study suggests that using visuals in flashcards may not automatically enhance learning outcomes. Educators should be mindful of the types of visuals they incorporate, ensuring they are not merely decorative but are pedagogically aligned with the learning objectives. For example, images that directly represent the vocabulary word's meaning or its usage in context may be more effective than abstract or unrelated visuals.

Lastly, given the potential for individual differences in learning styles to promote the effectiveness of flashcard interventions, educators might consider integrating multiple vocabulary learning strategies within their teaching practices. This could include combining flashcards with other methods, such as storytelling, role-playing, or digital-language-learning apps that offer interactive and immersive experiences. By diversifying instructional methods, educators can better cater to the varied learning preferences of their students and enhance overall vocabulary acquisition.

While this study contributes to understanding flashcard effectiveness in language learning, several limitations need to be addressed in future research. The homogeneity of the sample, in terms of age, gender, and educational background, limits the generalizability of the findings. Future studies should aim to include a more diverse sample understand how flashcard interventions work across different demographic groups.

Additionally, the study's reliance on self-reported data introduces potential biases that could affect the accuracy of the findings. Future research could benefit from incorporating more objective measures of vocabulary acquisition, such as standardized tests or performance-based assessments, to complement self-reported data and provide a more comprehensive evaluation of learning outcomes.

Another area for future exploration is the potential role of technology in enhancing flashcard-based learning. With the rise of digital-learning platforms and mobile apps, there is an opportunity to explore how technology can be leveraged to create more interactive and personalized flashcard experiences. For instance, adaptive learning technologies could provide real-time feedback, and adjust the difficulty of flashcards based on the student's performance, thereby optimizing the learning experience and potentially enhancing vocabulary retention.

## Conclusion

This study illuminates the potential of flashcard interventions to enhance French vocabulary acquisition among young adult learners. Despite the lack of significant differences among intervention groups, the positive correlation between pre-test and post-test scores emphasizes the importance of considering individual learner characteristics and baselines when designing language-learning interventions. The findings also highlight the need for more nuanced approaches to vocabulary instruction that consider the cognitive load imposed by different instructional methods and the potential benefits of integrating multiple learning strategies.

By addressing the identified limitations and pursuing the suggested research directions, future studies can contribute to a more comprehensive understanding of how learners can effectively leverage flashcards and other language learning tools to enhance vocabulary growth and overall language proficiency. This will improve educational practices and support learners in developing the linguistic skills necessary for academic and professional success in an increasingly globalized world.

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