Effectiveness of Using Mobile Dictionary App to Enhance Vocabulary Knowledge of EFL Learners with Different Level of Motivation

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Abstract
Vocabulary knowledge is crucial for learners of English as a Foreign Language (EFL), yet mastering it presents significant challenges. Understanding how to effectively enhance vocabulary acquisition is essential due to its fundamental role in language proficiency. While numerous studies have demonstrated the efficacy of mobile learning for enhancing both receptive vocabulary knowledge (RVK) and productive vocabulary knowledge (PVK), there is a lack of research investigating the relationship between vocabulary acquisition in receptive and productive and learner motivation within a mobile learning context. The current research aims to investigate the effect of using a mobile dictionary app on English vocabulary learning among undergraduates with varying levels of motivation. This study employed a quasi-experimental design with a pretest and posttest. One freshman class, consisting of 32 participants, was involved in the study. The Intrinsic/Extrinsic Motivation Scale of English Learning (I/EMSEL) and Core English Vocabulary (CEV) Test were used as instruments for data collection. Participants were divided into three groups based on their motivational levels: high, medium, and low. The learning effects of these groups were measured using pre-test and post-test assessments during a 12-week intervention. Data analysis was conducted using paired sample T-tests and one-way ANOVA. The results indicated that the mobile dictionary app effectively promotes vocabulary knowledge acquisition in both receptive vocabulary knowledge (RVK) and productive vocabulary knowledge (PVK) across different motivational levels. However, students with high motivation showed significantly greater improvements compared to those with medium and low motivation. These findings suggest that mobile learning tools are more effective for vocabulary acquisition in highly motivated students. Educators should focus on enhancing learner motivation to maximize the benefits of these tools. Future research should explore how motivation influences vocabulary learning and identify other factors that impact the effectiveness of mobile learning.

Introduction

Vocabulary, a fundamental building block of language, plays a critical role in human communication. It allows us to express, share, and understand thoughts and ideas. This is especially true for learners of English as a Foreign Language (EFL), particularly at the university level where academic success hinges on effective communication (Lasagabaster, 2011). However, limited exposure due to time constraints, both inside and outside the classroom, can make vocabulary acquisition a significant challenge (Elmahdi & Hezam, 2020; Nagy & Townsend, 2012). In response, teachers and students are increasingly seeking effective alternatives to traditional vocabulary learning methods.

The Role of Vocabulary in EFL Learning

Vocabulary plays a crucial role in English as a Foreign Language (EFL) learning, serving as the foundation for developing proficiency in reading, writing, listening, and speaking (Nurmanova & Komiljonova, 2024; Karakoç & Köse, 2017;). A robust vocabulary facilitates comprehension and communication, enabling learners to express themselves more precisely and understand others more effectively. Research indicates that vocabulary knowledge is a strong predictor of overall language proficiency, as it directly influences the ability to grasp complex texts and engage in sophisticated conversations (Schmitt, 2014; Pulido, 2007). Furthermore, vocabulary acquisition is intertwined with the learning of grammatical structures and idiomatic expressions, enhancing learners' ability to navigate various contexts and cultural nuances (Tavakoli, 2013). Effective vocabulary teaching and learning, therefore, should integrate both explicit leaning of word meanings and contextualized exposure through reading and listening activities. By prioritizing vocabulary development, EFL instructors and researchers can significantly enhance learners' language acquisition process, ultimately leading to greater confidence and competence in English.

Vocabullary Learning in MALL

The proliferation of mobile technology has revolutionized the field of education, particularly in language learning. Mobile applications (apps) have become ubiquitous tools for learners aiming to enhance their vocabulary knowledge in English as a Foreign Language (EFL) contexts (Lin & Lin, 2019; Klimova, & Polakova, 2020). These apps offer a range of interactive and engaging features that cater to various learning styles and preferences(Falloon, 2013; Drigas, & Angelidakis,2017). For example, mobile dictionary applications offer a dynamic and personalized learning experience that can significantly enhance EFL vocabulary acquisition (Lin, & Lin, 2019). Mobile-assisted language learning (MALL) has become increasingly popular in Chinese universities due to its practical applications. Mobile technologies are revolutionizing how students learn languages. They allow for "ongoing learning, in various settings, at an individual's pace, and adapted to their needs" (Bernacki & Greene, 2021). This flexibility breaks down the boundaries between formal classroom learning and informal practice. Additionally, mobile technology fosters interaction and allows learners to use language for everyday communication and cultural exploration (Kukulska-Hulme & Viberg, 2018; Chun et al., 2016). Studies have shown that mobile devices are particularly beneficial for setting personalized learning goals, organizing study materials, and customizing learning approaches.

Problem Statement

Implementing technology for vocabulary development might be more effective outside the classroom. Traditional classroom settings can be resistant to integrating new technologies into established curriculums (Lai & Gu, 2011). This is where MALL shines. Its unique feature is the ability to extend learning beyond the classroom, anytime and anywhere. Complementing classroom instruction with mobile-assisted activities empowers students to become more autonomous and self-directed learners – a valuable skill in any educational setting (Xodabande et al., 2022). However, the effectiveness of mobile apps might be influenced by the learners' level of motivation. According to Li (2021, p.10), "Students' learning motivation had a positive impact on vocabulary learning achievement, while learning motivation did not predict learning achievement.". In other words, vocabulary learning outcomes may vary from different level of motivation. However, there is few research related with different level of motivation, although some researchers have focused on the effects of mobile learning on autonomy, learning efficacy and motivation (Ciampa, 2014; Nikou & Economides, 2018). This study aims to contribute to the field by comparing different motivational groups on both receptive and productive aspects of vocabulary knowledge of non-English majors as EFL learners in private universities in China. The researcher specifically assessed how well learners retain word meanings and their ability to recall word collocations with different level of motivation groups, focusing on how different levels of motivation influence this process. Therefore, the research questions are as follow:

RQ1: What are the effects of mobile dictionary app on vocabulary knowledge among EFL learners of different levels of motivation?

