

Effect of Baicizhan Application on English Vocabulary Knowledge on Non-English Major University Students

Chenxing Wan^{1,2}, Ain Nadzimah Abdullah¹, Jusang Bolong³, Hadina Habil⁴,
Vahid Nimehchisalem⁵

¹School of Education, Faculty of Social Science and Leisure Management, Taylors' University, Selangor, Malaysia

²School of Foreign Languages, Jiangxi Science and Technology Normal University, Nanchang, China

³Department of Communication, Faculty of Modern Languages and Communication, University of Putra Malaysia, Selangor, Malaysia

⁴Language Academy, Faculty of Social Sciences and Humanities, University of Technology Malaysia, Johor, Malaysia

⁵Faculty of Humanities and Arts, University of Economics and Humanities in Warsaw, Warsaw, Poland

Email: chenxing.wan@sd.taylors.edu.my, ain@upm.edu.my, jusang@upm.edu.my, hadina@utm.my, nimechie@gmail.com

How to cite this paper: Wan, C. X., Abdullah, A. N., Bolong, J., Habil, H., & Nimehchisalem, V. (2025). Effect of Baicizhan Application on English Vocabulary Knowledge on Non-English Major University Students. *Open Journal of Modern Linguistics*, 15, 162-177.

<https://doi.org/10.4236/ojml.2025.152012>

Received: February 4, 2025

Accepted: March 24, 2025

Published: March 27, 2025

Copyright © 2025 by author(s) and Scientific Research Publishing Inc.

This work is licensed under the Creative Commons Attribution International License (CC BY 4.0).

<http://creativecommons.org/licenses/by/4.0/>



Open Access

Abstract

This study examines the impact of the Baicizhan vocabulary application on the receptive English vocabulary knowledge of non-English major Chinese undergraduates. A total of 126 first-year university students participated in a 14-week intervention, during which they used the application as a primary vocabulary learning tool. Vocabulary knowledge was assessed pre- and post-intervention using the updated Vocabulary Levels Test (UVLT), covering five-word frequency bands (1000, 2000, 3000, 4000, and 5000 words). The results of paired-sample t-tests demonstrated significant improvements ($p < 0.05$) in vocabulary knowledge across all frequency levels, with the largest gains observed at the 4000- and 5000-word levels. Conversely, improvements at the 1000-word level were modest, suggesting that students were already familiar with many high-frequency words before the intervention. The findings underscore Baicizhan's effectiveness as a mobile-assisted language learning (MALL) tool, particularly for acquiring less frequent vocabulary. The app's integration of spaced repetition, gamification, and personalized learning likely contributes to these outcomes, though variability in gains at higher levels highlights the influence of individual factors such as prior knowledge and motivation. This study extends existing research on technology-enhanced language learning and provides actionable insights for educators seeking to incorporate digital tools into English as a Foreign Language (EFL) instruction. Future research should explore long-term vocabulary retention and investigate how such tools can support the productive use of vocabulary in authentic contexts.

Keywords

Mobile-Assisted Language Learning (MALL), Vocabulary Acquisition, Baicizhan Application, English as a Foreign Language (EFL), Receptive Vocabulary

1. Introduction

Vocabulary knowledge is a fundamental component of language proficiency and plays a crucial role in various aspects of language use, including reading comprehension, listening, speaking, and writing (Nation, 2001). For non-English major university students in China, where English is a foreign language, the acquisition and retention of English vocabulary can be particularly challenging. These students often lack the immersive language environment and exposure that their English-major counterparts experience, making it difficult to develop a robust English vocabulary repertoire.

Vocabulary acquisition is critical not only for academic performance but also for enabling learners. It is essential for enabling learners to engage with authentic materials, participate in global communication, and enhance their professional opportunities in an increasingly interconnected world. In the Chinese context, the challenge of vocabulary acquisition is compounded by reliance on traditional teaching methods that emphasize rote memorization and test-oriented instruction, leaving limited room for practical application and deep learning. This creates a pressing need for innovative approaches that make vocabulary learning more engaging and effective.

In recent years, the rapid advancement of mobile technology has provided new opportunities for language learning, including the use of vocabulary memorization applications (apps) (Ismail et al., 2016; Pullen et al., 2015; Goundar, 2019; Papadakis, 2021; Rahmani et al., 2022). These mobile-assisted language learning (MALL) tools leverage accessibility, interactivity, and personalization to offer learners flexible and efficient ways to expand their vocabulary. One such app is Baicizhan, which has gained popularity among Chinese university students for its systematic and interactive approach to vocabulary learning (Li et al., 2021; Luo, 2023; Song & Xiong, 2023). Baicizhan incorporates spaced repetition and gamification strategies, supported by personalized learning pathways, aligning with established second language acquisition theories, such as the Ebbinghaus Forgetting Curve, which underscores the importance of spaced review for long-term retention (Schmitt, 2008).

