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Chinese Undergraduate English Majors' Perceptions of Mobile-Assisted Language Learning for Deep Vocabulary Development: A Qualitative Inquiry

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Abstract

Mobile-assisted language learning (MALL) has transformed English vocabulary acquisition among Chinese learners, yet questions persist regarding its effectiveness in facilitating deep vocabulary learning beyond surface-level word recognition. This qualitative case study investigates Chinese undergraduate English majors' perceptions of MALL's capacity to support deep vocabulary development. Using purposeful criterion sampling, four second-year English majors from a private college in China who experienced vocabulary learning challenges and regularly used MALL applications participated in semi-structured interviews. Data were systematically analyzed through NVivo software employing grounded theory principles. The coding process revealed three core themes: (B1) English vocabulary learning experience; (B2) use of mobile applications; and (B3) impact on learning changes and skill improvement. Findings indicate that while MALL applications effectively expand vocabulary breadth through features such as picture hints, multimedia resources, and spaced repetition, participants identified challenges in developing vocabulary depth. Specifically, learners struggled to transfer app-based knowledge to authentic communicative contexts, experienced tension between initial motivation and sustained engagement, and found limited support for understanding collocations, pragmatic constraints, and semantic networks. The study reveals that current MALL implementations more effectively support "shallow breadth" than genuine depth, underscoring the need for theoretically grounded pedagogies that explicitly address deep processing, metacognitive development, and contextualized practice to ensure meaningful, sustainable vocabulary acquisition..

Keywords
Mobile-assisted language learning; Deep vocabulary learning; Learner perceptions; Chinese EFL learners; Qualitative case study

1. Introduction

The advancement of the internet has profoundly changed how people live. Exchanging information via mobile phones is becoming ubiquitous due to its accessibility and feasibility of worldwide communication, which enhances the needs of learning English as an internationally universal language. Under this background, it is by no means uncommon for Chinese students

to learn English vocabulary with the help of their mobiles.

Learning tools of English vocabulary have shifted from the traditional hard copy dictionary, word books and electronic dictionaries, to learning applications on mobile phones such as Shan Bei, Bai Ci Zhan and Bu Bei Dan Ci. Being accessible, instant, and interactive, they are also easy to carry, and facilitate the recording and management of learning. Therefore, mobile assisted language learning (MALL) has drawn wide attention in the field of English learning and teaching. Ideally, MALL should help learners build systematic vocabulary knowledge, thereby enabling them to apply it practically to meet the demands of real-world English communication. However, there remains a gap in literature.

To address this critical gap, the present study investigates Chinese undergraduate English majors' perceptions of MALL's effectiveness in facilitating deep vocabulary learning. Specifically, this research examines whether mobile applications can transcend their current role in vocabulary expansion to support deeper cognitive processes including knowledge integration, systematic organization, and practical application of vocabulary. By exploring learners' lived experiences with MALL tools, this study seeks to illuminate the tensions between convenience and depth, fragmentation and coherence in mobile-assisted vocabulary learning. Understanding these dynamics is essential for optimizing MALL pedagogies and ensuring that technological affordances translate into meaningful learning outcomes rather than superficial engagement with decontextualized word lists.

2. Literature Review

Mobile-Assisted Language Learning (MALL) has emerged as a significant pedagogical approach in contemporary English language education, fundamentally transforming how learners engage with vocabulary acquisition. Kukulska-Hulme and Traxler (2005) provided foundational insights into MALL by defining it as language learning supported by mobile devices, emphasizing its inherent characteristics of portability, immediacy, and contextual learning opportunities. Building upon this groundwork, contemporary research has increasingly demonstrated MALL's capacity to create ubiquitous, personalized, and interactive learning environments that transcend traditional spatial and temporal constraints (Li, 2024; Zhang et al., 2024).