RQ2: Is there any significant difference among three motivation groups after using mobile dictionary app?

Literature Review

Mobile Apps in EFL Vocabulary Learning

Mobile apps designed for vocabulary learning leverage various multimedia elements, gamification techniques, and adaptive learning algorithms to create an immersive learning environment (Usmonaliyeva, 2024). These apps offer several advantages over traditional methods: a)Accessibility and Convenience: Mobile apps enable learners to access vocabulary lessons anytime and anywhere, facilitating continuous learning. b) Interactivity: Features such as quizzes, flashcards, and interactive games make learning more engaging and enjoyable. c) Personalization: Many apps use artificial intelligence to tailor content to individual learners' proficiency levels and learning pace. d)Immediate Feedback: Instant feedback helps learners identify their strengths and weaknesses, promoting effective learning (Tu et al., 2020).

Despite the numerous advantages, there are also challenges and considerations in the use of mobile apps for vocabulary learning in EFL contexts. One significant challenge is the potential for distraction (Tu et al., 2020; Scheiter et al., 2014). The same device that hosts educational apps also provides access to social media, games, and other entertainment, which can divert learners' attention (Kukulska-Hulme, 2012). Another consideration is the quality of the content. Not all vocabulary apps are created equal; some may lack pedagogical soundness or contain errors (Palshkov et al., 2024). Therefore, it is essential for educators to carefully select apps that are well-designed and evidence-based (Steel, 2012). Furthermore, while mobile apps can support vocabulary learning, they should not be seen as a replacement for traditional methods but rather as a complementary tool. Interaction with native speakers, exposure to authentic language contexts, and structured classroom instruction remain vital

components of effective language learning (Reinders & Hubbard, 2013). Therefore, exploring the long-term impact of mobile app usage on vocabulary acquisition and retention with different level of motivation is necessary with more advanced and personalized learning experiences in self-directed way.

Motivation in EFL Learning

Motivation is a crucial factor in language learning, influencing learners' engagement, effort, and persistence (Lasagabaster, 2011). It can be broadly categorized into two types: a) Intrinsic Motivation: Driven by internal factors, such as personal interest, enjoyment, and a desire for self-improvement. b) Extrinsic Motivation: Influenced by external factors, such as grades, rewards, or pressure from others (Deci & Ryan, 1985).

Understanding the role of motivation is essential for designing effective language learning interventions. Highly motivated learners are more likely to engage deeply with language learning activities, persist through challenges, and achieve better outcomes (Dörnyei,1998). Highly motivated learners are more likely to actively use the app, utilize its features effectively, and consistently practice vocabulary learning. Studies suggest a potential interaction between motivation and app effectiveness (Li, et al., 2018). Learners with high motivation might benefit more from mobile apps compared to those with lower motivation (Ciampa, 2014; Al-Said, 2023). The novelty and interactivity of the app might initially appeal to all learners. However, sustained engagement over time might depend on the individual's intrinsic motivation to learn.

The Intersection of Mobile Dictionary Apps and Motivation

The integration of mobile technology into language learning has provided new avenues for enhancing learner motivation, particularly through mobile dictionary apps. Motivation plays a critical role in the success of language learning (Oxford & Shearin, 1994). The use of mobile dictionary apps has been shown to positively influence learner motivation by offering immediate, convenient access to language resources. According to Stockwell (2010), mobile dictionary apps allow learners to look up words instantly, facilitating real-time learning and reducing frustration associated with not understanding new vocabulary (Wardak, 2020). This immediacy helps maintain learners' engagement and encourages continued use of the language.

Firstly, mobile dictionary apps enhance intrinsic motivation by making the learning process more enjoyable and self-directed (Lai et al., 2022). Learners can explore new words and phrases at their own pace, catering to their individual interests and curiosity. A study by Chen and Chung (2008) found that the interactive and user-friendly nature of mobile dictionary apps significantly increased learners' intrinsic motivation, as they enjoyed the autonomy and personalization these apps provided (as seen in Zou, et al., 2018). Secondly, the gamification elements often incorporated into mobile dictionary apps, such as rewards for regular use and progress tracking, boost extrinsic motivation. Learners are motivated by the sense of achievement and recognition these features offer. Wang and Smith (2013) reported that learners who used gamified mobile dictionary apps demonstrated higher levels of extrinsic motivation, as they were driven by the external incentives and structured goals (as seen in Chen et al., 2023).

Therefore, learners who are motivated are more likely to engage in regular practice and exposure to new words, which is essential for language learning. Research by Duman et al (2015) indicates that motivated learners using mobile dictionary apps showed significant

improvements in their vocabulary knowledge compared to those using traditional paper dictionaries or less interactive digital resources.

Multimodal Discourse Theory

"Multimodal Discourse" refers to the phenomenon of communication through various sensory modalities, such as auditory, visual, and tactile, using resources like language, images, sounds, and gestures (O'Halloran, 2011; Bateman & Wildfeuer, 2014). This theory challenges the traditional view that language dominates communication, asserting that images, sounds, colors, and actions are equal to language symbols in social interaction and meaning construction. Halliday (1978) proposed that language is a social semiotic system, a concept he extended to include all social symbols. He views language as a meaning-making system within this framework. Multimodal discourse theory, based on systemic functional linguistics, studies the grammatical frameworks of these semiotic systems and their collaborative roles in meaning expression (Bateman & Wildfeuer, 2014).

