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Effects of Anki-Based Spaced Repetition on Academic Vocabulary Use in Writing

Efectos de la repetición espaciada basada en Anki sobre el uso de vocabulario académico en la escritura

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ABSTRACT

Pre-service EFL teachers frequently struggle to use academic vocabulary in writing activities. This study aimed to investigate the effectiveness of Anki-based spaced repetition in enhancing the productive use of academic vocabulary in contextualized EFL writing tasks. The present study employed a quasi-experimental pretest-posttest design with a sample of 40 B1 Ecuadorian pre-service teachers, 31 women and 9 men. The intervention consisted of 8 sessions with 20 students in an experimental group and 20 in a control group. The experimental group reviewed 35 B2 academic words through Anki flashcards, whereas the control group received regular classroom instruction. Both groups completed the same writing tasks. To analyze the data, paired-samples and independent-samples t-tests were conducted. The outcomes indicated that the experimental group achieved higher post-test target vocabulary use ($M = 2.70$, $SD = 1.895$) than the control group ($M = 1.50$, $SD = 1.395$). The between-group difference was statistically significant, with a medium-to-large effect size (Cohen's $d = 0.72$). The findings suggest that combining spaced repetition with contextualized writing practice may help translate vocabulary knowledge into productive use. This study presents empirical evidence for integrating Anki-based spaced repetition with writing practice to enhance academic vocabulary development in EFL contexts.

Keywords: spaced repetition, Anki, productive vocabulary, pre-service teachers, EFL writing, vocabulary development

RESUMEN

Los futuros docentes de inglés como lengua extranjera (EFL) suelen tener dificultades para utilizar vocabulario académico en actividades de escritura. Este estudio tuvo como objetivo investigar la efectividad de la repetición espaciada basada en Anki para mejorar el uso productivo del vocabulario académico en tareas contextualizadas de escritura en contextos de inglés como lengua extranjera. Se empleó un diseño cuasi-experimental con pretest y posttest en una muestra de 40 futuros docentes ecuatorianos de inglés con nivel B1 (31 mujeres y 9 hombres). La intervención consistió en 8 sesiones, con 20 estudiantes en el grupo experimental y 20 en el grupo de control. El grupo experimental estudió 35 palabras académicas de nivel B2 mediante tarjetas de Anki, mientras que el grupo de control recibió instrucción regular en el aula. Los datos se analizaron mediante pruebas *t* para muestras relacionadas y muestras independientes. Los resultados mostraron que el grupo experimental alcanzó un mayor uso del vocabulario objetivo en el posttest ($M = 2.70$, $DE = 1.895$) que el grupo de control ($M = 1.50$, $DE = 1.395$). La diferencia entre grupos fue estadísticamente significativa con un tamaño del efecto de moderado a grande (d de Cohen = 0,72). Los resultados sugieren que combinar la repetición espaciada con escritura contextualizada puede mejorar el uso productivo del vocabulario en inglés. Este estudio aporta evidencia empírica para integrar la repetición espaciada basada en Anki con la práctica de escritura y fortalecer el desarrollo del vocabulario académico en contextos de inglés como lengua extranjera.

Palabras clave: repetición espaciada, Anki, vocabulario productivo, futuros docentes, escritura en inglés como lengua extranjera

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INTRODUCTION

Learning English continues to be a fundamental pillar for individuals who seek to advance academically and professionally in the 21st century. In the Ecuadorian context, higher English proficiency has been correlated with an increase in job prospects and opportunities for professional growth (Aguilar Villarroel & Córdova Calderón, 2024). In the same vein, English mastery is associated with greater remuneration and international mobility opportunities (Smith, 2025). Among the four core English skills (speaking, listening, writing, reading), many students often consider writing the most cognitively demanding ability. As Flower and Hayes (1981) explained in their writing model, writing is a multifaceted and recursive process that involves planning, translating, and reviewing. When writing, not only do students have to process language at different levels, such as lexical, syntactic, and semantic, but they also must take into account the audience, purpose, and overall coherence of the text (Khudaverdiyeva, 2025). For EFL teachers, academic writing is essential for engaging with pedagogical literature, conducting research projects, designing functional teaching materials, and communicating professionally in educational settings.

Previous studies indicate that EFL learners regularly experience a multitude of difficulties when using vocabulary appropriately in written texts. These mistakes often result in word choice errors and a significant gap between receptive and productive vocabulary knowledge (Ahmed et al., 2025; Isma et al., 2023; Yılmaz & Kavanoz, 2025). To promote accurate vocabulary use, spaced repetition applications like Anki have become a popular topic of recent EFL research due to their algorithms and long-term retention benefits (Honarзад & Soyoof, 2023; Nguyen et al., 2025). However, a limitation in previous work is that these digital flashcard systems often show more significant results in receptive rather than productive knowledge (Mohammadi et al., 2024). Furthermore, studies on spaced repetition for productive vocabulary use in contextualized writing tasks remain scarce (Lei & Reynolds, 2022). Specifically, limited evidence is available about its effect on productive academic vocabulary in writing tasks among Ecuadorian pre-service teachers.