Despite the growing popularity of Baicizhan, empirical evidence on its effectiveness remains limited, particularly in the context of non-English major students in China. Previous studies have primarily focused on English-major students or broader learner groups, leaving a gap in understanding how this tool specifically benefits non-English major learners, who often have different levels of

motivation, exposure, and learning needs (Luo, 2023; Song & Xiong, 2023). For instance, Luo (2023) highlighted the app's effectiveness in developing academic vocabulary among English majors, while Song and Xiong (2023) emphasized its limitations in fostering collaborative learning, particularly among diverse learner groups. Addressing this gap is critical, as non-English major students represent a significant portion of the university population and often face unique challenges in language acquisition.

Given the potential benefits of vocabulary apps like Baicizhan, it is essential to investigate their effectiveness in improving English vocabulary knowledge among non-English major Chinese undergraduates. Understanding the impact of such applications can inform language learning strategies and guide the integration of technology-assisted approaches in English language education (Hasumi & Chiu, 2024). Additionally, such research can provide practical insights for educators and policymakers seeking to enhance the effectiveness of EFL instruction in similar contexts.

This study aims to examine the effect of using the Baicizhan vocabulary application on the receptive English vocabulary knowledge of non-English major Chinese undergraduates. Specifically, it addresses the following research question:

- What is the effect of using the vocabulary memorization application, Baicizhan, on non-English major Chinese undergraduates' receptive English vocabulary knowledge?

This study hypothesizes that:

- The use of Baicizhan significantly improves the receptive English vocabulary knowledge of non-English major undergraduates due to its structured and gamified approach.

2. Literature Review

2.1. Vocabulary Knowledge and Its Role in Language Learning

Vocabulary knowledge is widely regarded as a cornerstone of language proficiency, serving as the foundation for the development of all four language skills: listening, speaking, reading, and writing (Nation, 2001; Qian, 2002). Beyond linguistic competence, vocabulary size and depth are critical for learners' ability to comprehend and produce language effectively in academic and professional contexts. Studies by Laufer and Goldstein (2004) and Milton and Alexiou (2020) reveal a strong correlation between vocabulary knowledge and success in tasks such as reading comprehension, listening accuracy, and oral fluency. These findings underscore the centrality of vocabulary in language acquisition.

In educational settings, vocabulary knowledge enables students to decode complex texts, engage in meaningful communication, and navigate diverse discourse domains. However, acquiring and retaining vocabulary in a second language (L2) is a challenging endeavor, especially in contexts where learners have limited exposure to authentic language use. Non-English major university students in China face compounded challenges due to the lack of immersive environments, limited

opportunities for contextual learning, and reliance on rote memorization. Such constraints often result in shallow vocabulary knowledge that may suffice for standardized testing but fails to support long-term language development (Zeng et al., 2022).

The dual dimensions of vocabulary knowledge—breadth (number of words known) and depth (understanding of meaning, usage, and collocations)—are essential for learners to transition from passive recognition to active application. Nation (2001) and Qian (2002) emphasize that achieving depth of knowledge requires repeated exposure to words across varying contexts, a process that traditional learning methods may not adequately support. These limitations have driven interest in innovative pedagogical tools, including mobile-assisted language learning (MALL), that provide opportunities for targeted, interactive, and engaging vocabulary learning.

2.2. Mobile-Assisted Language Learning (MALL) for Vocabulary Acquisition

The integration of technology into language education, particularly mobile-assisted language learning (MALL), has transformed traditional approaches to vocabulary instruction. MALL utilizes the portability and functionality of mobile devices to provide learners with anytime, anywhere access to language resources (Kukulska-Hulme & Shield, 2008). Mobile-Assisted Language Learning (MALL) utilizes the portability and adaptability of mobile devices to provide personalized learning experiences, which are particularly beneficial in classrooms with diverse student proficiency levels and needs (Mehdipour & Zerehkafi, 2013).

Smartphone applications offer several features that enhance vocabulary acquisition, including spaced repetition, gamification, and personalized learning pathways (Guo et al., 2022; Boroughani et al., 2023; Dağdeler, 2023). Spaced repetition systems (SRS), for instance, present vocabulary items at increasing intervals to optimize retention. Schmitt (2008) highlights the effectiveness of SRS in reinforcing long-term memory by revisiting lexical items before they are forgotten. Apps incorporating gamification strategies, such as points, badges, and leaderboards, further enhance learner motivation and engagement by creating a sense of achievement and competition (Hung, 2018). Personalized learning, which tailors content to individual needs, supports efficient vocabulary acquisition by focusing on words that are most relevant to the learner's goals and proficiency level (Heilman et al., 2010).

Research on smartphone applications has consistently demonstrated their potential to significantly improve vocabulary acquisition. For instance, Fengyu (2023) found that learners using smartphone-based vocabulary apps exhibited better retention and contextual usage of words compared to those relying on traditional methods. Similarly, Rahmani et al. (2022) reported that smartphone applications positively impacted both receptive and productive vocabulary, particularly when integrated with other learning strategies. A study by Li and Hafner

(2022) revealed that mobile-based word cards facilitated greater gains in vocabulary knowledge than traditional paper-based methods among Chinese EFL learners. Their findings highlighted the advantages of smartphones in providing interactive and easily accessible learning materials.