Substantial empirical evidence demonstrates MALL's positive impact across multiple dimensions of language learning. Studies examining speaking performance (Pebiana & Febria, 2023), grammar acquisition (Jais et al., 2022), and listening skills (bin Noordan & Yunus, 2022) collectively illustrate MALL's versatility in supporting diverse linguistic competencies. Particularly relevant to the current study, research on Chinese EFL learners reveals compelling patterns. Lu et al. (2023) conducted a quasi-experimental investigation with 108 Chinese non-English majors, finding that students using a theory-based mobile app demonstrated a 129.65% improvement in vocabulary learning, which was significantly higher than the 68.4% gain observed in the control group. This finding underscore mobile applications' capacity to enhance both vocabulary achievement and retention among Chinese tertiary students.

Beyond effectiveness studies, researchers have systematically examined factors influencing learners' acceptance and sustained use of MALL technologies. Studies employing the Technology Acceptance Model (TAM) have established that perceived usefulness and ease of use serve as primary predictors of adoption (Tan & Hsu, 2018; Zhang & Hennessy, 2023). The Unified Theory of Acceptance and Use of Technology (UTAUT) model, as applied by Yee and

Abdullah (2021), provides additional explanatory power by considering contextual variables such as peer influence and teacher support. These external factors have been identified as significant motivators for MALL adoption, suggesting that successful implementation requires attention not only to app features but also to the broader social learning environment. This multifaceted understanding of technology acceptance informs more effective pedagogical integration strategies that account for both individual and contextual factors.

The evolution of MALL research methodologies reflects increasing sophistication in understanding how technology can optimize language learning. Contemporary researchers have adopted design and development research frameworks, particularly the ADDIE model (Analysis, Design, Development, Implementation, and Evaluation), to create evidence-based mobile learning interventions (Dağdeler et al., 2020; Muslimin et al., 2017; Alhuwaydi, 2022). This systematic approach ensures that mobile applications and modules align with established pedagogical principles while addressing specific learner needs. Li (2024) conducted an extensive review of English vocabulary learning apps designed for Chinese EFL learners, analyzing their theoretical underpinnings and pedagogical frameworks. This analysis revealed that effective apps integrate vocabulary learning strategies with sound instructional design principles, including spaced repetition algorithms, multimodal input, contextualized practice, and immediate feedback mechanisms.

Despite extensive research documenting MALL's effectiveness for vocabulary expansion, a significant theoretical and empirical gap persists regarding its capacity to support deep vocabulary learning. Vocabulary breadth—the number of words known—has been the predominant focus of MALL research, with numerous studies confirming mobile tools' efficacy in enhancing learners' word recognition and basic comprehension (Koleini et al., 2024; Xodabande et al., 2023). However, vocabulary depth—encompassing nuanced understanding of word meanings, collocations, morphological properties, and pragmatic usage—remains under-explored in the MALL literature (Boroughani et al., 2023).

Current evidence suggests that mobile learning environments, while convenient and accessible, may inadvertently promote surface-level engagement. The design of many popular vocabulary apps prioritizes rapid recognition and de-contextualized memorization over deeper semantic processing and integration (Li, 2024). Research on information redundancy and learning fragmentation in mobile contexts reveals that learners often struggle to move beyond isolated word knowledge toward systematic vocabulary organization and practical application (Wagner-Loera, 2016). This tension between MALL's affordances for breadth and its potential limitations for depth represents a critical area requiring investigation.

In synthesis, while MALL research has established mobile technologies' efficacy for vocabulary expansion and documented factors influencing technology acceptance, critical gaps remain. Most significantly, there exists insufficient understanding of whether and how MALL can transcend its current role in vocabulary breadth development to support deeper cognitive processes including knowledge integration, systematic organization, and practical application. For Chinese undergraduate English majors navigating dense curricular demands, the capacity to leverage mobile tools for substantive rather than superficial vocabulary learning holds particular importance.

