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The Effectiveness of Mobile-Assisted Language Learning on Improving Chinese EFL Students' Vocabulary Learning

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ABSTRACT

Mobile learning with its characteristics of flexibility and convenience in assisting students' learning has become a new trend among language learners. Hence, the purpose of this study was to find out the effectiveness of mobile-assisted language learning(MALL) on improving Chinese English as a Foreign Language (EFL) students' English scores in their vocabulary learning. he study involved 96 students from a Chinese university to examine whether mobile-assisted language learning led to improvements in their English scores. The Baicizhan app was selected as a mobile-assisted language learning tool to test its effectiveness, due to its widespread use in China. Pre-test and post-test were conducted and a semester of experiment with the application of Baicizhan App was carried out, with 48 students selected to be in the experimental class and 48 students in the control class. A duration of one semester was utilised to carry out the study. The results of the tests showed that mobile-assisted language learning had improved Chinese EFL students' English scores in their vocabulary learning with the contribution of finding out an effective mode of teaching and learning vocabulary with Baicizhan App.

Keywords: Mobile-Assisted Language Learning (MALL), Constructivism, Vocabulary Learning, EFL, Baichizan App

1.0 INTRODUCTION

Language learning has long been a common topic for educators and researchers all around the world. Chinese EFL students usually believe that a foreign language learning should focus on the learning environment where a real situational context should be constructed in order to create a more suitable learning environment (Lin *et al*., 2022). Mobile-assisted language learning (MALL) with the characteristic of providing a real foreign learning environment and a new learning experience of situational context has attracted students' attention in language learning (Zain & Bowles, 2021). It seems that mobile-assisted language learning is the solution to second language learning for language learners in particular, vocabulary learning. One such assistance is using apps. In recent years, the proliferation of mobile-assisted language learning (MALL) tools in China has significantly influenced vocabulary acquisition among English as a Foreign Language (EFL) learners. Notably, applications such as Shanbei, Kaixinchicang, and Baicizhan have been widely implemented to support second language vocabulary

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learning across various educational levels. In the context of mobile-assisted vocabulary learning, Shanbei, Kaixinchicang, and Baicizhan represent three widely adopted applications in China, each reflecting distinct pedagogical orientations and learner engagement strategies. Shanbei emphasises self-regulated learning, incorporating spaced repetition and goal-setting functions that cater to independent learners, particularly those preparing for high-stakes language proficiency examinations such as the CET and TOEFL (Chong, 2018; Wan *et al*., 2025). Kaixinchicang, in contrast, adheres to more conventional instructional approaches, favouring rote memorisation and translation-based drills that mirror textbook practices and appeal to learners accustomed to traditional classroom methods (Chong, 2018). In an experimental study, Chong (2018) examined the efficacy of these applications and reported that Shanbei was primarily designed for young learners at the primary level, while Kaixinchicang demonstrated strong alignment with traditional rote memorization methods, similar to the use of paper dictionaries. In contrast, Baicizhan was found to be the most effective in enhancing learner engagement and motivation through its tailored practices and explanatory depth (Qi, 2012). Baicizhan offers a multimodal and gamified learning environment, integrating images, native audio, contextualised example sentences, and progress-tracking tools designed to enhance learner motivation and vocabulary retention (Qi, 2012; Huang *et al*., 2024; Wan *et al*., 2025). Among the three applications, Baicizhan demonstrates particular strength in supporting situated and contextual vocabulary learning through its adaptive, visually rich interface (Teng, 2020; Garzón *et al*., 2023). These distinctions highlight how mobile applications may be effectively aligned with varying cognitive preferences and instructional needs in Language for Specific Purposes (LSP) contexts, offering learners diverse pathways to develop domain-specific lexical competence.