Kacetl & Klímová (2019) reviewed various mobile applications used in English language learning and concluded that these tools were highly effective in promoting vocabulary acquisition and retention. The review emphasized improvements in learner motivation, self-confidence, and autonomy using mobile platforms. Furthermore, Mat Saad and Abd Rahim (2022) observed that beginners learning French benefitted significantly from using the Duolingo app, which provided an engaging and user-friendly approach to vocabulary acquisition.

These studies collectively underline the role of smartphone applications in enhancing vocabulary learning through features like spaced repetition, gamification, and personalized learning pathways. Despite their effectiveness, challenges such as unequal access to technology and differences in digital literacy levels remain significant barriers. Addressing these challenges is essential for maximizing the benefits of smartphone-assisted vocabulary learning.

2.3. Baicizhan and Its Features

Baicizhan is one of the most popular vocabulary learning apps in China, known for its systematic approach to vocabulary acquisition. It combines spaced repetition, gamification, and personalized learning pathways, aligning with established second language acquisition theories. The app's user-friendly design and multimedia resources make it particularly attractive to university students.

The spaced repetition feature, grounded in the Ebbinghaus Forgetting Curve, ensures that vocabulary is reviewed at increasing intervals to optimize long-term retention (Schmitt, 2008). This approach helps learners consolidate low-frequency and specialized vocabulary, which might otherwise be challenging to retain.

Gamification elements such as rewards, streaks, and leaderboards foster consistent engagement and motivation. Luo (2023) reported that these features significantly enhance user satisfaction and persistence, particularly among young adult learners.

Additionally, Baicizhan provides **personalized learning pathways** that adapt to each user's proficiency level and objectives. This tailored approach improves learning efficiency by focusing on vocabulary relevant to individual needs. By integrating multimedia resources and interactive examples, Baicizhan offers a rich and varied learning experience.

2.4. Gaps in Existing Research

Despite the growing body of research on MALL, studies specifically examining Baicizhan's impact on non-English major students remain limited. Existing research has largely focused on English-major students or general populations, leav-

ing a gap in understanding how non-English major learners engage with and benefit from the app. For instance, Luo (2023) highlighted Baicizhan's effectiveness in vocabulary acquisition but noted that its decontextualized nature may hinder deeper lexical understanding. Similarly, Song and Xiong (2023) observed that while the app excels in individual learning, it lacks collaborative features that could support interactive and communicative language use.

Non-English major students often face distinct challenges, such as limited exposure to English outside the classroom and varied levels of motivation. Addressing these factors requires a nuanced understanding of how tools like Baicizhan can be optimized to meet their needs. This study aims to fill this gap by exploring Baicizhan's effectiveness in improving receptive English vocabulary knowledge among this specific learner group. This study addresses the gap by demonstrating Baicizhan's specific impact on non-English major students, providing targeted insights for EFL contexts. By doing so, it seeks to provide practical insights for integrating technology into diverse educational contexts.

3. Methodology

This study employed a pre-test/post-test design to examine the effect of the Baicizhan vocabulary application on the receptive English vocabulary knowledge of non-English major Chinese undergraduates. A paired-sample t-test was conducted to analyze changes in vocabulary knowledge across five-word frequency bands (1000, 2000, 3000, 4000, and 5000 words) before and after the intervention.

The participants for this study were 126 volunteers, all non-English major freshmen from Jiangxi Science and Technology Normal University in Nanchang, Jiangxi province, China. Since studying the entire population of non-English major Chinese undergraduates was not feasible, a convenience sampling method was used. All participants had attended the Gaokao (National Higher Education Entrance Examination) and achieved similar scores in the English section, ensuring a comparable general English proficiency level.

This study does not focus on ensuring a specific baseline vocabulary level, but rather aims to observe vocabulary improvements following the intervention. The primary objective is to measure changes in vocabulary knowledge after using the Baicizhan app, rather than comparing the initial vocabulary knowledge across participants.

The sample consisted of 126 first-year non-English major students, with a gender-balanced distribution of 54 male and 72 female participants. To better understand their language exposure, the participants' English learning history was collected and summarized. As shown in Table 1, most participants had studied English for 6 - 10 years, with a smaller proportion reporting either shorter or longer learning experiences.

The primary instrument used for assessing vocabulary knowledge was the Updated Vocabulary Levels Test (UVLT) developed by Webb, Sasao, and Ballance (2017). The UVLT evaluates receptive vocabulary knowledge across five word fre-

quency bands, covering both high-frequency and less frequently encountered words. The test's reliability and validity in EFL contexts have been well-documented, making it an appropriate tool for this study.

Table 1. Summary of participants' English learning history.

English Learning History	Number of Students	Percentage (%)
Less than 1 year	0	0%
1 - 5 years	9	7%
6 - 10 years	92	73%
More than 10 years	25	20%

The Baicizhan vocabulary application served as the intervention tool. This app incorporates features such as spaced repetition, gamification, and personalized study plans to facilitate vocabulary learning. During the study, participants used Baicizhan regularly to learn and review vocabulary items tailored to their individual needs.