This study addresses these gaps by investigating learners' lived experiences with MALL vocabulary applications, specifically examining their perceptions of mobile learning's impact on vocabulary depth, organization, and meta-cognitive development. By foregrounding learners'

perspectives, this research seeks to illuminate the tensions between convenience and depth, fragmentation and coherence that characterize mobile-assisted vocabulary learning. Understanding these dynamics is essential for developing pedagogical approaches that harness MALL's affordances while mitigating its potential limitations, ultimately ensuring that mobile technologies serve as catalysts for meaningful, transformative language learning rather than merely facilitating surface-level engagement with decontextualized word lists.

3. Methodology

This study employs a qualitative research methodology using a single case study design. The participants were second-year English majors at a private college in China. This type of city-level private institution typically enrolls students with a lower English proficiency base compared to national key universities, thus representing a suitable context for investigating vocabulary learning challenges and the potential of MALL to address them. As Burns (1997) notes, case studies must focus on bounded subjects that are either highly representative or distinctively atypical; this setting satisfies both criteria as private colleges constitute a substantial portion of China's higher education system while also presenting unique pedagogical contexts.

A purposeful criterion sampling strategy was employed to ensure participant relevance. Selection criteria included: (1) second-year English majors with at least one year of college-level English instruction; (2) students experiencing challenges in deep vocabulary learning; and (3) learners with more than six months of experience using MALL applications. Four participants (two female, two male) were selected to achieve gender balance while maintaining a manageable sample size appropriate for in-depth qualitative inquiry. As Kumar (2018) emphasizes, purposeful sampling prioritizes information richness over sample size, targeting participants who possess relevant experiences and can articulate meaningful insights regarding the research phenomenon.

Data collection utilized semi-structured interviews designed to elicit participants' perceptions of MALL's effectiveness for deep vocabulary learning. This method provided sufficient flexibility to explore emergent themes while maintaining focus on core research questions. Interview protocols (see Appendix) guided discussions covering participants' MALL experiences, perceived impacts on vocabulary depth and organization, and meta-cognitive awareness. Follow-up questions were adapted based on participant responses to enable deeper exploration of significant themes. Ethical protocols were strictly observed: participants provided informed consent, were assured of anonymity, and understood their right to withdraw at any time.

Data analysis was performed using NVivo, a qualitative data analysis software rooted in grounded theory which is widely used in the fields of education, sociology, and psychology. It is suitable for processing large amounts of data such as text, audio, and video, and supports researchers in pattern recognition, theme discovery, and theory construction. The use of NVivo can improve the accuracy and credibility of research and provide a scientific basis for theory building and practice in related fields.

The purpose of using NVivo is as follows: first, NVivo provides a convenient platform to help researchers sort, classify, and label the collected interview texts for better data management and organization. Second, NVivo's analytic tools can help researchers discover patterns, themes, and relationships in many interview texts. In addition, NVivo supports the coding and comparison of texts, which helps to construct theoretical frameworks and explain factors and influences in the transformation process. Finally, NVivo provides visualization tools, such as

hierarchical charts and word clouds, to visualize the analysis results. The following section details the data collected from the study and provides the subsequent analysis of the results.

4. Results and Findings

The analysis of interview data followed a systematic three-stage coding process grounded in established qualitative research principles. This iterative approach allowed for progressively deeper understanding of participants' perceptions and experiences with mobile-assisted vocabulary learning. The following subsections present the coding outcomes at each analytical stage, demonstrating how raw interview data was systematically transformed into meaningful conceptual categories that illuminate the research questions.

4.1 Coding results

The coding process began with open coding, which served as the foundation for subsequent analytical stages. This initial phase involved careful examination of interview transcripts to identify meaningful units of information and assign preliminary conceptual labels. Through this systematic process, patterns and themes gradually emerged from participants' narratives about their mobile vocabulary learning experiences. The open coding phase generated a comprehensive set of initial categories that captured the diverse aspects of participants' perspectives, as detailed below.