Wan *et al*. (2025) demonstrated that in a 14-week intervention with 126 Chinese undergraduates using Baicizhan, significant improvements were shown across 1,000–5,000 frequency band vocabulary levels. Users showed preference for Baicizhan over social media-based vocabulary tools, with features like spaced repetition, gamification, and personalized plans supporting that engagement. Furthermore, Baicizhan has also emerged as the most popular application, with a growing user base attributed to its intuitive interface and adaptive design (Luan, 2021). The application offers level-specific learning plans and integrates progress monitoring tools and interactive features that align with differentiated learner needs (Hong, 2021). Such affordances are particularly relevant in LSP contexts, where learners benefit from scaffolded vocabulary acquisition that aligns with their academic and professional language goals. Crucially, Baicizhan incorporates multimodal learning resources -including images, videos, and audio stimuli -to reinforce word retention and improve overall language learning efficacy (Teng, 2020). Each vocabulary item is paired with visually rich examples and situated within meaningful contexts to facilitate cognitive associations. The app also features supplementary resources such as “Vocabulary TV” and “Vocabulary Building Station,” comprising over 10,000 vocabulary items explained by qualified instructors. Its curriculum design aligns with major standardized English proficiency tests commonly required in Chinese EFL contexts. Additionally, Baicizhan fosters peer learning through in-app social features that enable users to collaborate, share insights, and provide mutual accountability - an aspect particularly beneficial for learners in discipline-specific language environments. Therefore, the Baicizhan app was selected in this study as the mobile-assisted language learning tool to support English majors in their vocabulary learning.

The study targeted to investigate the effectiveness of mobile-assisted language learning on improving Chinese EFL students’ English scores, and constructivism as a guiding theory as well as mobile-assisted language learning in a Chinese university. It would help teachers make use of constructivism reflected in

mobile learning applications in their teaching to help them with more vivid teaching materials and teaching plans. In addition, the study would help students change their way of vocabulary learning and realise that it would be more effective to learn with a mobile learning application.

2.0 LITERATURE REVIEW

The integration of mobile technologies into language learning has garnered substantial attention over the past two decades, particularly within the context of English for Specific Purposes (ESP) and general English language instruction. Mobile-assisted language learning (MALL) has emerged as a prominent approach, offering flexible, contextualised, and learner-centred opportunities that align with the pedagogical aims of LSP. The initial implementation of MALL can be traced to Stanford University's Learning Lab in 2000 (Duman *et al*., 2015), and since then, mobile learning has become a global phenomenon, reshaping traditional language education practices (Khan *et al*., 2015; Al Adwan *et al*., 2018; Gan & Balakrishnan, 2018). Empirical evidence supports the efficacy of MALL across various educational levels and settings. Mihaylova *et al*.'s (2022) meta-analysis brought together the findings from 23 experimental studies comparing mobile-assisted language learning (MALL) with traditional methods, and it was found that MALL had a notably positive impact on second language acquisition, with a moderate to strong effect size (Hedges' g = 0.88) after adjusting for outliers. Similarly, Lin and Lin (2019) conducted a systematic review of 33 ESL/EFL studies focusing on vocabulary learning and reported substantial positive outcomes. Interestingly, their findings suggest that mobile-based Short Messaging System (SMS) and Media Messaging System (MMS) interventions demonstrated greater effectiveness than mobile applications, particularly in vocabulary retention.

The motivational dimension of MALL has also been explored. A recent review by Okumuş Dağdeler (2023) emphasized that mobile-assisted vocabulary learning improves not only retention but also learner motivation and attitudes - factors central to LSP contexts where learner autonomy and engagement are critical. Additionally, task-based mobile interventions have shown notable success in Content and Language Integrated Learning (CLIL) environments, further supporting their relevance for content-specific language learning (Pang & Aziz, 2021).

Garzón *et al*. (2023), in a meta-analysis of 62 ESL/EFL studies, found a large effect size (g = 0.89), with the strongest learning outcomes occurring in undergraduate settings and collaborative learning contexts. This finding is particularly pertinent to LSP, where collaborative, goal-oriented tasks often reflect real-world professional communication practices. Moreover, across 54 studies, the effectiveness of MALL was found to be moderated by pedagogical design and learner proficiency levels - reinforcing the importance of instructional alignment with learners' academic and disciplinary needs (Garzón *et al*., 2023).

Furthermore, a growing body of research has demonstrated the positive impact of MALL on second language acquisition, particularly in vocabulary development and learner motivation. Seyyedrezaeia *et al*. (2016) investigated the use of MALL among Iranian students and found notable improvements in vocabulary performance. Similarly, Loewen *et al*. (2019) examined learners using the Duolingo app and reported that participants found the mobile format flexible, enjoyable, and conducive to sustained engagement in second language learning. In a separate study, Gonulal (2019) explored the educational potential of Instagram as a language learning tool and concluded that it supported both linguistic development and communicative competence.

Vocabulary retention has also been strongly linked to MALL strategies. Lin and Lin (2019) found that mobile-supported instruction significantly enhanced word retention in ESL/EFL contexts. Reinforcing these findings, Katemba (2021) conducted an experimental study showing that learners using mobile applications outperformed peers in vocabulary acquisition when compared to those taught via traditional methods. Likewise, Chen *et al*. (2020) argued for greater attention to mobile learning tools, emphasizing their superiority over conventional classroom instruction in promoting vocabulary development.