To address this issue, the purpose of this study was to analyze the effects of Anki-based spaced repetition on target academic vocabulary use in writing. This study contributes to the field by evaluating an intervention that combines spaced repetition with targeted writing tasks to support the transition from vocabulary learning to productive lexical use. This investigation addressed the following research questions:

- How does the use of target academic vocabulary in students' writing change before and after the intervention?
- To what extent is Anki-based spaced repetition more effective than regular classroom instruction in increasing the use of target academic vocabulary in students' writing?

Literature review

Academic Vocabulary Development in EFL Writing

Several authors have made significant contributions to the understanding of the role of academic vocabulary in academic writing. In terms of its definition, academic vocabulary is considered an umbrella term that encompasses general cross-disciplinary words and domain-specific terms (Coxhead, 2024). A well-accepted list of academic vocabulary is the Academic Word List (AWL), developed by Coxhead (2000), which comprises 570 word families considered high-frequency across diverse disciplines. In recent applied linguistics research, some researchers have relied on large databases to extract vocabulary lists, such as the BNC/COCA wordlist, to best capture the shifts in modern discourse and meet contemporary linguistic needs (Ha, 2022). However, the ultimate success of vocabulary lists is intertwined with the ability of instructors to adapt the words based on students' proficiency and pedagogical needs (Qureshi & Malik, 2025). The importance of these words becomes significant in undergraduate programs where students are required to produce a variety of academic texts, such as essays, reports, and research papers. Moreover, having a strong command of academic vocabulary is crucial as it contributes to the overall quality of the written composition (Maamuujav, 2021). Hence, leveraging such words may support academic comprehension and better engagement with academic writing.

Notwithstanding the relevance of academic vocabulary, English learners regularly face a myriad of difficulties. Maamuujav (2021) stated that the use of academic vocabulary in academic contexts poses a substantial hurdle for learners who are still developing their language proficiency. Such difficulties are reflected in recent findings. Isma et al. (2023) analyzed university students' writing assignments and found that errors in word form, inappropriate word choice, and wrong English collocations were among the most prominent writing mistakes. They suggested that expanding learners' vocabulary repertoire can reduce the likelihood of these errors. Similarly, a Saudi Arabian study conducted by Ahmed et al. (2025) concluded that L1 negative transfer, limited vocabulary, and ineffective learning strategies are some of the reasons why EFL undergraduates tend to struggle with wrong word choice in writing. Taken together, these studies demonstrate that mistakes in academic vocabulary use are associated with a lack of lexical knowledge and insufficient awareness of context-appropriate word usage.

Relationship Between Vocabulary Knowledge and Writing Quality

Vocabulary knowledge has consistently been identified as an important predictor of writing quality in EFL contexts. Mujtaba et al. (2021), through written picture descriptions and vocabulary assessments, found a positive correlation between vocabulary size and writing performance. In terms of vocabulary complexity, Peng et al. (2023) found that a more complex vocabulary was closely linked to EFL learners' writing quality. Overall, these findings indicate

that several dimensions of vocabulary knowledge play a significant role in enhancing the quality of written production.

Nevertheless, possessing vocabulary knowledge does not necessarily ensure its successful use in writing. Lee (2025) identified that there is indeed a gap between active and passive vocabulary among different English levels, but it narrows as learners achieve a higher level of language proficiency. By contrast, findings from Yılmaz and Kavanoz (2025) indicate that the disparity may actually become more pronounced at B1 level. Moreover, they found no correlation between vocabulary knowledge and writing scores, and writing tasks were suggested as a way to bridge the gap. In order to use words actively, Evans et al. (2025) stressed that learners need a deeper level of lexical knowledge to integrate them into messages within appropriate contextual and grammatical frameworks. However, effective productive vocabulary use also depends on the ability to retain vocabulary.

Spaced Repetition and the Forgetting Curve

Spaced Repetition (SR) has been widely studied in educational research. SR is a learning technique that involves strategically reviewing information at intervals distributed over time (Burel et al., 2025). Spaced reviews are believed to expand memory retention more than massed practice, even if the study time is identical in both methods (Kang, 2016). Review timing is often categorized as uniform when intervals remain the same, expanding when intervals steadily increase over time, and contracting when intervals decrease over time. A less fixed spacing schedule is called “adaptive reviewing” and refers to spacing systems that adjust the review timing based on learners’ performance and practice history. This approach allows review schedules to be tailored to individual learning needs (Choffin et al., 2021). Ebbinghaus (1885, as cited in Abbas et al., 2023, pp. 3–4) pioneered the study of forgetting, identifying that newly learned information is rapidly forgotten if not periodically reviewed. This concept is known as the forgetting curve, a pattern of memory loss that demonstrates that retention declines as time passes after initial learning. Furthermore, he suggested that repeated, spaced reviews strengthen memory retention and slow the rate of forgetting, and that techniques that utilize active recall methods can counteract the natural forgetting pattern (Abbas et al., 2023, p. 4).

Digital Vocabulary Learning Tools

The integration of mobile technology has substantially reshaped the landscape of modern foreign language education. According to Burston and Giannakou (2022), Mobile-Assisted Language Learning (MALL) refers to the use of mobile applications with built-in functions such as audio/video recording or taking pictures and notes for the purpose of language teaching and learning within educational settings. A four-month study by Boroughani et al. (2023) found that university students who utilized a mobile application (Quizlet) significantly outperformed those who used traditional paper materials, with very large effect sizes in vocabulary retention. This finding aligns with Burston and Giannakou's meta-analysis that revealed large learning effects of

the use of smartphones in vocabulary acquisition. These positive outcomes could be explained by the unique characteristics of mobile devices. Mobile language-learning applications increase students' engagement, promote autonomy, and provide access to information, and often include SR algorithms (Teymouri, 2024). Ultimately, these findings build upon the extensive literature about how mobile tools assist vocabulary acquisition and promote flexible, independent study.