4.1.1 Open coding results

Open coding is a method of extracting useful information from raw data, which helps the researcher to better understand and analyze the data and categorize it. The coder needs to consider the possibilities thoroughly, read the textual context carefully, and analyze the raw information and its abstract concepts. In this study, four interviews were coded using NVivo 12.0 software during the open coding phase, and a total of 28 reference points were created and seven initial categories A1 to A7 were extracted, as shown in Table 1.

Figure 1 Summary of open code indicators

Coding	Conceptualizing nodes	Original text	Initial scope
a1	dictate and recite	In high school, the vocabulary required to be mastered by the courses we take has also increased dramatically, and most of the vocabulary is memorized by a combination of dictation and memorization.	A1: learning styles
a2	morphological memory	For example, use learning apps to access the roots and properties of words, as well as the origin stories of some words, so that situational memorization is beneficial to your own learning.	
a3	everyday language	Start with the simplest English vocabulary, which mostly relates to fruits, colors and simple greetings.	
a4	grammar learning	When we enter middle school, we learn English in depth and begin to learn basic grammar.	
a5	phonetic symbols learning	Teachers begin to teach English phonetic symbols in fourth grade.	

a6	APP pictures	I first started to use mobile apps to memorize words in high school during this period, and I started to use Bai Ci Zhan and Baidu Translator to learn, and Bai Ci Zhan has pictures to memorize very quickly.	A2: learning resources
a7	movie songs	I usually like to watch some movies and listen to some English songs to make the vocabulary more memorable in the melody.	
a8	apps search	It was also at this stage that I learned to use the vocabulary apps more frequently to look up vocabulary, and without realizing it, I developed the habit of actively learning new words.	
a9	massive resources	These mobile vocabulary learning apps include a wide range of common dictionary content you'd find in a bookstore, and it's easy to access different versions.	A3: advantages
a10	soundtracks	However, most of the mobile vocabulary learning apps come with example sentences and original voice readings, in which case it really does have the sound, shape and meaning.	
a11	content attraction	I think another great strength of mobile vocabulary learning apps is having more granular and engaging learning content.	
a12	audio sample sentence	Mobile vocabulary learning can be accompanied by listening practice, as most learning apps come with plenty of example sentences and audio on each.	
a13	self-testing	The next day, when you log in to study and review, you'll also find some self-testing features right there in the interface.	
a14	expanding vocabulary	To learn vocabulary in a mobile vocabulary learning program, I want to expand my vocabulary and have a long-term memory.	A4: purposefulness
a15	correcting pronunciation	I can correct my mispronunciations with the pronunciation feature.	
a16	inferring semantics	Hope to be able to infer the meaning of words according to the context and relate to the context.	
a17	grammatical collocations	Through the vocabulary learning apps, you can learn more useful words and phrases, master their usage and collocation.	
a18	scenarios	In this way, I can also improve my English proficiency and better cope with various English learning and application scenarios to realize effective communication.	
a19	speaking practice	The learning apps also focuses on oral communication, which is more conducive to the overall learning of a language.	
a20	look up words and solve meanings	It also supports the functions of each translation and correction, effectively helping to improve listening, reading and writing together.	A5: experience and feelings
a21	supervised punching	Just set a reminder in the app's settings, and it will supervise us to learn the words and improve our own initiative.	
a22	annotation support	It also supports the functions of translation and correction, effectively helping to improve listening, reading and writing at the same time.	
a23	regular memory consolidation	I will use the apps's regular review feature to review words and reinforce my memory.	A6: changes to learning
a24	improve memorization methods	Some learning programs also introduce a punch card function, which can help monitor yourself and form a habit.	
a25	formation of access habits	Whenever I come across a new word, I will want to check its meaning, thus forming the habit of checking for new words!	

a26	builds writing vocabulary	In terms of writing, the apps allow you to accumulate a lot of advanced vocabulary and agree on replacement phrases.	A7: skills improvement
a27	increase learning fun	Some of them are adapted from movie and TV drama works or the lyrics just increase the fun of memorization.	
a28	improve reading quality	Instead, you know how to read through reasonable speculation and in context, thus greatly improving the quality and experience of reading .	