The introduction of Multimodal Discourse Theory to lexicographical studies has shifted the perspective on dictionaries, considering them not just as texts but also as subjects for study and enhancement through this theory. "Multimodal lexicography," a relatively new field first proposed by Lew in his 2010 paper "Multimodal Lexicography: The Representation of Meaning in Electronic Dictionaries," treats micro-level information in dictionaries as discourse. This approach incorporates various modalities—such as visual, auditory, and tactile elements—into lexicography. As a result, it improves the communicative function of dictionaries, more effectively conveys the lexicographer's intent, and makes dictionaries more user-friendly.

In the preface to the 8th edition of the "Oxford Advanced Learner's English-Chinese Dictionary," Hu highlighted that multimodal dictionaries utilize multiple symbols and multimodal technology (Gouws & Prinsloo, 2021). These dictionaries combine text, images, sounds, and colors, engaging the visual, auditory, and tactile senses. This comprehensive integration enhances the interaction and communication between learners and dictionaries, ultimately boosting communicative and learning efficiency.

Methodology
Participants

The study's population consists of non-English majors attending private universities in Shaanxi province, located in northwest China. In 2024, Shaanxi Province has a total of 18 private colleges and universities, excluding independent colleges. Samples were taken from University A, one of the top five private universities in China and ranked first in Shaanxi province. Therefore, university A students are considered representative of private universities in Shaanxi Province. One out of thirty-three classes was randomly selected, with the sample comprising 30 students divided into three groups based on high, middle, and low motivation levels. The sample size details are provided in Table 1 below:

Table 1
Sample Distribution

Groups	Motivational level	No. of Students
1	High	10
2	Medium	10
3	Low	10
	Total	30

Target Words
The core vocabulary in CET 4 refers to a list of approximately 4,000 words considered essential for understanding academic texts commonly encountered at the college level and functioning effectively in English-speaking academic environment (Wu, 2014). As for target words in current study, the researcher chose 120 content words including 30 nouns, 30 adjectives, 30 verbs and 30 adverbials from 739 high frequency core wordlist, which are extracted from past paper in CET 4.

Despite the fact that the requirements and standards for English courses for university graduates have not been stringent in recent years, universities still expect their teachers to assist students in passing the College English Test Band 4 (CET4) and/or the College English Test Band 6 (CET6), which take place twice a year(June and Dec.) for all Chinese EFL college or university students and administrated by Ministry of Education in China, testing their English listening, reading, writing and translating capability wherever they are in private or public ones. Therefore, if students can learn how to study vocabulary on their own, rather than relying on their teachers, they take control of their learning process. This study aims to investigate the relationship between mobile dictionary app and motivation, and further to identify a personalized and practical method to assist students in independently learning vocabulary.

Research Design
The current study employs a quasi-experimental design with pre- and post-tests. This quantitative research clearly illustrates the effects of mobile vocabulary learning on the vocabulary knowledge of students with high, medium, and low motivation levels. The study's measurements and analysis focused on understanding the impact of a mobile vocabulary app on both receptive and productive vocabulary knowledge among non-English majors in a private university, considering different motivational levels.

Table 2
Research Design

Motivation Groups	Pre-test	Intervention	Post-test
High	O1	X	O2
Medium	O3	X	O4
Low	O5	X	O6

Instruments
The current study utilized the Intrinsic/Extrinsic Motivation Scale of English Learning questionnaires along with English vocabulary pre- and post-tests to conduct the research.

Intrinsic /Extrinsic Motivation Questionnaire

The Intrinsic/Extrinsic Motivation Scale of English Learning (I/EMSEL), developed by Wang Fengxia (2008) within a specific Chinese context, consists of 24 items rated on a five-point Likert scale. This scale was employed to investigate the relationship between intrinsic motivation, extrinsic motivation, and English achievement. The I/EMSEL scale was administered to two samples of first-year non-English majors. Factor analysis of the results revealed a multidimensional construct comprising motivation for knowledge, motivation for challenge, internal fulfillment regulation, and external utility regulation, which together explained 53.3% of the variance. Pearson correlations and multiple regressions were then conducted between different types of motivation and English achievement. After eliminating confusing items, the reliability of the I/EMSEL, measured by Cronbach's alpha, was .80 (Wang, 2008, p. 638). The results indicated that autonomous extrinsic motivation positively correlated with intrinsic motivation and achievement, while controlled extrinsic motivation negatively correlated with them. The researcher received approval to use this questionnaire to study Chinese private university students, confirming its intelligibility and applicability.

In the current study, based on the specific context of A university, questions Q4, Q5, Q14, Q16, Q17, and Q20 were modified, and questions Q25 and Q26 were added following a pilot study. This revised questionnaire was then administered to 32 first-year non-English majors at A University (see Appendix A). Respondents rated their agreement with each statement using a scale of 1 = strongly disagree, 2 = disagree, 3 = neutral, 4 = agree, and 5 = strongly agree. Although Smith et al (2008) reported the instrument's reliability and validity, this research needs to reestablish these metrics due to the modifications and additions made.

Vocabulary pre-test and post-test

The researcher reviewed the vocabulary test format in receptive and productive with mobile leaning apps in CNKI scholar from 2006 to 2022 in China, and framed as below Table 2.