Among the wide range of MALL applications available, digital flashcard systems have received considerable attention. Research conducted by Mohammadi et al. (2024) compared mobile-based flashcards (Anki app), paper-based flashcards, and traditional vocabulary lists. Results showed that digital flashcards are superior to traditional teaching methods or vocabulary lists for vocabulary learning. Likewise, Honarзад and Soyoof (2023) and Nguyen et al. (2025) compared paper and digital flashcards and observed that although both yielded improvements in word retention, the digital flashcard app (Anki) was more effective in increasing L2 vocabulary acquisition. Reinforcing this, Najafi Karimi and Kheradmandi Amiri (2025) demonstrated, by employing a delayed posttest, that Anki provided superior long-term retention compared to both printed flashcards and traditional word lists. A contrasting finding was from Trinh Quoc et al. (2026), who reported no statistically significant difference in vocabulary learning between the experimental group using a flashcard system (Quizlet) and the control group receiving traditional instruction. They concluded that utilizing flashcard software in isolation may not be sufficient to promote vocabulary development. This highlights the importance of implementing opportunities for vocabulary use as a complement to flashcards.

Anki is a learning tool that has become a popular topic of recent EFL research due to its powerful spaced-repetition algorithm and customization features. It is an open-source program that incorporates adaptive review scheduling and retrieval practice. Its algorithm schedules review intervals based on users' ratings of recall difficulty for each card, with easier flashcards appearing less often and difficult ones being shown more frequently (Anki, 2025). This mechanism increases efficiency as students focus on the words they struggle to remember instead of studying everything uniformly. Moreover, it integrates retrieval practice, a studying technique that has been found to strengthen long-term memory more effectively than passively restudying material (Roediger & Karpicke, 2006). Furthermore, it offers the possibility to include images, text, video, and audio. Such multimodal options allow for vocabulary to be presented through diverse formats, which could enhance retention and users' experience.

Empirical Studies on Spaced Repetition in EFL Contexts

Although extensive research has examined the effects of spaced repetition on vocabulary development, there is little evidence of its impact on productive academic vocabulary use in writing tasks. Previous research by Honarзад and Soyoof (2023) and Nguyen et al. (2025) reported that Anki flashcards promoted more long-term vocabulary retention than paper flashcards. However, they did not measure productive vocabulary gains. Mohammadi et al.

(2024), on the other hand, studied both productive and receptive vocabulary learning and found that the group using Anki outperformed paper-based flashcard and vocabulary list groups in both aspects. Despite this promising result, productive lexical gains were measured through sentence-completion exercises. The paucity of empirical studies that have examined the effects of spaced repetition on productive vocabulary use has already been identified in research synthesis by Lei and Reynolds (2022). All of these findings emphasize the need for studies employing spaced repetition that focus on measuring productive vocabulary, especially in contextualized writing.

MATERIALS AND METHODS

Research Design

This study follows a quasi-experimental research design, employing a quantitative research approach to investigate the effects of Anki-based spaced repetition on academic vocabulary use in EFL writing. The quantitative approach was deemed appropriate for this study because it sought to determine the effectiveness of an instructional intervention through the collection and analysis of numerical data (Creswell & Creswell, 2018, pp. 22, 35). A quasi-experimental design was adopted, as data were collected from a real EFL classroom where random assignment was not feasible. In educational settings, using pre-existing groups is considered a characteristic of quasi-experimental research (Creswell & Creswell, 2018, p. 146). The study involved both an experimental and a control group. To address the research questions, pre- and post-tests were administered to both groups to measure changes in academic vocabulary use subsequent to the intervention. The experimental group received 8 sessions in which Anki was used as a tool for reviewing the target academic words. Conversely, the control group received regular classroom instruction without the use of Anki.

Participants and Context

This study involved a total sample of 40 EFL students who were in the second year of an English teaching degree by the time of the intervention. This research was conducted at a public university in Ecuador. A convenience sampling technique was employed as participants were readily accessible and enrolled in a pre-existing writing subject where the intervention could be best implemented. The participants' English proficiency was approximately at the B1 level, as determined by the program curriculum. The experimental and control groups each comprised 20 students who reported that they had never used Anki or any other spaced-repetition tool before. The groups belonged to pre-existing classes. Most participants in both groups were between 19 and 22, with only two students from the experimental group being 27 and 33 years old.

Initially, there were 47 students who agreed to participate in the study. However, the number of participants was reduced to 40 after the following criteria were applied. Inclusion criteria were created to determine the participants whose paragraphs were going to be analyzed. Students' paragraphs had to meet the following points: (1) the text addressed the prompt, (2) the

writing contained a minimum of 130 words, (3) the text was understandable enough although errors were present. Students were also excluded from the analysis process if they attended fewer than 6 sessions.