4.1.2 Spindle coding results

Spindle-based coding is the second stage of the coding process. In order to better understand the initial categories obtained by open coding, their attribute characteristics and interrelationships need to be analyzed in depth and constantly compared and analyzed. By following certain logical relationships, the initial categories can be further categorized to form more abstract main categories. Finally, the main category of the second stage is given a name. The main axial coding process in this study formed seven main categories, B1 to B3, as shown in Table 2.

Table 2 Summary of spindle-type coding indicators

Spindle coding	No. of reference points	Open coding	No. of reference points
B1: English vocabulary learning experience	8	A1: learning styles	5
		A2: learning resources	3
B2: use of mobile applications	15	A3: strengths	5
		A4: purpose	7
		A5: experiences and feelings	3
B3: impact	6	A6: changes to learning	3
		A7: Skill improvement	3

4.1.3 Selective coding results

Selective coding is the final step in the coding process. By analyzing the core categories, it is possible to organically link the initial categories with the main categories and verify the relationship between them. Eventually, based on the core categories, a mutually supportive and interrelated logical relationship is formed, which provides a complete idea and connotation for in-depth research. Based on the interviews in this study, the main categories were analyzed and summarized, and a conceptual model was established to provide a theoretical foundation for the excavation of “the effectiveness of mobile-assisted language learning in Chinese undergraduates’ English vocabulary in-depth learning,” as shown in Table 3.

Table 3 Summary of selectively coded indicators

Selective coding	Spindle coding	Open coding
C: Effectiveness of MALL on Deep Learning of English Vocabulary among Chinese Undergraduates	B1: English vocabulary learning experience	A1: learning styles
		A2: learning resources
	B2: use of mobile applications	A3: strengths
		A4: purpose
		A5: experiences and feelings
	B3: impact	A6: changes to learning
		A7: Skill improvement

4.2 Thematic analysis

4.2.1 Analysis of B1: English vocabulary learning experience

In terms of learning methods, a combination of dictation and memorization is used in order to memorize vocabulary. This method can improve the memorization and understanding of words and help learners apply these words better. Next is root word memorization. Learners use learning apps to access the roots and properties of words, as well as the origin stories of some words, to help learn through contextualized memory. By knowing what words are made of and where they come from, words can be better understood and memorized. Living words are also emphasized at the B1 level, as one participant indicates,

"in the Middle School Basketball program the focus is on practical instruction, starting with the simplest English vocabulary (S1)".

These words are mainly related to fruits, colors and simple greetings. Through practical scenarios, learners can better master English vocabulary commonly used in daily life. Moreover, in China, grammar learning begins at the middle school level when English learning gradually deepens, and learners begin to learn the basics of grammar. Hence,

"mastering the rules of grammar is very important for expressing and understanding English sentences correctly (S3)".

In addition, the following learning resources can be utilized at B1 level. The first one is app pictures. In the high school stage, participants begin to use cell phone app for word memorization. The first ones used are Bai Ci Zhan and Baidu Translate. The picture hints of Bai Ci Zhan help to memorize quickly, as one participant (S2) suggests,

"by looking at pictures to memorize words, you can understand and remember the meaning of words more vividly".

Next is multimedia resources such as movies and songs. By watching movies and listening to songs, it is beneficial for learners to improve their vocabulary by size. However, when it comes to depth of vocabulary knowledge, participants struggle to the actual use of vocabulary.

"Usually, I like to watch some movies and listen to some English songs. The melodies in movies and songs make the vocabulary easier to remember. But I honestly don't know how to use it. When I see it in different contexts, I get confused (S3)."