The participants used the Baicizhan app for vocabulary learning throughout the study. The app created a personalized study plan for each student, which they were required to complete daily. To ensure consistency in usage, students were required to "clock in" each day after completing their assigned tasks. Every two weeks, the students' English teachers reviewed their clock-in records to verify compliance with the study plan. This clock-in process also contributed 10% to the participants' final English course grade.

The study was conducted over 14 weeks, beginning with a baseline assessment using the UVLT to evaluate participants' initial vocabulary knowledge. Following the pre-test, students were instructed to use the Baicizhan application daily. Participants used the app for an average of 30 minutes daily, focusing on activities that emphasized word retention and contextual usage. Weekly usage logs were maintained to monitor compliance and engagement levels.

At the end of the intervention, a post-test using the UVLT was administered to measure changes in vocabulary knowledge. Both tests were supervised by researchers to ensure consistency and eliminate the possibility of external influences.

The data were analyzed using a paired-sample t-test to compare pre-test and post-test scores across the five-word frequency bands. This statistical method was chosen to determine the significance of changes in receptive vocabulary knowledge after the intervention. Descriptive statistics, including means and standard deviations, were calculated to summarize the results.

4. Data Analysis

The objective of this study was to evaluate the impact of the vocabulary memorizing application, Baicizhan, on the receptive English vocabulary knowledge of non-English major Chinese undergraduates. The following **Table 2** shows the t-test result.

Table 2. Paired sample t-test result of pre- and post-vocabulary test (N = 126).

Word Level	Mean (Pre)	Mean (Post)	Std. Deviation (pre)	Mean Different	Std. Deviation (post)	t-value	One-Sided <i>p</i> -value
1000	27.21	28.20	1.685	-0.990	0.947	-6.218	< 0.05
2000	21.39	23.90	3.504	-2.510	2.958	-7.746	< 0.05
3000	14.19	16.97	3.363	-2.781	4.962	-5.771	< 0.05
4000	11.22	15.09	4.295	-3.875	6.009	-5.846	< 0.05
5000	9.65	12.23	3.997	-2.583	5.879	-4.122	< 0.05

Note: 95% Confidence Interval of the Difference; 1000-word level -1.306 to -.674; 2000-word level -3.154 to -1.867; 3000-word level -3.738 to -1.824; 4000-word level -5.191 to -2.559; 5000-word level -3.827 to -1.339.

For the 1000-word level, the mean score significantly increased ($p < 0.05$) from 27.21 (SD = 1.685) to 28.20 (SD = 0.947), indicating that the students' vocabulary knowledge at the 1000-word level improved after using Baicizhan. The smaller standard deviation in the post-test results indicates less variability in scores, implying that the improvement was consistent among the participants. The students' vocabulary knowledge at this level improved, however, among all the word levels (from 1000-word level to 5000-word level), the smallest gain was observed at this level. Since the participants are first-year university students and they have acquired most of the 1000-word level vocabulary during their high school, thus, the students were likely already familiar with many of these high-frequency words, leaving less room for significant improvement.

The mean score significantly increased ($p < 0.05$) from 21.39 (SD = 3.504) to 23.90 (SD = 2.958), demonstrating a substantial improvement in students' vocabulary knowledge at the 2000-word level. The improvement suggested that Baicizhan effectively helped students learn more words at this intermediate level, which are likely more contextually diverse and encountered in varied academic texts. The increase at this level may be due to the structured and repetitive learning approach provided by the application, which aids in the retention of moderately common vocabulary. Similar to the 1000-word level, the improvement was noticeable but less dramatic due to pre-existing familiarity with these words.

For the 3000-word level, the mean score significantly increased ($p < 0.05$) from 14.19 (SD = 3.363) to 16.97 (SD = 4.962). This increase indicated that students' receptive vocabulary knowledge at the 3000-word level improved after using Baicizhan. However, the post-test standard deviation is higher, suggesting more variability in students' scores. This could imply that while some students made substantial progress, others did not benefit as much at this level. The words at the 3000 level are less frequent and more complex, which may explain the greater variability and slightly less pronounced improvement compared to the 1000 and 2000-word levels.

The mean score significantly increased ($p < 0.05$) from 11.22 (SD = 4.295) to 15.09 (SD = 6.009) in the 4000-word level. The significant gain in scores suggests that Baicizhan is effective in enhancing English receptive vocabulary knowledge

at the 4000-word level. The higher standard deviation in the post-test scores indicates substantial variability in learning gains among the students. This level includes more advanced and specialized vocabulary, which might be challenging for some students but more attainable for others, depending on their prior knowledge and exposure.

In terms of the 5000-word level, the mean score significantly increased ($p < 0.05$) from 9.65 (SD = 3.997) to 12.23 (SD = 5.879), showing an improvement in vocabulary knowledge at the 5000-word level. High standard deviations in post-test scores for the 4000- and 5000-word levels suggest substantial individual differences in learning outcomes. This variability may result from factors such as learners' prior exposure, motivation, or the ability to process advanced vocabulary, underscoring the importance of personalized learning interventions. The vocabulary at this level is likely very advanced and less frequently encountered, which could explain why some students showed significant improvements while others did not. The effectiveness of Baicizhan at this level may vary based on individual students' previous vocabulary knowledge and their ability to grasp complex words.