These studies collectively support the integration of MALL into language learning frameworks. The theoretical underpinnings of such approaches are often grounded in constructivist learning theory, as articulated by Piaget (1957) and Vygotsky (1968). Piaget emphasised individual cognitive development through environmental interaction, while Vygotsky highlighted the social dimensions of learning, particularly the role of the Zone of Proximal Development (ZPD) in facilitating growth through guided support. Applied to MALL, these theories align with learner-centred practices that emphasize autonomy, active engagement, and social interaction. Clark (2018) affirmed that constructivist pedagogy fosters discovery-based learning, where learners form meaning through self-guided exploration rather than passive reception. Similarly, Barnett (2018) emphasised the importance of learners constructing knowledge through reflection and experience, a process well-supported by mobile technologies that promote personalization, interaction, and multimodal access to content.

Within the Chinese EFL context, recent studies have further substantiated the efficacy of MALL. Yang (2020) investigated motivational factors influencing Chinese university students and identified engaging content as a key driver of mobile learning uptake. Li (2023) found that mobile-assisted methods were more effective than traditional instruction in enhancing EFL learners' listening skills. A comprehensive meta-analysis by Li (2022) of experimental and quasi-experimental studies conducted between 2000 and 2020 revealed that MALL significantly improved reading comprehension among Chinese learners, with intervention duration and instructional design serving as key moderating variables.

In terms of vocabulary learning, Xiao *et al*. (2022) reported that MALL interventions positively influenced learners' attitudes and self-regulatory behaviours, both of which are critical in specialized language learning environments. Huang *et al*. (2024) added that Chinese undergraduates' engagement in out-of-class mobile learning was significantly shaped by their EFL proficiency levels, which mediated their preferences for mobile-based instruction. Meanwhile, Zhou (2021), in a review of studies from 2017 to 2021, concluded that MALL had a demonstrable impact on improving English speaking proficiency among Chinese EFL learners.

Collectively, these findings suggest that mobile-assisted approaches are not only well-established in Chinese higher education but also effective across various language domains, including vocabulary, reading, listening, and speaking. Given the growing emphasis on learner autonomy and contextualised learning in LSP settings, these insights reinforce the relevance of MALL in enhancing vocabulary outcomes among Chinese undergraduate EFL students. The current study builds upon this foundation by focusing specifically on vocabulary learning among English majors in a mobile-supported environment, aiming to explore whether such interventions can yield measurable gains in vocabulary knowledge and learner motivation.

3.0 METHOD

The study adopted a quantitative method in discovering Chinese EFL students' language learning effectiveness. The participants in the study were 96 English major students in a Chinese university in China, in which 48 students were in the experimental class and 48 students were in the control class. When entering into the university, students were distributed to different classes according to their English scores in the College Entrance Examination, so that students with similar English level can be better educated and cultivated in the same classes. Therefore, the selection of students in the experimental class and the control class was in accordance with their English scores and class number, where the students' English level and performance were similar in the experimental class and control class. Hence, the validity of the participants in the experimental class and the control class could be ensured. The sampling of the study was purposive sampling from among English major students that the teacher had taught intensive reading to the previous semester, in which students with intermediate level were involved in the treatment.

The instruments for the study included two parts: Baicizhan App, which served as representative of mobile-assisted language learning, and the test paper for pre-test and post-test. When using Baicizhan App for the first time, a reminder would be emerged asking for the user's needs of vocabulary learning, and after selecting the English level, the learning began. Baicizhan App offered different kinds of functions for vocabulary learning, with the first step the selection of the right picture. If one chose the right picture with the right meaning, then another new word appeared. If not, there would be detailed explanations to enhance the memory of the words. The App contained pictures, audios, videos, charts, word formation explanations, etc. to help students be immersed in a situational contexts to learn vocabulary which helped them memorize and understand the words better. The functions described above in Baicizhan App were the best reflection of constructivism that students' needs were placed first, and knowledge was built in a situational way. The following was the review part and preview part, which would repeat the wrong answers one made in the first step to further deepen the impression of the words. After that, a stop could appear to congratulate the finishing of a day's learning. Figure 1 shows the contents of vocabulary learning within Baicizhan App.