Table 3

Format of Vocabulary Assessment in RVK &PVK

No.	Researcehrs (Year)	Types of vocabulary learning	Vocabulary Knowledge	
			Receptive	Productive
1	Wang, (2017)	Baicizhan app vs traditional approach	1.Multiple choice 2. Matching with the right definition	Filling-in-the-gap with the given letter
2	Guo, (2022)	Baicizhan app vs traditional approach	1.Word dictation 3.Multiple choice	Translation (L2 to L1)
3	Wu, (2017)	Baicizhan app vs traditional approach	Multiple choice	Filling-in-the-blanks
4	Li, (2021)	Baicizhan app vs traditional approach	1.Word dictation 2.Translation test	1.Filling-in-the-blanks 2.Word Formation
5	Hu, (2019)	Baicizhan app vs traditional approach	-	1.Sentence completion with grammar knowledge; 2.Writing; 3.Filling-in-the-blanks; 4.Collocation Test;
6	Chen(2008)	Dictionary	Multiple choice	Filling-in-the-blanks
7	Miller(2006)	Dictionary	-	Sentence completion(close format)
8	Lu(2014)	Dictionary	Matching with the right definition	Sentence Completion

From the Table 2 above, it can be seen that three formats, namely word dictation tasks and multiple choices are used to test receptive vocabulary knowledge. For productive vocabulary knowledge, A definition competition test (Read, 1995), Writing, Close, vocabulary depth test Read (1995) and Filling-in-the-blanks are used. Analyzing the format of the tests from the previous studies, it has been decided that multiple choices and Filling-in-the-blanks are to be employed in the present study. The former measures students' receptive vocabulary knowledge Waring (1998), while the latter measures students' productive vocabulary knowledge Waring (1998) since it tested words in context that had a cuing effect on recall (Kuen, 2004; Watanabe, 1997). Moreover, Filling-in-the-blanks is employed to help students in the engagement of deep processing Folse (2004a), while multiple choices are amenable to analysis (O'Dwyer, 2010).

Table 4
Samples of Vocabulary Knowledge Tests in Current Study

Section A RVK	Section B PVK
I.Multiple Choice (1*10=10 points) Example: 1.I don't like this woollen trouser because it tickles. a) soothes b) shrinks c) itches d) shines 2.The sheep were grazing on the lush green pastures a) land b) province c) forest d) area	**I. Filling in the blanks with proper forms (Grammer) (1*10=10 points)** Example: 1. There is a growing _____ among employers to hire casual staff. (tendency) 2. And what is _____ than this event is that she lost her eyes. (more surprising)
II.Word parts test (Affixes)(1*10=10 points) Example: 1. dis- (disappear; disorder) (1) not (2) person (3) new (4) main 2. -able (acceptable; predictable) (1) person (2) not (3) can (4) one	II. Filling in the blanks with proper preposition 1.To my surprise, he refused to cooperate_____ us! (to work together) 2.The boss remind _____us

Distracters or fillers are added in the multiple choices so as to minimize students' reliance on guessing (Folse, 2006). In the multiple-choice questions, four alternative answers are given to students. Osterkind (2002) argues that a great number of response alternatives – four and five – increases the reliability of the test items. Meanwhile, in the fill-in-the-blanks questions, distracters are initiated to reduce the chance of getting the answers correct by simply filling in words for the questions asked (Kuen, 2004). In essence, all tests in the current study have distracters there are three in the multiple-choice questions.

Apart from that, to ensure that the target words are used appropriately in the context of the sentences for all the tests, the sentences are not formed arbitrarily but taken and adapted from various dictionaries such as *Youdao Dictionary, Collins Dictionary, Compendious Dictionary, Oxford Dictionary, Bing Dictionary.* Corpora. Several example sentences from

Baicizhan and *Youdao Dictionary* may also be taken and used to test them. Hence, sentences in the tests accurately reflect how the target words are used in authentic situations.

To evaluate students' vocabulary proficiency, a pre-test and post-test using the Core English Vocabulary (CEV) test in digital format were conducted at orientation and at the study's conclusion, respectively. Both tests contained identical content. Three question types were selected to assess the progress of vocabulary knowledge, divided into two sections to measure both receptive and productive aspects. Data analysis was performed using SPSS 25.0.

Procedures

The researcher divided 30 participants into three groups based on their motivation level (high, medium, low). Firstly, pre-test (a vocabulary knowledge test)was administered to to all participants before any intervention. Then, instructor introduce the mobile dictionary app and provide instructions on its vocabulary learning features. Three motivation groups used the mobile dictionary app for12 weeks to learn vocabulary. Lastly, post-test(the same vocabulary knowledge test) was administered to three motivation groups after the intervention period.

Data Collection and Analysis

The original Intrinsic/Extrinsic Motivation Scale of English Learning (I/EMSEL) questionnaire was written in English and it was translated into Chinese to fit the subjects of this study. It was scattered to randomly sampled 32 freshmen, and collected through Questionnaire Star online. After data screening in SPSS 25.0, two data set (No.30 and No.32) were excluded because of unengaged cases (≤.4). Through a dimension reduction process and ascending sort, the subjects were categorized into high, medium and low motivation groups. The low motivation group (M=2.35-3.08) consisted of the first 10 participants, including participants numbered 10, 7, 9, 15, 31, 4, 6, 29, 3, and 17. The high motivation group (M=3.58-4.00) consisted of the last 10 participants, including participants numbered 23, 27, 26, 21, 28, 16, 24, 12, 13, and 14. The remaining participants formed the medium motivation group(M=3.27-3.50). Thirdly, pre-test was carried to three motivational groups in second week. The scores of three groups for pre-test in Core English Vocabulary (CVR) collection were put into excel form and imported into SPSS 25.0 for statistical analysis. After a 12-week learning, post-tests were carried to the groups separately at the end the term.