At the 4000- and 5000-word levels, the pre-test scores were lower, suggesting greater potential for improvement. Consequently, the post-test gains were more substantial when compared to the relatively higher pre-test scores observed at the 1000, 2000, and 3000-word levels. The significant gains at the 4000- and 5000-word levels are likely due to minimal prior exposure to these words, combined with Baicizhan's systematic practice and exposure strategies. The systematic exposure and practice provided by the application likely led to more noticeable improvements in these less familiar words. Furthermore, the introduction of new and challenging vocabulary might have heightened students' engagement and motivation, contributing to the more significant gains observed at the higher word levels.

5. Discussion

The findings of this study demonstrate that Baicizhan significantly improved the receptive English vocabulary knowledge of non-English major Chinese undergraduates across all five-word frequency levels, with the most pronounced gains observed at the 4000- and 5000-word levels. However, the improvement at the 1000-word level was less significant. The relatively smaller gain at the 1000-word level can be explained by the participants' prior knowledge of these words. Since the required vocabulary knowledge for the Gaokao is 1800 words, and all participants had a similar English study background, most students had already acquired most of the 1000 most frequent words before the intervention. As a result, there was less room for improvement at this level, as these high-frequency words were already familiar to the participants.

Educators can leverage Baicizhan's features to address gaps in vocabulary acquisition by integrating app-based learning with classroom activities, such as con-

textualized discussions and collaborative tasks. These results highlight the potential of mobile-assisted language learning (MALL) tools to address specific vocabulary learning challenges, particularly for less frequent and more advanced words. When situating the findings within the broader context of existing studies, as well as theoretical frameworks on vocabulary acquisition and learning technology, some critical insights and nuances emerge.

The significant gains observed at the 4000- and 5000-word frequency levels align with prior research emphasizing the role of spaced repetition and personalized learning in achieving long-term retention of less familiar vocabulary. [Luo \(2023\)](#) similarly reported that Baicizhan was particularly effective for infrequent vocabulary, largely due to its structured approach to spaced repetition. This feature ensures that learners encounter and review challenging words at optimal intervals, making it easier to consolidate them into long-term memory. The present study also adds to this by showing that, while spaced repetition works well for low-frequency words, the improvements at higher levels may vary among learners, due to individual differences in motivation, language aptitude, and prior knowledge. For example, some learners might have had limited exposure to advanced vocabulary in authentic contexts, which could explain the variability in post-test scores at the higher word frequency bands.

Baicizhan's strengths, such as gamification and structured repetition, specifically address the needs of non-English major learners, who benefit from systematic vocabulary exposure. For instance, while tools like Quizlet and Anki rely heavily on user-generated content and flashcards, they lack the integrated gamified elements of Baicizhan, which may enhance learner engagement. The gamification components, such as daily streaks, badges, and leaderboards, likely played a role in maintaining students' motivation to consistently engage with the app throughout the 14 weeks. Previous research (e.g., [Hung, 2018](#)) highlights that gamification fosters a sense of achievement and competition, which can drive learners to persist even with challenging tasks. The findings of this study support this assertion, as the participants demonstrated steady improvement across all word frequency levels despite the varying difficulty of the vocabulary. However, while gamification may maintain engagement, it does not necessarily provide opportunities for deeper lexical processing or productive use of vocabulary in authentic contexts. This limitation mirrors findings by [Song and Xiong \(2023\)](#), who argued that social media-based tools, which allow for collaborative and contextualized vocabulary use, may outperform gamified applications in fostering long-term retention and productive language skills.

The results also call into question whether gamification alone is sufficient to overcome the challenges of learning advanced vocabulary. Although Baicizhan's design ensures frequent interaction with new words, the decontextualized nature of its vocabulary lists may limit its ability to fully address the depth of lexical knowledge required for productive use. [Nation \(2001\)](#) argues that vocabulary learning requires not only repeated exposure but also opportunities to encounter

words in varied contexts, as this promotes the development of richer semantic networks. In this study, the smaller improvements observed at the 1000-word level suggest that learners were already familiar with many high-frequency words, leaving minimal room for improvement. However, the lack of more meaningful interactions with these words, such as sentence-level practice, may have also contributed to the relatively modest gains. Similarly, the variability observed at the 3000-, 4000-, and 5000-word levels indicates that while Baicizhan effectively introduces learners to new words, some students may require additional scaffolding, such as contextualized examples or teacher-led instruction, to fully internalize advanced vocabulary.