Participants voluntarily agreed to take part in the study by signing an informed consent form before the intervention was conducted. Prior to signing, they were informed about the structure of the sessions, potential advantages of using Anki, and their right to withdraw at any moment with no academic repercussions. Additionally, the researcher ensured all data collected would be confidential, with access being restricted only to the researcher and the researcher's supervisor.

Instruments

The research questions were answered using paragraph writing tasks that constituted the pre-test and post-test. The purpose of this instrument was to obtain quantitative data on the number of target academic vocabulary items in written output before and after the intervention. Both paragraphs consisted of the same prompt to ensure adequate comparison between the writings. The prompt was “*Write a paragraph between 130 and 150 words discussing the role of technology in education. Include: 1) Advantages of technology in education, 2) Disadvantages or problems caused by technology, 3) Your personal opinion.*” Students were given 40 minutes to complete the paragraphs, which should be between 130 and 150 words. Both tests were developed under strict supervision, limiting access to any external help.

The students' written output was analyzed by the researcher and scored as follows. Each correctly used target word was awarded one point. Repeated target words were counted only once, whereas misspelled words or target words used incorrectly in context were not counted. Inflectional forms of the target words were accepted provided that they retained the same part of speech. The total number of correctly used target vocabulary items comprised each participant's score.

Intervention

The intervention for the experimental group involved the use of Anki-based spaced repetition supported by writing practice to improve students' productive target vocabulary use in writing. In contrast, the control group followed the regular classroom instruction without any dedicated vocabulary-review activities. Despite this difference, both groups completed the same writing practice activities during the intervention.

The experimental intervention consisted of eight sessions conducted over the course of four weeks, with two weekly sessions. Each session was developed in alignment with the subject's academic objectives. The overarching goal of the course was to develop students' ability to write in the target language for academic purposes. Each intervention session had a duration of 60 minutes and was structured as follows. During the first 20 minutes, students completed reviews using Anki while the instructor clarified their doubts. Anki was set to show a maximum of five

new academic words per day. Previously learned vocabulary was reviewed according to Anki’s spaced repetition algorithm. After the review time, students were given 10 minutes to analyze the prompt and brainstorm ideas, as writing is not a linear but a recursive process (Flower & Hayes, 1981). In the last 30 minutes, students were required to write a paragraph incorporating the target vocabulary items they could remember from the review. This writing practice was considered crucial as research by Lavigne et al. (2022) demonstrates that simply increasing vocabulary breadth does not independently improve writing quality. Instead, students must actively apply new words in context. The researcher provided the paragraph prompts, which naturally triggered the use of the new words. Students were encouraged to complete daily reviews outside the classroom. Table 1 presents a summarized description of how each session was structured.

Table 1.
Intervention Procedure

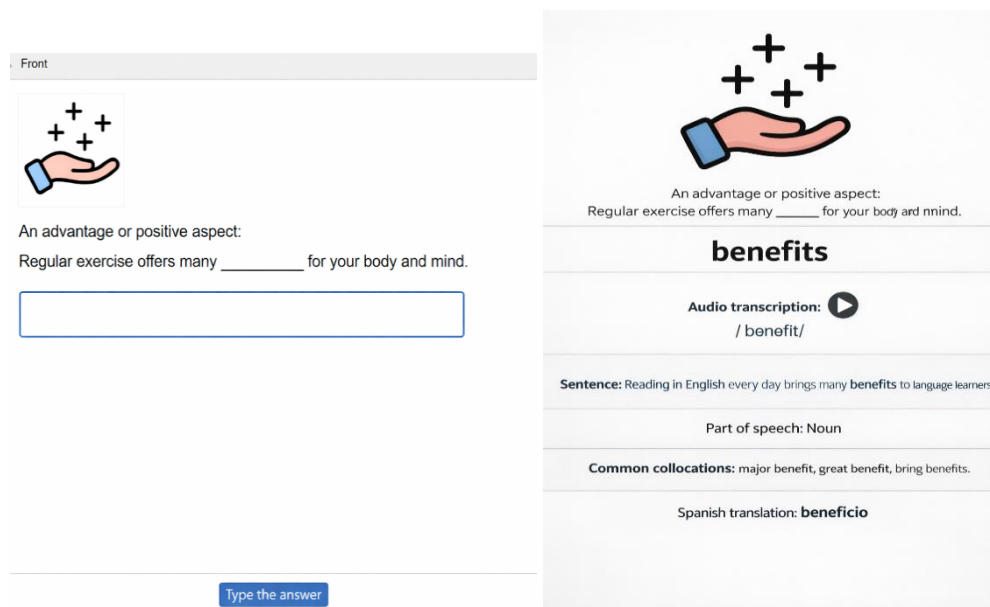
Time	Activity
20 min	Flashcard review of pending and new academic words.
10 min	Reading the prompt and brainstorming ideas
30 min	Completion of a paragraph integrating the target vocabulary.

Flashcard format

The type of flashcard used in the deck is called “type the answer”. With that format, students could input their responses and verify the answer alongside the spelling. With respect to the content of the flashcards, Figure 1 illustrates the format and its components. The front part incorporates a visual aid, the meaning, and a sentence example with a blank space that indicates the word that needs to be typed. Once students typed the answer, they could access the rest of the flashcard, which was composed of the correct word and spelling, the audio pronunciation accompanied by its phonetic transcription, another sentence example, the part of speech, common collocations, and the Spanish translation. Definitions, audio pronunciations, phonetic transcriptions, and parts of speech were obtained from the Cambridge and Oxford dictionaries. The remaining content was adapted by the researcher, with assistance from ChatGPT. Each section was selected to give students a comprehensive understanding of the word use in authentic contexts as well as to ensure accurate pronunciation.