Another instrument employed was the test paper. For English major students, TEM 4 (Test for English Majors-Band 4) was the exam that all students needed to pass before their graduation. TEM 4 is the standard for Chinese EFL students in testing their English level and performance (He & Wu, 2019). In order to check students' English scores by using Baicizhan App, the simulation test paper of TEM 4 was applied, with the third and fourth part as the contents of the test papers. Part Three and Part Four in TEM 4 were directly related to language usage (Li, 2018), which were more suitable in the study for testing students' capacity of language application.

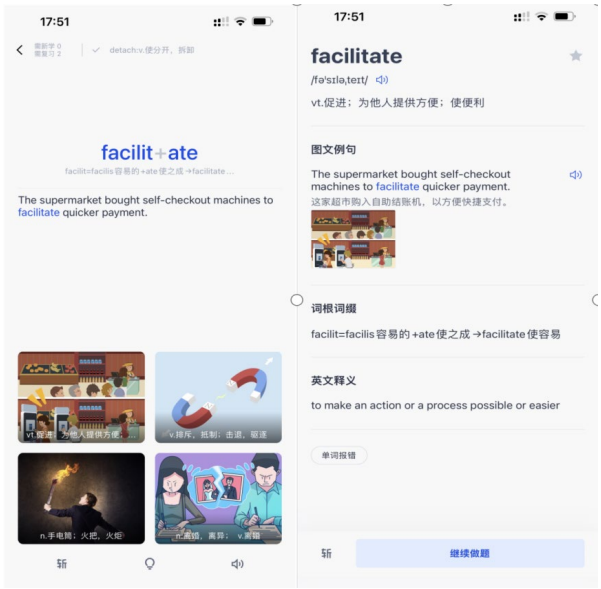

Figure 1 Sample Contents of Learning in Baicizhan App

Before the treatment, a pre-test was carried out to check the students' scores in both experimental class and control class for the comparison with the post-test after the treatment. The pre-test and post-test papers were the simulation test for TEM 4 (Test for English Majors-Band 4) which was the exam that all English major students had to pass during the college time, or they cannot acquire the Bachelor's degree after graduation. According to Jin and Fan (2011), validity and reliability are essential in test development, with validity referring to how well test scores serve their intended purpose and reliability indicating the consistency of test results. A Sino-British validation study (1993-1996) of TEM4 and TEM8 reported high internal consistency coefficients (0.854 for TEM4 and 0.801 for TEM8), demonstrating strong reliability. Factor analyses further supported the tests' validity by identifying general competence and comprehension versus production dimensions. The study concluded that the TEMs were appropriately challenging, reliable, and valid, and it also led to the implementation of standardized quality control procedures. Aligned with the National College for English Teaching Syllabus for English Majors (NACFLT) Syllabus, the TEM has since undergone revisions and is now a well-established English proficiency test in China, with its validity and reliability supported by multiple studies. Figure 1 shows the sample contents of learning Baichizan App of the of the study. The experiment was carried out during the intensive reading class, where students were required to learn English vocabulary and reading in class. The treatment was implemented in the experimental class with mobile-assisted language learning instrument-Baicizhan App, and the teacher introduced the functions of the App to the students during the first class and guided them to use it for learning vocabulary during class time. After class, students were asked to review and preview the vocabulary with Baicizhan App, and they were required to learn at least 20 minutes a day with the App. The students in the control class were using the traditional way of learning with textbooks and dictionaries, and the teacher continued the traditional way of teaching in class with textbooks.

4.0 RESULTS AND DISCUSSION

In this section, it describes and discusses the findings of the study. Based on the findings, students in the experimental class received a semester's treatment of using Baicizhan App to assist their intensive reading and vocabulary learning in class and out of class, while students in the control class continued learning with textbooks and dictionaries. Part Three and Part Four in the simulation Test for English Majors (TEM) 4 test paper of 2019 and 2020 were used with the total score of 40. The results of the treatment are divided into the following four parts:

1. Result of Pre-Test of the Experimental Class and the Control Class

Table 1 displays the results obtained for the pre-test of the experimental class and the control class.

Table 1 The Result of Pre-test of the Experimental Class and the Control Class

Group	Mean	Std.	SE Mean	t	p
Pre-test for EC (N=48)	29.9167	2.132	0.308	-0.274	0.785
Pre-test for CC (N=48)	30.0417	2.333	0.337		

Based on the table, the mean score of the pre-test for the experimental class and the control was 29.9 and 30.0, respectively. Independent T-test showed that p was 0.785, greater than 0.05, which meant that no significant difference was found between the pre-test scores of the experimental class and the control class. Thus, the results proved that students' English scores in the pre-test of both classes were almost the same and their English level was similar with each other, so that they could be taken as the research objectives for the following experiment.