When comparing Baicizhan to other tools such as Duolingo and Memrise, its strengths and limitations become more apparent. Duolingo, for example, integrates vocabulary learning with grammar, listening, and sentence-building tasks, offering a more holistic approach to language acquisition. While Baicizhan excels in systematically targeting vocabulary, its focus on isolated words may limit its potential to foster broader language skills. Memrise, on the other hand, incorporates video-based content and native speaker recordings, providing learners with authentic contexts for word usage. In contrast, Baicizhan's reliance on static images and definitions may not fully satisfy the need for contextualized learning, particularly for learners aiming to develop productive skills like writing or speaking. These comparisons suggest that while Baicizhan is highly effective for receptive vocabulary acquisition, particularly for less frequent words, it may need to be supplemented with other tools or instructional methods to address the broader needs of language learners.

Relating these findings to theoretical frameworks further underscores the strengths and limitations of Baicizhan. The significant improvements across all word frequency levels can be explained by the principles of spaced repetition, which have been shown to enhance memory retention by gradually increasing the intervals between encounters with new information (Schmitt, 2008). This learning mechanism is especially effective for vocabulary acquisition, as it allows learners to consolidate their knowledge over time. Baicizhan's implementation of spaced repetition likely contributed to the participants' ability to retain low-frequency words, which they may not have encountered in traditional classroom settings. However, the variability in learning outcomes, particularly at the advanced word levels, suggests that spaced repetition alone may not be sufficient to address the complexities of vocabulary acquisition. According to Dörnyei's (2005) theory of individual differences, factors such as intrinsic motivation, prior language exposure, and learning strategies significantly influence the effectiveness of any learning tool. While Baicizhan provides a personalized learning experience by tailoring word lists to the user's proficiency level, the results indicate that some learners may require additional support, such as explicit instruction or contextualized practice, to fully benefit from the app.

Moreover, the motivational benefits of gamification, as described by Hung

(2018), are evident in the consistent engagement observed among participants. The app's use of rewards, such as points and badges, likely encouraged students to maintain their learning routines, even when faced with challenging vocabulary. However, motivation alone does not guarantee deeper lexical processing, which is essential for developing a comprehensive vocabulary repertoire. Nation (2001) emphasizes that vocabulary learning involves not only recognizing words but also understanding their meanings, associations, and usage in various contexts. While Baicizhan excels at introducing and reinforcing word forms and definitions, its lack of contextualized practice may limit its ability to support deeper learning outcomes. This highlights the need to integrate Baicizhan with other instructional methods, such as teacher-led discussions, reading activities, or collaborative tasks, to provide learners with richer and more meaningful vocabulary experiences.

Recent studies further emphasize the effectiveness of smartphone applications for vocabulary acquisition. For example, Li and Hafner (2022) highlighted the potential of mobile-based word cards in improving both receptive and productive vocabulary knowledge among Chinese EFL learners, particularly for intermediate and advanced learners. Similarly, Kacetl & Klímová (2019) concluded that mobile apps enhance self-directed learning by promoting autonomous engagement with vocabulary tasks, a finding that aligns with the current study's observation of consistent participant engagement over 14 weeks.

Mat Saad and Abd Rahim (2022) compared different mobile apps and found that gamification elements, when combined with multimedia features like native speaker recordings, significantly boosted vocabulary retention. While Baicizhan's gamification components foster engagement, its reliance on static imagery and definitions, as noted earlier, limits opportunities for productive vocabulary use.

Lastly, Dağdeler (2023) conducted a systematic review of Mobile-Assisted Vocabulary Learning emphasized that while apps like Baicizhan excel at presenting vocabulary in manageable chunks, they must be supplemented with collaborative tools or real-world tasks to achieve comprehensive language development. These findings further underscore the need to complement Baicizhan with other resources to bridge gaps in contextualized and productive learning.

Overall, these findings highlight the need to complement technological innovations like Baicizhan with instructional methods that address the deeper complexities of vocabulary learning. Such integration could better support learners in developing a comprehensive understanding and application of vocabulary. Building on the study's findings, educators can explore strategies to enhance the application of vocabulary apps in classroom settings. To maximize the effectiveness of vocabulary apps like Baicizhan, educators can integrate these tools into broader instructional frameworks. For instance, combining app-based learning with collaborative classroom activities, such as group discussions or task-based learning, can provide opportunities for contextual vocabulary use. Additionally, instructors could use data from the app to identify specific vocabulary gaps and tailor their lessons, accordingly, thereby enhancing the overall learning experience.

To maximize its effectiveness, it can be integrated into classroom settings beyond individual use. To integrate the Baicizhan app into classroom settings, teachers can incorporate it as a supplementary tool to traditional classroom activities. For example, instructors can assign specific vocabulary from the app for students to review outside of class and then follow up with classroom activities that encourage active use of the vocabulary. This could include group discussions where students are asked to use newly learned words in context, vocabulary quizzes, or collaborative word games. Additionally, teachers can create in-class activities like role-playing exercises, debates, or task-based learning projects that require students to apply the vocabulary they learned through the app. This integration ensures that students engage with the vocabulary both passively (through the app) and actively (through classroom interaction).

6. Conclusion

This study examined the effect of using the Baicizhan vocabulary application on the receptive English vocabulary knowledge of non-English major Chinese undergraduates. The findings suggest that the use of Baicizhan had a significant positive impact on the participants' receptive vocabulary knowledge across different word frequency levels (1000, 2000, 3000, 4000, and 5000 words).