Figure 1

Flashcard format and content



Academic Target Words

The target vocabulary was organized in an Anki deck, which contained 35 words as shown in Table 2. All flashcards were created by the researcher. Each word was selected in accordance with the following three criteria: A) Relevance to the lesson topic. B) At least 5 occurrences per million words in the subcategory “academic” from the Corpus of Contemporary American English (COCA). C) The word level must be B2 according to the English Vocabulary Profile. Although the participants were at a B1 proficiency level, B2 target words were selected because future English teachers in Ecuador are expected to reach a B2 level by the end of their undergraduate studies (Presidencia de la República del Ecuador, 2023). Before creating the flashcards, words were revised and validated by a professor with experience teaching B1 English learners.

Table 2

Target words per session

Sessions	Target Vocabulary
Session 1	struggle, lack, concern, setting, crucial
Session 2	transform, contemporary, rapid, significant, while
Session 3	approach, primary, effective, resource, furthermore
Session 4	impact, consequence, virtual, instant, as a result
Session 5	educational, access, benefit, enable, contribute
Session 6	responsible, substantial, increase, moreover, consequently
Session 7	diverse, whereas, in contrast, on the one hand... on the other hand, considerable.
Session 8	Review of pending words

Data Collection Procedure

Data were collected at different stages of the study. In Week 0, informed consent was obtained, and the pre-test paragraph was administered. Additionally, participants from the experimental group received instruction on how to use the mobile application. During Weeks 1 to 4, they engaged in two weekly sessions incorporating Anki-based vocabulary practice and writing practice. In Week 5, a post-test paragraph was administered using the same writing prompt as the pre-test. Table 3 summarizes the data collection timeline.

Table 3

Data Collection Timeline

Week	Activity
0	Obtain consent, instruction on Anki use, and Pre-test.
1–4	Anki practice and short writing tasks.
5	Post-test Paragraph

Data Analysis

A two-step analysis was conducted on the writing samples to determine the number of the target academic vocabulary. Firstly, the paragraphs were submitted to the AntWordProfiler program (Anthony, 2026) along with the word list containing the target academic vocabulary and its inflectional forms. This step was done to extract the number of target words students used in their writings. Then, the researcher manually reviewed the words flagged by the program to discard forced and unnatural vocabulary use.

Subsequently, the data obtained from the previous process were analyzed using a paired-samples t-test to examine differences in target vocabulary scores within each group. Additionally, an independent-samples t-test was conducted to compare post-test scores between the experimental and control groups. All statistical analyses were conducted using SPSS version 27, with significance level set at $p < .05$. The use of this dual approach provides a clear description of changes within groups and a fair comparison between groups.

RESULTS

This study aimed to analyze the effects of Anki-based spaced repetition on target academic vocabulary use in writing. This section presents the results according to the two research questions. The first research question was answered through a paired-samples t-test which examined changes in target academic vocabulary use within each group from pre-test to post-test. The results of the second research question were obtained from an independent-samples t-test, which evaluated the effectiveness of the Anki-based spaced repetition intervention from the post-test performance of the experimental and control groups.

Within-Group Changes

Table 4 presents the results of the paired-samples t-tests for the experimental and control groups. The experimental group showed an increase in the mean number of correctly used academic words from 1.05 (SD = 1.538) on the pre-test to 2.70 (SD = 1.895) on the post-test, representing a mean gain of 1.65 points. This increase was statistically significant, $t(19) = -4.067$, $p = .001$, with a large effect size (Cohen's $d = 0.90$). In contrast, the control group showed only a minimal increase in mean scores from 1.40 (SD = 1.429) on the pre-test to 1.50 (SD = 1.395) on the post-test, yielding a negligible mean gain of 0.10 points. The analysis confirmed that this difference was not statistically significant, $t(19) = -0.384$, $p = .705$, with a small effect size (Cohen's $d = 0.08$).

Table 4

Paired-Samples T-Test Results

Group	N	Pre-test M (SD)	Post-test M (SD)	Mean Gain	<i>t</i>	<i>df</i>	<i>p</i>	Cohen's <i>d</i>
Experimental	20	1.05 (1.538)	2.70 (1.895)	+1.65	-4.067	19	.001	0.90
Control	20	1.40 (1.429)	1.50 (1.395)	+0.10	-0.384	19	.705	0.08

Note. *M* = mean; *SD* = standard deviation; *df* = degrees of freedom; Cohen's *d* = standardized mean difference.

Between-Group Differences

An independent-samples t-test was conducted (See Table 5) to compare the performance of the experimental and control groups. Before the analysis, Levene's Test for Equality of Variances was run to verify that the two groups had similar variability in their scores. The assumption of homogeneity of variance was met in the pre-test ($F = 0.259$, $p = .614$) and post-test ($F = 1.516$, $p = .226$). This confirmed that equal variances could be assumed and a standard independent-samples t-test was conducted. As shown in Table 5, there was no statistically significant difference between the two groups on the pre-test, $t(38) = -0.746$, $p = .461$, indicating that the groups were comparable before the intervention. However, a statistically significant difference was found on the post-test, $t(38) = 2.281$, $p = .028$. The experimental group ($M = 2.70$, $SD = 1.895$) obtained higher post-test scores than the control group ($M = 1.50$, $SD = 1.395$). The effect size was medium to large (Cohen's $d = 0.72$).