2. Result of Post-test of the Experimental Class and the Control Class

The post-test was held after a semester's experiment, and the results of post-test for the experimental class and the control class were depicted in Table 2.

Table 2 The Result of Post-test of the Experimental Class and the Control Class

Group	Mean	Std.	SE Mean	t	p
Post-test for EG (N=48)	33.083	2.448	0.353	6.338	<0.001
Post-test for CG (N=48)	30.063	2.216	0.329		

The mean score of the experimental class in post-test was 33.0, while the mean score of the control class in post-test was 30.0. Through the independent T-test, t was 6.338, $p<0.05$, which signalled that significant difference existed in post-test results among the experimental class and the control class, and the scores of post-test in experimental class were higher than that in the control class. Consequently, it can be acquired that after a semester's learning with mobile-assisted learning instrument-Baicizhan App, the experimental class students' scores were much higher than students who were learning with traditional method.

3. Results of Pre-Test and Post-Test for the Control Group

Students in the control class continued traditional method of language learning with textbooks and self-learning with dictionaries. Table 3 depicts the result of pre-test and post-test for the control class.

Table 3 The Result of Pre-test and Post-test for the Control Group

Group	Mean	Std.	SE Mean	t	p
Pre-test for CG (N=48)	30.042	2.333	0.337	-0.275	0.785
Post-test for CG (N=48)	30.063	2.216	0.329		

The results of control class in the pre-test and post-test were almost the same with 30.04 and 30.06 as its mean score, respectively, and through paired samples T-test, $p=0.785>0.05$, which indicated that no significant difference was discovered in pre-test and post-test for the control class. It could be stated that after a semester's learning with traditional method, students' scores in the control were not improving.

4. Result of Pre-Test and Post-Test for the Experimental Class

Students in the experimental class employed mobile-assisted learning method with Baicizhan App for in class and out of class learning. Table 4 shows the result of pre-test and post-test for the experimental class.

Table 4 The Result of Pre-Test and Post-Test for the Experimental Class

Group	Mean	Std.	SE Mean	t	p
Pre-test for EG (N=48)	29.916	2.132	0.308	-51.091	<0.001
Post-test for EG (N=48)	33.083	2.448	0.353		

The mean score in the pre-test and post-test was 29.9 and 33.0 respectively, which was a big difference. Through paired samples T-test, $p<0.05$, which illustrated that significant difference was found between the results of pre-test and post-test for the experimental class. It can be concluded that students in the experimental class had improved their English scores after using Baicizhan App to assist learning, which further proved the effectiveness of mobile-assisted language learning to Chinese EFL students.

DISCUSSION

The discussion will firstly engage in existing contradictory studies, cognitive load issues, or long-term vocabulary retention in relation to the results displayed in Table 1, Table 2, Table 3, and 4.

The results presented in Tables 1 through 4 offer important insights into how cognitive principles intersect with mobile-assisted language learning (MALL). Drawing on Cognitive Load Theory (Sweller, 2010), effective MALL design should aim to reduce unnecessary distractions (extraneous load), manage the complexity of content (intrinsic load), and increase meaningful mental effort (germane load). In practice, this means creating streamlined, user-friendly interfaces, using multimedia that provides

meaningful context, incorporating spaced repetition, and designing interactive, game-like tasks to support deeper learning and vocabulary retention.

As shown in Table 1, the findings reveal no significant difference in vocabulary improvement for the group using traditional learning tools ($p = 0.785$, $t = -0.274$). These results are consistent with earlier studies (e.g., Bai, 2017; Wang *et al*., 2014; Lin & Huifen, 2021), which suggest that short-term interventions, limited instructional design, and overly rigid assessments can hinder long-term vocabulary retention. Liu and Lee (2023) further argue that when instructional methods fail to match learners' cognitive capacities, they can overwhelm working memory and diminish learning outcomes. To address this, scholars increasingly recommend mobile learning designs that include rich media, interactive tasks, and spaced review cycles - elements that help facilitate deeper processing and sustained engagement.