The most notable improvements were observed at the 4000- and 5000-word levels, where the students demonstrated substantial gains in their receptive vocabulary knowledge. This can be attributed to the students' relatively lower pre-test scores at these levels, indicating greater room for improvement. The structured and repetitive learning approach provided by Baicizhan, along with the introduction of new and challenging vocabulary, likely contributed to the more significant gains at the higher word frequency levels.

The results also revealed some variability in learning outcomes, particularly at the 3000-, 4000-, and 5000-word levels. This suggests that while Baicizhan was effective in enhancing vocabulary knowledge overall, the degree of improvement varied among individual students. Factors such as prior vocabulary knowledge, language aptitude, and motivation may have influenced the students' ability to benefit from the application.

Overall, the findings of this study provide empirical evidence that the use of the Baicizhan vocabulary application can positively impact the receptive English vocabulary knowledge of non-English major Chinese undergraduates. These results have implications for language learning strategies and the integration of technology-assisted approaches in English language education, particularly in contexts where students face challenges in vocabulary acquisition. While Baicizhan demonstrates significant potential as a vocabulary acquisition tool, integrating it with contextualized classroom instruction, such as reading tasks and group activities, could maximize its impact and foster deeper learning.

To further maximize the impact of the Baicizhan app, it can be integrated with classroom activities for more comprehensive language learning. One way to do

this is by assigning specific vocabulary from the app for students to review outside of class, with follow-up classroom activities that encourage active use of the vocabulary. For example, group discussions can be organized where students are required to use newly learned words in context. Additionally, task-based learning activities, such as writing assignments, presentations, or debates, can help students apply their vocabulary in practical settings.

Classroom games such as vocabulary bingo, word association games, or flash-card competitions can also help reinforce newly learned vocabulary in an engaging way. These activities can be used as a fun and interactive way to recall and apply words learned through the app. Finally, peer teaching—where students present vocabulary words to their peers—can help reinforce learning and encourage collaboration.

Future research could examine the long-term retention of vocabulary learned through Baicizhan by implementing follow-up assessments or interviews. Investigating how factors such as learner motivation, daily engagement patterns, and prior vocabulary knowledge influence the app's sustained impact across diverse learning contexts would provide valuable insights. Investigating the sustainability of learning gains over extended periods would provide valuable insights into the durability of app-based vocabulary acquisition. Additionally, studies could explore how variations in motivation, such as intrinsic versus extrinsic drivers, influence user engagement with the app and their overall learning outcomes. Researchers could also examine the integration of Baicizhan with classroom practices to maximize its impact. For instance, combining app-based learning with collaborative tasks or project-based activities might foster opportunities for contextualized and active vocabulary use. Further, understanding how personalized features, such as adaptive difficulty levels or tailored content, can be optimized to meet individual learners' needs would enhance the app's potential for broader scalability. To maximize Baicizhan's impact, integrating it with contextualized classroom activities, such as group discussions or reading tasks, can foster deeper vocabulary learning and retention.

Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

References

- 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*, Article 1112429. <https://doi.org/10.3389/fpsyg.2023.1112429>
- Dörnyei, Z. (2005). The Psychology of the Language Learner: Individual Differences in Second Language Acquisition. *ALLA Review, 19*, 42-68. <https://doi.org/10.1075/aila.19.05dor>
- Fengyu, Z. (2023). The Impact of Vocabulary Learning Methods on Students' Vocabulary Application Skills. *English Language Teaching and Linguistics Studies, 5*, 206.