A Pre-test/Post-test Design with Within-Subjects Analysis was used to assess the significant differences in Core English Vocabulary (CEV) results among the three motivation groups. First, the pre-test and post-test scores within each group were analyzed to see how vocabulary knowledge changed for each group. The study focused on individual improvement within each motivation group and tried to find whether there is a significant difference within and among three groups after 12 weeks learning.

Results
(I/EMSEL) Questionnaires
Reliability Analysis
The reliability of the (I/EMSEL) questionnaire, which includes dimensions of internal motivation (Q1, Q2, Q3, Q4, Q5, Q6, Q7, Q9, Q10, Q11, Q12, Q17) and external motivation (Q8, Q13, Q14, Q15, Q16, Q18, Q19, Q20, Q21, Q22, Q23, Q24, Q25, Q26), is detailed in the Appendix. Reliability refers to the stability and consistency of scores obtained from an

instrument (Creswell, 2012). The Cronbach's Alpha coefficient for the adapted (I/EMSEL) Questionnaires used in this study was α = .825 (see Table 4). This value falls within the range of .8 to .9, indicating good reliability for the entire questionnaire.

Table 5
Reliability Test

Dimension	Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	Items
Internal Dimension	.831	.833	12
External Dimension	.774	.777	14
Total Dimension	.822	.825	26

The reliability of the entire motivation questionnaire, comprising 26 items, is presented in Table 4. The Cronbach's Alpha coefficient for the adapted (I/EMSEL) Questionnaires used in this study was α = .822, falling within the range of .8 to .9, which indicates good reliability. Specifically, for the internal motivational dimension, which includes 12 items, the Cronbach's Alpha was α = .831. For the external motivational dimension, comprising 14 items, the Cronbach's Alpha was .774, falling within the acceptable range of .7 to .8.

Validity Analysis

Because the reliability of the (I/EMSEL) Questionnaires a=.822>.7, its validity can be carried out after that. Validity includes content validity, facial validity and structure validity. New additional two items (Q25, Q26) were confirmed by two experts in linguistics in B university in Shannxi Province.

For conducting an analysis of structural validity, the KMO (Kaiser-Meyer-Olkin) and Bartlett's test are used to assess the questionnaire. The KMO value is used to evaluate the adequacy of the selected variables in factor analysis, examining the correlation among variables. The criteria for judging the KMO value are as follows: >0.9, very suitable; 0.8-0.9, suitable; 0.6-0.8, adequate; <0.6, unsuitable. Generally, a KMO value greater than 0.6 is required for factor analysis. Bartlett's test is to examine whether the variables are independent and to determine the correlation among factors. If the model is significant (with a corresponding p-value less than 0.05), it indicates that factor analysis is appropriate. The results of structure validity are as follow:

Table 6
Results of KMO and Bartlett's Test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.661
Bartlett''s Test of Sphericity	Approx. Chi-Square	161.654
	df	66
	Sig.	.000

In Table 5, KMO=.661, Sig.=.000, that means the (I/EMSEL) Questionnaires have an appropriate structure validity.

An eigenvalue is the rate of change of a square matrix under linear transformation, indicating the contribution of each factor before factor rotation. The sum of these values matches the number of items. The larger the eigenvalue, the greater the contribution of the factor. Generally, the Eigenvalue which is lager than 1 was chosen. The variance explained rate is primarily used to determine the appropriate number of factors to extract, as well as to assess

the variance explained rate of each factor and the cumulative variance explained rate. The larger the variance explained rate, the more information from the original data the factor contains.

Table 7
Total Variance Explained

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	4.569	38.076	38.076	4.569	38.076	38.076	3.519	29.326	29.326
2	2.010	16.750	54.827	2.010	16.750	54.827	2.428	20.234	49.560
3	1.284	10.698	65.524	1.284	10.698	65.524	1.916	15.964	65.524
4	1.109	9.245	74.770						
5	.767	6.391	81.161						
6	.697	5.809	86.970						
7	.439	3.656	90.626						
8	.365	3.045	93.670						
9	.335	2.794	96.464						
10	.196	1.635	98.099						
11	.133	1.109	99.208						
12	.095	.792	100.000						

Extraction Method: Principal Component Analysis.

It can be seen from Table 6 above that there are 4 Components with an Eigenvalue greater than 1. The cumulative percentage values indicate the total variance explained by all factors up to that point. For example, the first factor explains 38.076% of the variance, and the first three factors together explain 65.524% of the variance.

Students with external motivation learn English mainly for the praise of the teacher, examination and graduation. Compared with other research done in English-speaking countries, the English learning motivation of Chinese students showed special characteristics. Mori and Gobel (2006) found that to go abroad or travel overseas is important for Japanese college students (Wang, 2008). Those items also are treated as indicative of integrative motivation. However, the item "In order to go abroad in the future I study English diligently" didn't load on any factors in the present research. It shows that college students in Chinese private univerisity don't have a strong desire to go abroad or to integrate into English-speaking communities. The difference may be due to the cultural context because it is impossible for most students to go abroad or to study further in China.