Table 5

Independent Samples T-test Results

Comparison	Experimental M (SD)	Control M (SD)	<i>t</i>	<i>df</i>	<i>p</i>	Cohen's <i>d</i>
Pre-test	1.05 (1.538)	1.40 (1.429)	-0.746	38	.461	0.23
Post-test	2.70 (1.895)	1.50 (1.395)	2.281	38	.028	0.72

Note. *M* = mean; *SD* = standard deviation; *df* = degrees of freedom; Cohen's *d* = standardized mean difference.

DISCUSSION

This paper sought to test whether Anki-based spaced repetition could increase target academic vocabulary use in writing among pre-service EFL teachers. The results were positive, as the students who utilized Anki produced more target academic vocabulary in the post-test paragraph compared to the control group. This difference in post-test scores was statistically significant, indicating that Anki-based spaced repetition helped students learn and use more target academic vocabulary than regular classroom instruction.

RQ1: Changes in productive target academic vocabulary use

The increase in the number of target academic vocabulary items used by the experimental group can be explained by two key features of the Anki-based intervention: adaptive review scheduling and retrieval practice. According to Ebbinghaus (1885, as cited in Abbas et al., 2023), information is gradually forgotten if not reviewed at key intervals. Anki applies this principle by adjusting reviews before significant forgetting occurs based on learners' ratings of recall difficulty (Anki, 2025). As a result, students could focus more on reviewing challenging vocabulary items instead of words that they had already mastered. Another distinctive factor was the retrieval practice. Roediger and Karpicke (2006) argued that actively retrieving information strengthens memory more significantly than passive restudying. In the present study, repeated retrieval of the target vocabulary may have strengthened students' ability to access these words when completing the post-test writing task. However, while Anki strengthened memory through retrieval practice, the targeted writing tasks were also important because they created opportunities to apply the vocabulary in meaningful contexts. This aligns with Lavigne et al. (2022), who highlighted that increasing vocabulary knowledge alone does not necessarily improve writing performance unless learners actively apply new words in meaningful contexts. Therefore, retrieval practice and adaptive review scheduling may have helped students access the target vocabulary more readily, while writing tasks provided a timely opportunity to use the target vocabulary in writing.

RQ2: Comparison with regular instruction

This study found that the group using Anki-based spaced repetition attained a larger increase in the use of target academic vocabulary in writing from the pre-test to the post-test than the control group, which used regular classroom instruction. These findings corroborate past studies which reported that spaced repetition systems outperform conventional learning approaches (Honarзад & Soyoof, 2023; Najafi Karimi & Kheradmandi Amiri, 2025; Nguyen et al., 2025). In terms of productive vocabulary development, the present findings align with those of Mohammadi et al. (2024), who found that learners using SR through Anki exhibited gains in productive academic vocabulary. Additionally, while Mohammadi et al. stressed that the group that used Anki yielded smaller gains in productive knowledge than in receptive recall, the present

study suggests that combining Anki with targeted writing tasks can facilitate the transfer of vocabulary knowledge to active use.

The contribution of this study is significant when considering the typical scope in EFL research employing SR for vocabulary learning. As observed in the literature, most studies focus primarily on investigating how SR improves vocabulary learning and retention. Albeit useful, the lack of studies assessing its impact on productive vocabulary use raised the question of whether SR's benefits could extend to active vocabulary use in contextualized writing. Considering the studies reviewed, only Mohammadi et al. (2024) examined the effects of SR on productive vocabulary. However, the present study extends their work by measuring vocabulary production through contextualized writing activities instead of sentence completion exercises. This focus addresses the scarcity of research on the use of SR for productive vocabulary, a gap that had been previously identified by Lei and Reynolds (2022). The present findings suggest that Anki-based spaced repetition facilitates academic vocabulary use in contextualized writing tasks.

CONCLUSION

Past studies have shown that spaced repetition is particularly effective at increasing students' vocabulary recognition. Likewise, spaced repetition through Anki has helped learners use academic vocabulary in sentence completion exercises. Nonetheless, it remained unclear whether the use of Anki-based spaced repetition could promote productive academic vocabulary use in contextualized writing tasks. The findings provide evidence that Anki-based spaced repetition successfully facilitated productive academic vocabulary use in contextualized writing. The increase in the number of target academic vocabulary items in the post-test achieved by the experimental group was found to be statistically significant. Conversely, the control group did not exhibit a significant change. Similarly, the experimental group outperformed the control group on the post-test with a medium-to-large effect size. These results suggest that Anki-based spaced repetition with contextualized writing practice is more effective than regular classroom instruction for promoting productive academic vocabulary. Importantly, these findings extend previous work that has examined vocabulary production through isolated exercises by demonstrating that Anki can support the transition from reviewing words to applying them in written communication.