- <https://doi.org/10.22158/eltls.v5n4p206>
- Goundar, P. R. (2019). Vocabulary Learning Strategies (VLSs) Employed by Learners of English as a Foreign Language (EFL). *English Language Teaching*, 12, 177-189. <https://doi.org/10.5539/elt.v12n5p177>
- Guo, F., Zhang, Y., & Wu, Z. (2022). Mobile-Assisted Vocabulary Learning through the Shanbay App Outside the Classroom: Effects of Self-Regulation and Peer Scaffolding. *Frontiers in Psychology*, 13, Article 993224. <https://doi.org/10.3389/fpsyg.2022.993224>
- Hasumi, T., & Chiu, M. S. (2024). Technology-Enhanced Language Learning in English Language Education: Performance Analysis, Core Publications, and Emerging Trends. *Cogent Education*, vol. 11. <https://doi.org/10.1080/2331186X.2024.2346044>
- Heilman, M., Collins-Thompson, K., Callan, J., Eskenazi, M., Juffs, A., & Wilson, L. (2010). Personalization of Reading Passages Improves Vocabulary Acquisition. *International Journal of Artificial Intelligence in Education*, 20, 73-98. <https://doi.org/10.3233/JAI-2010-0003>
- Hung, H. (2018). Gamifying the Flipped Classroom Using Game-Based Learning Materials. *ELT Journal*, 72, 296-308. <https://doi.org/10.1093/elt/ccx055>
- Ismail, I., Azizan, S. N., & Gunasegaran, T. (2016). Mobile Learning in Malaysian Universities: Are Students Ready? *International Journal of Interactive Mobile Technologies (IJIM)*, 10, 17-23. <https://doi.org/10.3991/ijim.v10i3.5316>
- Kacetyl, J., & Klímová, B. (2019). Use of Smartphone Applications in English Language Learning—A Challenge for Foreign Language Education. *Education Sciences*, 9, 179.
- Kukulska-Hulme, A., & Shield, L. (2008). An Overview of Mobile Assisted Language Learning: From Content Delivery to Supported Collaboration and Interaction. *ReCALL*, 20, 271-289. <https://doi.org/10.1017/S0958344008000335>
- Laufer, B., & Goldstein, Z. (2004). Testing Vocabulary Knowledge: Size, Strength, and Computer Adaptiveness. *Language Learning*, 54, 399-436. <https://doi.org/10.1111/j.0023-8333.2004.00260.x>
- Li, F., Fan, S., Wang, Y., & Lu, J. (2021). Chinese University Students' Experience of WeChat-Based English-Language Vocabulary Learning. *Education Sciences*, 11, Article No. 554. <https://doi.org/10.3390/educsci11090554>
- Li, Y., & Hafner, C. A. (2022). Mobile-Assisted Vocabulary Learning: Investigating Receptive and Productive Vocabulary Knowledge of Chinese EFL Learners. *ReCALL*, 34, 66-80. <https://doi.org/10.1017/S0958344021000161>
- Luo, H. (2023). Developing Chinese College English Learners' Vocabulary Proficiency with a Mobile-Assisted Language Learning Application. *EAI Endorsed Transactions on e-Learning*, 10, e5.
- Mat Saad, S., & Abd Rahim, N. A. (2022) Vocabulary Acquisition Using Duolingo in French Language Learning: A Malaysian Context. *E-BANGI: Jurnal Sains Sosial dan Kemanusiaan*, 19, 256-281.
- Mehdipour, Y., & Zerehkafi, H. (2013). Mobile Learning for Education: Benefits and Challenges. *International Journal of Computational Engineering Research*, 3, 93-101.
- Milton, J., & Alexiou, T. (2020). Vocabulary Size Assessment: Assessing the Vocabulary Needs of Learners in Relation to Their CEFR Goals. In P. Davidson, M. Coombe, W. Jones, & S. Al-Hamly (Eds.), *Vocabulary in Curriculum Planning: Needs, Strategies, and Tools* (pp. 9-27). Springer. https://doi.org/10.1007/978-3-030-48663-1_2
- Nation, I. S. P. (2001). *Learning Vocabulary in Another Language*. Cambridge University Press. <https://doi.org/10.1017/cbo9781139524759>

- Okumuş Dağdeler, K. (2023). A Systematic Review of Mobile-Assisted Vocabulary Learning Research. *Smart Learning Environments*, 10, Article No. 19. <https://doi.org/10.1186/s40561-023-00235-z>
- Papadakis, S. (2021). Advances in Mobile Learning Educational Research (A.M.L.E.R.): Mobile Learning as an Educational Reform. *Advances in Mobile Learning Educational Research*, 1, 1-4. <https://doi.org/10.3390/educsci11040193>
- Pullen, D., Swabey, K., Abadoo, M., & Sing, T. K. R. (2015). Malaysian University Students' Use of Mobile Phones for Study. *Australian Educational Computing*, 30, 1-14. <https://journal.acce.edu.au/index.php/AEC/article/view/55>
- Qian, D. D. (2002). Investigating the Relationship between Vocabulary Knowledge and Academic Reading Performance: An Assessment Perspective. *Language Learning*, 52, 513-536. <https://doi.org/10.1111/1467-9922.00193>
- Rahmani, A., Asadi, V., & Xodabande, I. (2022). Using Mobile Devices for Vocabulary Learning outside the Classroom: Improving the English as Foreign Language Learners' Knowledge of High-Frequency Words. *Frontiers in Psychology*, 13, Article ID: 899885. <https://doi.org/10.3389/fpsyg.2022.899885>
- Schmitt, N. (2008). Review Article: Instructed Second Language Vocabulary Learning. *Language Teaching Research*, 12, 329-363. <https://doi.org/10.1177/1362168808089921>
- Song, B., & Xiong, D. (2023). A Comparative Study of the Effects of Social Media and Language Learning Apps on Learners' Vocabulary Performance. *Asia Pacific Education Review*. <https://doi.org/10.1007/s12564-023-09871-z>
- Webb, S., Sasao, Y., & Ballance, O. (2017). The Updated Vocabulary Levels Test. *ITL—International Journal of Applied Linguistics*, 168, 33-69. <https://doi.org/10.1075/itl.168.1.02web>
- Zeng, Y., Lu, Q., Wallace, M. P., Guo, Y., Fan, C., & Chen, X. (2022). Understanding Sustainable Development of English Vocabulary Acquisition: Evidence from Chinese EFL Learners. *Sustainability*, 14, Article No. 6532. <https://doi.org/10.3390/su14116532>