The results provide implications for English teachers in China. It is argued that examinations play a very important role in English learning. What attitude should we have towards them? If students are learning English merely to pass an exam then they are motivated externally. If students have internalized the importance of English learning, they have internal fulfillment regulation which is more autonomous, and if students treat an English examination as an evaluation of what they have learned they have intrinsic motivation. In this study both aspects of intrinsic motivation subscales correlated significantly with English achievement and the factor of motivation for knowledge was a moderate predictor of it. These results are consistent with other research. Students with high intrinsic motivation show great interest in

English, put much effort into English learning, have a high academic self-concept(Bai & Wang, 2023; Liu, 2020), high self-efficacy (Liu & Wang, 2021; Liu, 2020), and tend to persist when facing challenging tasks. Intrinsic motivation also influences academic achievement through the effects of learning strategies and self-confidence (Ummat & Retnowati, 2022).

Core English Vocabulary Pre- and Post-tests

Through the (I/EMSEL) Questionnaires scores analysis, No.2, 4, 6, 7, 13, 15, 18, 22, 23, 25 were chosen as low motivation group; No. 1, 8, 9, 14, 19, 21, 24, 28, 29, 30 were chosen as the high motivation group, left are medium motivation group. Three different motivational groups participated in pre- and posttest of core English vocabulary test in receptive and productive vocabulary knowledge.

Core English Vocabulary (CEV) Descriptive Analysis

The pilot study noted in the questionnaire was applied to the pilot sample study size of 30 students in B University.

(1) Pre and Posttest Descriptive Analysis

Table 8
Test Descriptives

		N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean Lower Bound	Upper Bound	Minimum	Maximum
Pre test	low	10	14.1667	.59979	.18967	13.7376	14.5957	13.27	15.00
	medium	12	14.1000	2.34353	.67652	12.6110	15.5890	10.00	17.67
	high	10	14.8000	2.02503	.64037	13.3514	16.2486	11.33	17.67
	Total	32	14.3396	1.82867	.32327	13.6803	14.9989	10.00	17.67
Post test	low	10	19.3867	9.53873	3.01641	12.5631	26.2103	1.33	29.00
	medium	12	18.2167	3.73627	1.07857	15.8428	20.5906	10.67	23.67
	high	10	30.3133	4.03394	1.27564	27.4276	33.1990	21.33	36.00
	Total	32	22.3625	8.12377	1.43609	19.4336	25.2914	1.33	36.00

（2）Normality for Pre-and Posttest

Table 9
Tests of Normality

	Motivation	Kolmogorov-Smirnov[a] Statistic	df	Sig.	Shapiro-Wilk Statistic	df	Sig.
pretest	Low	.198	10	.200*	.914	10	.311
	Medium	.150	12	.200*	.942	12	.530
	High	.178	10	.200*	.943	10	.592
Posttest	Low	.226	10	.161	.849	10	.057
	Medium	.184	12	.200*	.945	12	.562
	High	.248	10	.082	.898	10	.206

*. This is a lower bound of the true significance.

The data from Table 10 above summarizes the results of normality tests (Kolmogorov-Smirnov and Shapiro-Wilk) for three groups with different levels of motivation. A significance level (0.05) is used to determine if the data deviates from a normal distribution. If the p-value is

greater than 0.05, it fails to reject the null hypothesis that the data follows a normal distribution, indicating that the data for these motivation levels is normally distributed. Therefore, One-way ANOVA can be adopted to measure the difference among three motivational groups

（3）Test of Homogeneity of Variances
Table 10
Levene's test for Pre-and Posttest

	Levene Statistic	df1	df2	Sig.
Pretest Based on Median	3.030	2	29	.064
Posttest Based on Median	2.638	2	29	.089

The test of homogeneity of variances, which is also called Levene's test, is used to assess whether the variances of a variable are equal across different motivational groups in vocabulary knowledge tests. From the Table above, it can be seen that the p-value (Sig.) is the key value to focus on. It indicates whether there is a statistically significant difference in variances across the groups. The common alpha level used is 0.05. Since .064/.089 > .05, it fails to reject the null hypothesis. This means there is no significant difference in variances across the groups for the pretest and posttest data. The variances can be considered homogeneous.

Paired-sample T-test within groups
Table 11
Paired Samples Correlations

	N	Correlation	Sig.
Low pretest & posttest	10	.153	.674
Medium pretest & posttest	10	.169	.640
High pretest & posttest	10	.783	.007

From above table, it can be seen that high motivation group shows a strong and statistically significant correlation(Phigh=.007<.05), indicating a meaningful and reliable relationship between the pretest and posttest scores. Both low and medium groups show very weak correlations, implying no meaningful relationship between the pretest and posttest scores(Plow=.674; Pmedium=.640).

Table 12
Paired Difference Test

Groups		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference Lower	Upper	t	df	Sig(2-tailed)
Low	pre-post	-6.7450	2.92351	.92450	-8.83635	-4.65365	-7.296	9	.000
Medium	pre-post	-5.2900	3.00054	.94885	-7.43645	-3.14355	-5.575	9	.000
High	pre-post	-11.3400	7.08676	2.24103	-16.40956	-6.27044	-5.060	9	.001

All three groups show a statistically significant increase in scores from pretest to posttest. The high motivation group shows the largest average increase (11.34), followed by the low motivation group (6.745), and then the medium motivation group (5.29). The statistical significance ($p < 0.05$ for all three groups) indicates that these increases are unlikely to be due to chance.

One-way ANOVA

In order to answer research question 2, Anova test was used to measure the difference among three motivational groups at post tests.