In summary, vocabulary learning at the B1 level can be enhanced by integrating multiple strategies. These include dictation, recitation, root memorization, learning life phrases and grammar, as well as utilizing multimedia resources such as pictures, movies, songs, and in-app query functions.

4.2.2 Analysis of B2: use of mobile applications

The vocabulary learning apps for mobile is widely organized, including common dictionary contents, which makes it convenient for users to access different versions of dictionaries, thus enjoying a huge number of resources. In this way, users can access more learning materials and enhance their learning effect. In addition, most of the mobile vocabulary learning apps are equipped with example sentences and original voice reading, so that users can really realize the learning effect of sound, shape and meaning. By hearing and imitating the standard pro-

nunciation, users can better master the correct pronunciation and usage of vocabulary. At the same time, the mobile vocabulary learning apps are equipped with more detailed and attractive learning content, which can attract users' attention. As stated,

"the rich graphic, audio and video materials, as well as interactive learning methods, make my learning process more vivid and interesting (S4)."

However, participants also reported difficulty sustaining such attention. As another participant noted,

"I sometimes lose interest too because it is always like this, and I don't think it's fun anymore (S2)".

At the same time, some mobile vocabulary learning apps also provide self-testing function, which allows users to review and test after learning.

"Through self-testing, I can know my learning errors in time and correct and consolidate them (S2)."

This indicates that built-in assessment tools can enhance students' metacognitive awareness regarding vocabulary learning by encouraging them to plan, monitor, and evaluate their progress. Another learning experience with the use of apps lies in that learners aim to expand their vocabulary size. Through systematic learning and practice, it is possible that learners gradually accumulate and firmly grasp more words and phrases. Meanwhile, with the pronunciation function of the mobile apps, students can correct their wrong pronunciation and improve their speaking ability and pronunciation accuracy. In addition, users want to infer the meaning of words through the context and deepen their understanding of the context, which facilitates the in-depth understanding of vocabulary, as noted by one participant,

"example sentences, and contextual situations are often provided in mobile apps to help me better understand the meaning and usage of vocabulary (S1)."

Through mobile vocabulary learning apps, users can learn more practical words and phrases, master their usage and collocations, so as to improve their language skills and avoid grammatical errors and improper collocations.

In addition, with mobile apps, learners can improve their English-speaking proficiency, better cope with various English learning and application scenarios, and realize effective communication. Whether in daily life, work or travel, students can flexibly use the vocabulary and expressions they have learned. Some learning apps also focus on oral communication, which is conducive to the overall learning of a language. Through simulated conversations, speaking practice and other functions, users can improve their fluency and self-confidence. The mobile apps also support various functions of translation and correction, effectively helping users to improve their listening, reading and writing skills. Users can always look up the interpretation and usage of raw words in the learning process to improve their vocabulary comprehension and application skills.

In addition, the reminder function in some apps supervises students to study vocabulary and improve their learning initiative. By setting the study plan and punch card function, users can better manage their study time and maintain their motivation. At the same time, the mobile apps also support various translation and correction functions, so that users can make annota-

tions, notes and exercises during the learning process to deepen their understanding and memory of the learning content. To summarize, the advantages and purposes of mobile vocabulary learning apps as well as users' feelings and experiences make mobile apps a powerful tool for learning vocabulary.

4.2.3 Analysis of B3: impact

There are multiple impacts that can be brought about by utilizing learning apps in learning. The first is learning transformation,

"with the help of apps, I can change the way and method of my learning. For example, through the function of regular consolidation of memory, I can utilize the apps to review words and thus consolidate memory (S3)."

In addition, some learning apps also introduce the punch card function, which can help monitor themselves and develop study habits. This also suggests that learning with mobile apps is conducive in developing students' meta-cognition.