This study identifies three primary implications for EFL teaching. First, it is fundamental to combine spaced repetition systems with opportunities for language production such as writing to help students use the vocabulary in meaningful contexts. Moreover, using MALL tools such as Anki can promote vocabulary practice outside the classroom because of its adaptive review schedule. Furthermore, ELT programs should select target vocabulary according to learners' proficiency levels and relevance to the learning objectives as opposed to general vocabulary lists.

Despite these promising results, this study presents several limitations. The first limitation concerns the small sample size, which was obtained from one university in Ecuador. Although the findings provide evidence of the benefits of the intervention, the participation of 40 students limits the generalizability of the results to other populations. Another limitation was that the study measured exclusively productive vocabulary gains and not receptive knowledge. Hence, the study could not report whether the intervention also produced gains in receptive knowledge. Finally, this study did not implement a delayed post-test. As a result, it is unknown for how long the observed gains can be maintained over time.

Therefore, this paper recommends the following directions for future research. Future research should implement this methodology with other populations, such as high-school students, or with larger samples to evaluate its effectiveness in different educational settings. Additionally, researchers should measure both productive and receptive vocabulary learning to fully understand how effective the intervention is at increasing both types of lexical knowledge. Likewise, a delayed post-test should be administered in future studies to determine whether the intervention leads to long-term retention of productive vocabulary use.

REFERENCES

- Abbas, A. M., Hamid, T., Iwendi, C., Morrissey, F., & Garg, A. (2023). Improving learning effectiveness by leveraging spaced repetition (SR). In N. Venkataraman, L. Wang, X. Fernando, & A. F. Zobaa (Eds.), *Big data and cloud computing* (Vol. 1021). Springer. https://doi.org/10.1007/978-981-99-1051-9_10
- Aguilar Villarroel, E. A., & Córdova Calderón, A. V. (2024). *Influencia de la competencia en el idioma inglés en la percepción de empleabilidad de graduados de administración de empresas en una universidad pública del Ecuador* [Proyecto integrador]. ESPOL FCSH. <http://www.dspace.espol.edu.ec/handle/123456789/65555>
- Ahmed, F. E. Y., Abdallah, N. M. M., Hamed, S. O. E., & Hamed, F. M. A. (2025). Word choice errors in EFL undergraduates' written language. *Eurasian Journal of Applied Linguistics*, 11(1), 79–86. <https://doi.org/10.32601/ejal.11107>
- Anki. (2025). Background. Retrieved June 29, 2026, from <https://docs.ankiweb.net/background.html>
- Anthony, L. (2026). *AntWordProfiler* (Version 2.3.0) [Computer software]. Waseda University. <https://www.laurenceanthony.net/software/antwordprofiler/>
- Boroughani, T., Behshad, N., & Xodabande, I. (2023). Mobile-assisted academic vocabulary learning with digital flashcards: Exploring the impacts on university students' self-regulatory capacity. *Frontiers in Psychology*, 14, 1112429. <https://doi.org/10.3389/fpsyg.2023.1112429>
- Burel, J., Trost, O., Demeyere, M., Rives, N., Estour, F., Ladner, J., Crampon, F., Deneuve, S., & Maquet, C. (2025). Spaced repetition and other key factors influencing medical school entrance exam success: Insights from a French survey. *BMC Medical Education*, 25, 1036. <https://doi.org/10.1186/s12909-025-07605-w>
- Burston, J., & Giannakou, K. (2022). MALL language learning outcomes: A comprehensive meta-analysis 1994–2019. *ReCALL*, 34(2), 147–168. <https://doi.org/10.1017/S0958344021000240>
- Choffin, B., Popineau, F., & Bourda, Y. (2021). Extending adaptive spacing heuristics to multi-skill items. *Journal of Educational Data Mining*, 13(3), 69–102. <https://doi.org/10.5281/zenodo.5634220>
- Coxhead, A. (2000). A new academic word list. *TESOL Quarterly*, 34(2), 213–238. <https://doi.org/10.2307/3587951>
- Coxhead, A. (2024). Current issues and future research on teaching and learning of academic vocabulary in EMI contexts. *International Journal of TESOL Studies*, 6(2), 105–108. <https://doi.org/10.58304/ijts.20240207>