Table 13
Anova at Post Test

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	309.949	2	154.974	5.170	**.013**
Within Groups	809.268	27	29.973		
Total	1119.217	29			

From above table 13, it can be seen that there is a significant difference among groups (p=.013) at post test.

Table 14
Multiple Comparisons

LSD

(I) Motivation	(J) Motivation	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval Lower Bound	Upper Bound
low	medium	.58000	2.44838	**.815**	-4.4437	5.6037
	high	-6.51000*	2.44838	.013	-11.5337	-1.4863
medium	low	-.58000	2.44838	.815	-5.6037	4.4437
	high	-7.09000*	2.44838	.007	-12.1137	-2.0663
high	low	6.51000*	2.44838	.013	1.4863	11.5337
	medium	7.09000*	2.44838	.007	2.0663	12.1137

*. The mean difference is significant at the 0.05 level.

However, from post hoc test, it is easily seen that high motivation group is significantly different from low group(p=.013<.05)and medium group(p=.007<.05) at post test, however, there is no difference between low and medium motivational groups(p=.815>.05)

Discussion

For High Motivation Learners

The study confirms that mobile dictionary apps can significantly enhance vocabulary knowledge acquisition among learners of English as a Foreign Language (EFL), especially those with high intrinsic motivation. The interactive and personalized nature of these apps aligns well with the needs and preferences of motivated learners, making learning more enjoyable and effective. Firstly, the interactive nature of mobile apps facilitates active engagement with the learning material, which is crucial for language acquisition. Through features such as quizzes, flashcards, and interactive games, learners are not merely passive recipients of information but active participants in the learning process. This aligns with Vygotsky's sociocultural theory, which emphasizes the importance of interaction and engagement in cognitive development (Vygotsky, 1978). Secondly, the personalization capabilities of mobile apps play a significant role in catering to the individual needs and preferences of learners. These apps often employ adaptive learning algorithms that tailor content and difficulty levels to match the user's proficiency and progress. This personalized approach not only addresses the diverse learning paces and styles of EFL learners but also enhances their sense of autonomy and competence, which are critical components of Self-Determination Theory (Ryan & Deci, 2000). Moreover, the study suggests that the motivational design of mobile apps, which incorporates elements of gamification and instant feedback, further enhances their efficacy. Gamified elements such as points, badges, and leaderboards make the learning experience more engaging and enjoyable, thereby sustaining learners' motivation over extended periods (Hamari et al., 2014). Instant feedback mechanisms provide learners with immediate reinforcement and corrective input, which is essential for effective learning and retention of new vocabulary. Additionally, the alignment of mobile apps with the preferences of intrinsically motivated learners cannot be overstated. Intrinsically motivated individuals are driven by an inherent interest and enjoyment in the learning activity itself, rather than by external rewards (Deci & Ryan, 1985). The customizable and interactive features of mobile apps resonate well with these learners, as they offer a sense of control and relevance, thereby enhancing the overall learning experience.

In conclusion, the study underscores the potential of mobile apps as powerful tools for vocabulary enhancement among EFL learners. By leveraging interactive and personalized features, these apps not only meet the educational needs of learners but also align with their intrinsic motivational drivers, making the process of vocabulary acquisition more effective and enjoyable.

For Low and Medium Motivation Learners

However, for EFL learners with low and medium levels of motivation, the effectiveness of mobile apps in enhancing vocabulary acquisition may be limited unless supplemented with additional strategies aimed at sustaining their engagement. Research indicates that these learners often require more than just interactive and personalized features to maintain their interest and motivation (Dörnyei, 2001).

One potential strategy to address this issue is the integration of more social and collaborative features within mobile apps. According to social constructivist theories, learning is inherently a social process that is enhanced through interaction and collaboration with others (Vygotsky, 1978). By incorporating features that enable learners to interact with peers, participate in group activities, or engage in language exchange partnerships, mobile apps can create a more supportive and engaging learning environment. These social interactions not only provide

opportunities for meaningful communication but also help to build a sense of community and belonging, which can significantly enhance motivation (Wenger, 1998).

Furthermore, providing external incentives can be an effective way to motivate learners with lower levels of intrinsic motivation. External incentives, such as rewards, certificates, or recognition, can serve as extrinsic motivators that encourage learners to persist in their efforts and achieve their learning goals (Deci et al., 1999). While intrinsic motivation is ideal for sustained engagement, extrinsic rewards can provide the initial push needed to get learners started and keep them engaged, particularly in the early stages of language learning. Another important strategy is to incorporate content that aligns with the learners' interests and goals. Research has shown that relevance and personal significance of the learning material are critical factors in maintaining motivation (Hidi & Renninger, 2006). By offering a diverse range of topics and themes that cater to the varied interests of learners, mobile apps can make the learning experience more relevant and engaging. This could include incorporating cultural content, current events, or professional language tailored to the learners' career aspirations.

In addition to these strategies, it is essential to provide continuous and adaptive support to learners. Adaptive learning technologies that adjust the difficulty level and type of content based on the learners' progress and performance can help maintain an optimal level of challenge, preventing both boredom and frustration (Corno & Snow, 1986). Furthermore, regular feedback and encouragement from teachers or automated systems can reinforce positive behaviors and keep learners motivated.

In summary, while mobile apps have the potential to enhance vocabulary acquisition among EFL learners, those with low to medium motivation may require additional strategies to sustain their engagement. Integrating social and collaborative features, providing external incentives, and incorporating content aligned with learners' interests and goals are critical components in creating an effective and motivating learning environment.