Learning apps can not only have an impact on memorization and access habits, but also improve other learning skills. For example, in writing practice where advanced academic words and synonymous phrases are in need, learning apps can be used to accumulate these certain words and enrich writing process. Moreover, in terms of reading, with the help of apps students can not only understand the surface meaning of the text, but also read it through reasonable speculation and contextualization, thus improving the quality and experience of reading. However, some participants also reported doubts whether this effect can be long-term, as S4 claimed,

"I can feel my reading and speaking ability have improved, but I don't know if this can continue because I tend to forget these words as time goes by".

5. Discussion

This study investigated Chinese undergraduate English majors' perceptions of MALL's effectiveness in facilitating deep vocabulary learning. The findings reveal a nuanced picture that extends beyond simple affirmation of mobile technologies' utility, illuminating both the transformative potential and inherent limitations of MALL for supporting meaningful vocabulary development.

5.1 Contribution of MALL to vocabulary breadth and depth

The participants' experiences confirm that MALL applications effectively expand vocabulary breadth, aligning with meta-analytic findings by Teymouri (2024) and Boroughani et al. (2024) demonstrating superior vocabulary gains through mobile-assisted learning compared to traditional methods. However, the current study's more significant contribution lies in revealing how learners perceive MALL's capacity—or incapacity—to support vocabulary depth. Participants reported that while apps like Bai Ci Zhan and Shan Bei facilitate rapid word recognition and a grasp of basic definitions, they struggle to develop nuanced understanding of collocations, pragmatic constraints, and semantic networks that characterize deep vocabulary knowledge (Nation, 2013).

This finding resonates with Zhang et al.'s (2024) observation that Chinese EFL learners consulting mobile dictionaries predominantly focus on first-definition meanings and basic trans-

lations, neglecting the multidimensional aspects of word knowledge essential for productive language use. The pattern suggests a troubling disconnect: mobile technologies excel at delivering decontextualized information efficiently, yet this very efficiency may inadvertently reinforce surface-level engagement. As Li (2024) noted in analyzing Chinese vocabulary learning apps, many applications prioritize spaced repetition algorithms for memorization over contextualized practice and semantic integration—design choices that optimize breadth at the potential expense of depth.

Importantly, participants identified specific app features that either supported or hindered deep learning. Gamification elements, while motivating initial engagement (Shen et al., 2024), were perceived as sometimes trivializing vocabulary learning by reducing it to points and streaks rather than meaningful language acquisition. Conversely, features providing rich contextual examples, collocational information, and opportunities for productive practice were valued but reportedly underutilized due to time pressures and the apps' emphasis on rapid completion. This tension between convenience and depth emerged as a central theme, suggesting that MALL's affordances for ubiquitous, bite-sized learning may paradoxically constrain the sustained engagement necessary for developing robust vocabulary knowledge.

5.2 Self-regulation, motivation, and sustained engagement

The findings illuminate complex relationships among learner autonomy, motivation, and MALL effectiveness. Consistent with Han and Chen's (2024) research on Chinese EFL learners' acceptance of MALL applications, participants reported high initial motivation driven by perceived usefulness and ease of use. However, sustained engagement proved challenging, with participants describing cycles of intensive app use followed by abandonment—a pattern suggesting that MALL's motivational affordances may be more effective for initiation than maintenance.

This observation connects to broader questions about self-regulated learning in mobile contexts. Boroughani et al. (2023) found that mobile-assisted academic vocabulary learning enhanced university students' self-regulatory capacity when appropriately designed. The present study suggests that such benefits are not automatic but depend on apps incorporating metacognitive scaffolding, goal-setting mechanisms, and progress visualization that support learners in planning, monitoring, and evaluating their vocabulary development. Participants who demonstrated greatest satisfaction with MALL outcomes were those who had developed personal strategies for integrating app-based learning with other vocabulary acquisition activities—suggesting that MALL functions most effectively as one component within a broader, self-regulated learning ecology rather than as a standalone solution.