In contrast, the data from Table 2 paints a more promising picture. With a t-value of 6.34 and a p-value < 0.001, the mobile-assisted group demonstrated significant gains in vocabulary knowledge. The estimated effect size (Cohen's $d = 0.82$) falls within the upper range reported in prior MALL studies (Bai, 2017; Liu & Lee, 2023). These findings highlight the potential of well-structured mobile interventions to reduce extraneous cognitive load while enhancing germane load through visually engaging, spaced, and interactive features. The outcomes reinforce the idea that when mobile learning is thoughtfully designed, it not only captures learner interest but also supports long-term retention-especially in Chinese EFL contexts.

The comparison group, which relied on traditional tools such as textbooks and self-directed dictionary use (Table 3), showed no statistically significant gains ($p = 0.79$, $t = -0.28$). These results are in line with previous findings suggesting that traditional vocabulary learning approaches often fall short when it comes to engagement and retention (Lu, 2019; Kim & Lee, 2017; Gafni *et al*., 2019). The passive nature of these methods, combined with a lack of spaced practice and multimedia support, may increase extraneous cognitive load, leading to shallow processing and poor memory retention over time (Sweller, 2010; Chen, 2014; Jung, 2021).

Moreover, traditional methods typically lack built-in mechanisms for revisiting content at optimal intervals or placing words in meaningful, contextual frameworks-two features that MALL environments often provide. This contrast underscores a growing consensus in the literature: mobile-assisted approaches tend to outperform conventional strategies in promoting vocabulary growth and long-term retention (Levy & Kennedy, 2005; Gafni *et al*., 2019).

Finally, Table 4 presents the most striking result, with a highly significant difference between pre- and post-tests in the experimental group ($p < 0.001$, $t = -51.091$). This dramatic improvement further validates the potential of MALL to enhance vocabulary learning among Chinese EFL learners, echoing the strong positive outcomes documented in several earlier studies (Bai, 2017; Liu & Lee, 2023). However, it is important to note that MALL is not a one-size-fits-all solution. Some researchers, such as Levy and Kennedy (2005) and Gafni *et al*. (2019), have reported mixed results, particularly among learners who may struggle with motivation, prefer traditional methods, or are exposed to poorly designed mobile interventions.

Cognitive overload is another key concern. If mobile content is too dense, fast-paced, or visually complex, it may tax working memory rather than support it (Sweller, 2010; Jung, 2021). Moreover, while many studies report strong short-term gains, these benefits can fade without ongoing review and reinforcement (Lu, 2019; Kim & Lee, 2017). Thus, while the results of this study strongly support the use of MALL in vocabulary instruction, they also highlight the importance of thoughtful instructional design, regular spaced practice, and adaptation to learners' individual needs and cognitive limits.

5.0 CONCLUSION

This study found that students in the experimental group, who used the Baicizhan app as part of their vocabulary learning, achieved significantly higher scores than those in the control group. These results offer empirical support for the effectiveness of mobile-assisted language learning (MALL) in enhancing vocabulary acquisition among Chinese EFL learners. More importantly, the findings resonate with the principles of constructivist learning theory, suggesting that vocabulary development can be meaningfully facilitated when learners actively reconstruct knowledge through interaction with digital tools and content.

The use of independent and paired samples t-tests confirmed that MALL, via the Baicizhan app, contributed positively to students' English language performance. For English language educators, this points to the potential of integrating mobile learning tools as a pedagogical strategy not only to raise achievement levels but also to make vocabulary learning more engaging and accessible for learners.

However, several limitations should be noted. First, the study relied exclusively on quantitative methods, which may have limited the depth of interpretation by overlooking learners' experiences, motivations, and contextual influences. The absence of triangulation-such as interviews, classroom observations, or learner reflections-restricts understanding of how students interacted with the app and constructed meaning through its features. Moreover, variables such as learners' prior vocabulary knowledge, familiarity with mobile apps, or levels of autonomy were not controlled for, and may have influenced the outcomes in unmeasured ways.

To deepen the understanding of how MALL supports vocabulary development, future research should incorporate theory-driven and mixed-methods approaches. Constructivist and sociocultural learning frameworks can provide richer insights into how learners engage with mobile technologies across different settings. Comparative studies involving varied institutions, language proficiency levels, or cross-cultural cohorts-particularly in non-Chinese EFL contexts-will be crucial for assessing the broader relevance and transferability of MALL. By expanding both the theoretical and methodological scope, future investigations can offer a more comprehensive and context-sensitive understanding of mobile-assisted learning in second language education.

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CONFLICTS OF INTEREST

The authors declare that there is no conflict of interest regarding the publication of this paper.

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