Implications for Educators

Educators or instructors should consider incorporating mobile apps into their vocabulary teaching strategies, particularly for motivated learners who can benefit most from these tools. However, it's also essential to provide support and encouragement to less motivated learners, perhaps by integrating app-based learning with traditional methods and offering regular feedback and encouragement.

Conclusion

The effectiveness of mobile dictionary apps in enhancing vocabulary knowledge in terms of RVK and PVK among EFL learners is evident, with motivation playing a crucial role in determining learning outcomes. Highly motivated learners benefit the most from the interactive and personalized features of mobile dictionary apps, while those with lower and medium motivation may require additional support and incentives to achieve similar gains. As mobile technology continues to evolve, its potential to transform language learning and address individual learner needs becomes increasingly apparent.

In future, interview need to be done firstly. To gain deeper insights into the effects of the mobile dictionary app on different motivation groups, interviews should be conducted. The objectives of the interviews are: understanding iuser experiences. For example, gather qualitative data to know on how different motivation groups interact with the app, on what features they find most beneficial, and on any challenges they encounter. Second, sample size

needs to be expanded. To ensure the findings are generalizable and reflective of a broad population, the sample size should be expanded. Involving a larger number of participants enhanced the statistical power of the study, leading to more robust and reliable results. A larger sample size also allows for more detailed subgroup analyses, helping to identify specific patterns and trends within different motivation groups.

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Appendix A Questionnaire about the Intrinsic /Extrinsic Motivation Scale of English Learning
Dear students,

We are now carrying on an investigation about non-English majors' English language learning motivations in B University. We truly welcome you to spend a few minutes to fill out this basic survey.

Please select one score from 5 to 1（**5=totally agree, 4=agree, 3= somewhat agree, 2=disagree, 1= totally disagree**）for every statement according to your own views. The survey does not intend to collect personal information, all data collected would be kept confidential and for academic research only. Thank you!

Q1. I like studying English.
Q2. I will insist learning English when I meet the difficulties in learning it.
Q3. I will accomplish my English assignment actively.
Q4. I like to listen to English speech such as TED.
Q5. I like to read some short and interesting English articles.
Q6. I feel more self-confident in English studying than my classmates.
Q7. I accomplish my assignments in English following after a plan.
Q8. I study English very hard in order to have a good development in the coming career.
Q9. I like to challenge the difficult tasks in English study.
Q10. I pay much attention on English exams because I think that is the evaluation of my English level.
Q11. I am fond of watching English movies.
Q12. I feel happy when I can manage a tough task in English studying.
Q13. I will study English much harder for the teacher's acknowledgement.
Q14. I rarely read English after the class.
Q15. I study English merely for passing CET-4 or CET- 6.
Q16. I nearly cannot finished English homework on my own.
Q17. It is under great pressure to talk with foreign speakers.
Q18. So as to get to know recent progress in my major, I study English very hard.
Q19. The English achievement is an essential factor in getting the scholarship, so I study English very hard.
Q20. I study English very hard merely for graduating from university on time.
Q21. English is a key communicating tool so I study it very hard.
Q22. So as to get a satisfactory job in the future I study English very hard.
Q23. Studying English takes great merits on the future work.
Q24. So as to go abroad in the future, I study English very hard.
Q25. I learn English because the boss prefers multi-skilled people in the future job.
Q26. In order to improve my computer skill I must learn English well.

Appendix B：Chinese Version
英语学习的内在/外在动机量表问卷
亲爱的同学们：
我们正在对 B 大学非英语专业学生的英语学习动机进行调查。我们真诚地欢迎您花几分钟时间填写这个基本调查。
请根据自己的实际，从 5 到 1**(5=完全同意，4=同意，3=不确定，2=不同意，1=完全不同意)**如实选择。本调查无意收集个人资料，所收集的资料将会保密，并只作学术研究用途。谢谢你!

Q1. 我喜欢学习英语。
Q2. 当我遇到学习英语的困难时，我会坚持学习英语。
Q3. 我会积极完成我的英语作业。
Q4. 我喜欢听英语演讲，如 TED。
Q5.我喜欢读一些简短而有趣的英语文章。
Q6. 在英语学习方面，我比我的同学更有自信。
Q7. 迄今为止, 我按照计划完成我的英语任务。
Q8. 我努力学习英语是为了在未来的职业生涯中有一个好的发展。
Q9. 我喜欢在英语学习中挑战困难的任务。
Q10. 我很重视英语考试，因为我认为那是对我英语水平的评价。
Q11. 我喜欢看英语电影。
Q12. 当我能处理英语学习中的一项艰巨任务时，我感到很高兴。
Q13. 为了老师的认可，我会更加努力地学习英语。
Q14.为了平时考核分，我才按时完成课后作业。
Q15. 我学习英语只是为了通过四级或六级。
Q16. 英语是学校课程安排，不得不学。
Q17.为了能够考取研究生，我努力学习英语。
Q18. 为了了解我的专业最近的进展，我非常努力地学习英语。
Q19. 英语成绩是获得奖学金的一个重要因素，所以我努力学习英语。
Q20. 我努力学习英语只是为了拿到学位证，按时从大学毕业。
Q21. 英语是一种重要的交流工具，所以我非常努力地学习它。
Q22. 为了在将来找到一份满意的工作，我非常努力地学习英语。
Q23. 学习英语对未来的工作有很大的好处。
Q24. 为了将来出国，我很努力地学习英语。
Q25. 我学习英语是因为未来的工作中，老板更喜欢多技能人才。
Q26. 为了提高计算机水平，我必须学好英语。