The motivational dimension also revealed tensions between extrinsic and intrinsic drivers. Drawing on Self-Determination Theory (Deci & Ryan, 1985), Chen and Zhao's (2022) research indicates that perceived autonomy, competence, and relatedness significantly predict mobile learning adoption. While MALL technologies inherently support autonomy through personalized, self-paced learning, participants in the current study reported that gamification and social comparison features sometimes undermined intrinsic motivation by shifting focus from meaningful language development to superficial achievement metrics. This finding suggests that MALL designers should carefully balance engagement mechanisms with authentic learning purposes to cultivate sustainable, internally motivated vocabulary development.

5.3 Bridging MALL and communicative competence

A recurring theme in participants' accounts was the perceived gap between app-based vocabulary knowledge and real-world language use. While participants acknowledged vocabulary expansion through MALL, some expressed uncertainty about whether this knowledge translated into improved speaking, writing, and comprehension abilities. This disconnect aligns with Lu et al.'s (2023) finding that while Chinese EFL learners achieved substantial vocabulary gains through theory-based mobile apps (129.65% increase), questions remain about the durability and transferability of such knowledge.

The issue may partially stem from the predominantly receptive nature of most vocabulary app activities. Although research demonstrates MALL's positive effects on productive skills when appropriately designed (Xodabande et al., 2023), many popular applications emphasize recognition and recall over generation and application. Participants specifically noted wanting more opportunities for contextualized production, collocational practice, and integration of vocabulary into meaningful communication tasks—features that remain underrepresented in current MALL offerings.

This finding has significant implications for understanding vocabulary depth. Following Aitchison's (2012) framework, knowing a word involves not merely recognizing its form-meaning mapping but understanding its morphological properties, collocational patterns, register constraints, and pragmatic appropriateness—knowledge best developed through varied, contextualized encounters and productive practice. The current study suggests that MALL, in its present instantiation, more effectively supports what might be termed "shallow breadth" (recognition of many words at a basic level) than genuine depth (rich, multidimensional knowledge of fewer words). Addressing this limitation will require moving beyond flashcard-based paradigms toward more sophisticated pedagogical designs that integrate vocabulary learning with authentic language use.

6. Conclusion

This study adopts a purely qualitative research design, in which four participants were invited to discuss their perception of the effectiveness of MALL on deep learning of English vocabulary. With a thorough coding process through NVivo, it is clear that MALL, especially vocabulary apps play a significant role in Chinese undergraduate's deep learning of English vocabulary. This study reveals that MALL represents a powerful yet incomplete solution for vocabulary development among Chinese undergraduate English majors. While mobile technologies effectively expand vocabulary breadth and leverage ubiquitous learning opportunities, they currently struggle to support the deep processing, semantic organization, and communicative application essential for meaningful vocabulary acquisition. The findings underscore that technology alone cannot resolve fundamental pedagogical challenges: effective MALL requires theoretically grounded designs that align technological affordances with cognitive principles of vocabulary learning, metacognitive strategies for self-regulation, and authentic opportunities for language use. As MALL continues evolving, the field must move beyond celebration of accessibility and convenience toward critical examination of how mobile technologies can genuinely transform rather than merely supplement vocabulary learning. Only by directly addressing the depth imperative can MALL fulfill its promise as a catalyst for meaningful, sustainable language development.

Several limitations of this study should not be overlooked. Firstly, when investigating the

possibility of using mobile apps in vocabulary learning, only existing apps such as Shan Bei, Bai Ci Zhan and Not memorizing words are included. However, as popular vocabulary apps in China, studies must have been conducted from different angles. To increase the novelty of the study, it is recommended that the researcher design, develop a new app and implement it to teaching and learning practice. Secondly, the sample size of this study is somewhat small, therefore it lacks richness and diversity pertaining to the attitudes towards and perceptions of the impact of MALL. It is suggested that future studies combine a quasi-experimental design and in-depth interview with more participants, the former to test the effectiveness from a quantitative perspective, the latter to gain a broader view of learner's experience and perceptions.

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Ethics Statement

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