- Creswell, J. W., & Creswell, J. D. (2018). *Research design: Qualitative, quantitative, and mixed methods approaches* (5th ed.). SAGE.
- Evans, L., Lund, E. A., & Werfel, K. L. (2025). Is knowing words enough? Assessing vocabulary in children who are deaf or hard of hearing. *Language, Speech, and Hearing Services in Schools*, 56(2), 252–266. https://doi.org/10.1044/2024_LSHSS-24-00046
- Flower, L., & Hayes, J. R. (1981). A cognitive process theory of writing. *College Composition and Communication*, 32(4), 365–387. <https://doi.org/10.2307/356600>
- Ha, H. T. (2022). Vocabulary demands of informal spoken English revisited: What does it take to understand movies, TV programs, and soap operas? *Frontiers in Psychology*, 13, 831684. <https://doi.org/10.3389/fpsyg.2022.831684>
- Honarzad, R., & Soyooof, A. (2023). Two vocabulary learning tools used by Iranian EFL learners: Physical flashcards versus a mobile app. *Computer Assisted Language Learning Electronic Journal*, 24(1), 160–178.
- Isma, A., Rasmin, L. O., & Samsudin, S. (2023). Decoding the challenges: A study of English writing errors among EFL students. *GLENS: Global English Insights Journal*, 1(1), 1–9. <https://doi.org/10.61220/glens.v1i1.2023a1>
- Kang, S. H. K. (2016). Spaced repetition promotes efficient and effective learning: Policy implications for instruction. *Policy Insights from the Behavioral and Brain Sciences*, 3(1), 12–19. <https://doi.org/10.1177/2372732215624708>
- Khudaverdiyeva, T. (2025). The importance of writing in language acquisition: A cognitive, communicative, and pedagogical perspective. *Global Spectrum of Research and Humanities*, 2(3), 127–138. <https://doi.org/10.69760/gsrh.0203025014>
- Lavigne, C. S., Tremblay, K. A., & Binder, K. S. (2022). It's in the way that you use it: How vocabulary knowledge and usage predict writing quality among adult basic education learners. *Journal of Psycholinguistic Research*, 51(5), 1023–1041. <https://doi.org/10.1007/s10936-022-09877-5>
- Lee, S. (2025). The relationship between receptive and productive knowledge of L2 English collocations. *International Journal of Applied Linguistics*, 35, 109–133. <https://doi.org/10.1111/ijal.12605>
- Lei, Y., & Reynolds, B. L. (2022). Learning English vocabulary from word cards: A research synthesis. *Frontiers in Psychology*, 13, 984211. <https://doi.org/10.3389/fpsyg.2022.984211>
- Maamuujav, U. (2021). Examining lexical features and academic vocabulary use in adolescent L2 students' text-based analytical essays. *Assessing Writing*, 49, Article 100540. <https://doi.org/10.1016/j.asw.2021.100540>
- Mohammadi, M., Zohdi Jalal, P., Valizadeh, M., & Xodabande, I. (2024). University students' academic vocabulary development through mobile-assisted learning: Exploring the

- impacts on receptive and productive knowledge. *Heliyon*, 10(6), Article e28103. <https://doi.org/10.1016/j.heliyon.2024.e28103>
- Mujtaba, S. M., Kamyabi Gol, A., & Parkash, R. (2021). A study on the relationship between language aptitude, vocabulary size, working memory and L2 writing accuracy. *Foreign Language Annals*, 54, 1059–1081. <https://doi.org/10.1111/flan.12584>
- Najafi Karimi, S., & Kheradmandi Amiri, R. (2025). The effects of using digital flashcards versus paper flashcards on vocabulary learning and retention of Iranian intermediate EFL learners. *Cogent Education*, 12(1), Article 2548353. <https://doi.org/10.1080/2331186X.2025.2548353>
- Nguyen, T. M. H., Nguyen, M. N., & Luong, H. P. (2025). Utilizing Anki to enhance vocabulary acquisition among first-year students at a university in Hanoi. *Proceedings of the AsiaCALL International Conference*, 7, 34–47. <https://doi.org/10.54855/paic.2574>
- Peng, Y., Sun, J., Quan, J., Wang, Y., Lü, C., & Zhang, S. H. (2023). Predicting Chinese EFL learners' human-rated writing quality in argumentative writing through multidimensional computational indices of lexical complexity. *Assessing Writing*, 56, Article 100722. <https://doi.org/10.1016/j.asw.2023.100722>
- Presidencia de la República del Ecuador. (2023, February 22). *Reglamento general a la Ley Orgánica de Educación Intercultural* (Decreto Ejecutivo No. 675). *Segundo Suplemento del Registro Oficial No. 254*. <https://www.gob.ec/regulaciones/reglamento-general-ley-organica-educacion-intercultural-0>
- Qureshi, M. A., & Malik, N. (2025). Academic word lists: A comprehensive review. *Vocabulary Learning and Instruction*, 14(2), Article 103079. <https://doi.org/10.29140/vli.v14n2.103079>
- Roediger, H. L., III, & Karpicke, J. D. (2006). Test-enhanced learning: Taking memory tests improves long-term retention. *Psychological Science*, 17(3), 249–255. <https://doi.org/10.1111/j.1467-9280.2006.01693.x>
- Smith, O. (2025). El inglés como mejora para la carrera profesional y empresarial local e internacional. *Ciencia Latina Revista Científica Multidisciplinar*, 9(5), 5038–5056. https://doi.org/10.37811/cl_rcm.v9i5.19839
- Teymouri, R. (2024). Recent developments in mobile-assisted vocabulary learning: A mini review of published studies focusing on digital flashcards. *Frontiers in Education*, 9, Article 1496578. <https://doi.org/10.3389/educ.2024.1496578>
- Trinh Quoc, L., To Thai, N. D., Le Cong, T., Ngo Huynh, H. N., & Le Thanh, T. (2026). The use of Quizlet to enhance English as a foreign language learners' lexical study and retention. *Journal of Educators Online*, 23(1), 1–11. <https://doi.org/10.9743/JEO.2026.23.1.2>
- Yılmaz, S., & Kavanoz, S. (2025). Measuring the effect of receptive and productive vocabulary size on foreign language skills. *Porta Linguarum: An International Journal of Foreign*

Language Teaching and Learning, (44), 29–45.
<https://doi.org/10.30827/portalin.vi44.31870>