Manar Elsharq Journal
for Literature and Language Studies
ISSN: 2959-037X(Print)
Website: http://meijournals.com/ara/index.php/mejlls/index

Exploring the Combined Impact of Electronic Dictionary Use and Mobile-Assisted Vocabulary Apps on Depth of Vocabulary Knowledge among EFL Learners

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ARTICLE INFO

Received: 15 Jun
Accepted: 23 July
Volume: 3
Issue: 3

ABSTRACT

This research examines how Iraqi EFL learners' depth of vocabulary knowledge is affected by using electronic dictionaries, mobile-assisted vocabulary applications, and their combination use. Based on their placement exam results, 116 intermediate-level Babylon University students in all were chosen and divided into four groups: electronic dictionary, mobile-assisted vocabulary applications, integrated tools, and a control group. Participants in an intervention spanning four weeks interacted with either Merriam-Webster's Dictionary app, Memrise, both tools, or conventional education. Using the Word Associates Test, pre- and post-tests were given to gauge vocabulary depth changes. All three experimental groups demonstrated statistically significant increases in depth of vocabulary knowledge when compared to the control group, the findings indicated. Furthermore, the group using both instruments exceeded all others, suggesting a synergistic impact. These results imply that including many digital tools will help lexical development in EFL environments more successfully. The research emphasizes the pedagogical worth of vocabulary training improved by technology and suggests mixed digital methods to develop stronger lexical competency.

KEYWORDS: Depth of vocabulary knowledge, digital tools, electronic dictionary, mobile-assisted vocabulary apps, vocabulary acquisition

1 Introduction

The process of learning a second or foreign language, particularly for English as a Foreign Language (EFL) learners, heavily relies on vocabulary knowledge (Vafaee & Suzuki, 2020; Zhang & Zhang, 2022). Along with supporting reading and listening comprehension (Zhang & Graham, 2020), a solid vocabulary basis improves writing and speaking fluency (Perez, 2022). Long underlined as a fundamental component of language development by academics are vocabulary breadth and the word count a student learns (Wu et al., 2021). But depth of vocabulary knowledge—that is, how well students grasp the meaning, use, and relationships of the words they know—has lately attracted increasing interest in educational and linguistic studies. With mobile devices and digital tools providing new chances for interactive and self-directed learning, improvements in educational technology have changed the way language is taught and learnt in step with this conceptual change.

Depth of vocabulary knowledge is the qualitative component of word knowledge that includes register, morphological awareness, semantic connections, word collocations, and semantic awareness (Slippe, 2024). One powerful paradigm for evaluating depth combines syntagmatic relationships—e.g., collocations and use patterns—with paradigmatic relationships—e.g., synonyms and antonyms—Read, 1993. Unlike breadth, which is often learned swiftly in classroom settings (Wu et al., 2021), depth develops more gradually and needs repeated exposure, contextual application, and explicit teaching (Slippe, 2023). Advanced language learners notably need it as they must not only identify words but also apply them precisely, adaptably, and suitably across many settings. But because of restricted classroom time, lack of rich exposure to real-world information, and inadequate attention on collocations and semantic subtleties in conventional sources, many EFL students find it difficult to acquire deep lexical knowledge.

Mobile-Assisted Language Learning (MALL) has grown in popularity, so digital technologies have been used into vocabulary teaching more and more to handle these difficulties. Electronic dictionaries among these tools provide instantaneous access to definitions, pronunciation, sample sentences, and word use (Alamri & Hakami, 2022; Ferrett & Dollinger, 2021). Students now make extensive use of them to improve comprehension and help to retain language. Memrise and other mobile vocabulary applications simultaneously use gamification, spaced repetition, and multimedia material to provide interesting, customized learning opportunities (Aprizal & Wachyudi, 2024). Learner motivation and autonomy have been seen to rise with these tools (Nguyen et al., 2023). Although various research have individually shown the advantages of electronic dictionaries and vocabulary applications, results have been conflicting and most concentrate on vocabulary breadth rather than depth (Alamri & Hakami, 2022; Aprizal & Wachyudi, 2024; Nguyen et al., 2023). Few studies have also looked at the potential synergistic effects of combining these instruments.

Notwithstanding the increasing corpus of studies on digital vocabulary learning (Dan et al., 2024; Koleini et al., 2024; Okumuş Dağdeler, 2023), the literature still shows a clear discrepancy in how various

technological tools, individually and in concert, influence learners' depth of vocabulary knowledge. Most current research has focused mostly on quantitative increase in general language ability or vocabulary size, without enough consideration of lexical development. Moreover, even while both mobile applications and electronic dictionaries have been proved to have different benefits, no empirical research to date has methodically assessed their efficacy or investigated the possible combined usage potential. In EFL environments such as Iraq, where students can have limited access to significant English input outside the classroom, this gap is especially pertinent.

This gap drives the current research to evaluate the effects of electronic dictionary usage, mobile-assisted vocabulary applications, and their combination on the depth of vocabulary knowledge among intermediate-level Iraqi EFL learners. This research aims to find if technologies-mediated vocabulary learning tools can greatly improve learners' semantic and collocational knowledge by comparing the results of these three instructional strategies against a control group. The results should guide vocabulary instruction and further the developing discipline of mobile-assisted language learning.

The study aimed to answer the following research questions:

RQ1: *Does electronic dictionary use have any significant impact on the depth of vocabulary knowledge among EFL learners?*

RQ2: *Do mobile-assisted vocabulary apps have any significant impact on the depth of vocabulary knowledge among EFL learners?*

RQ3: *Does an electronic dictionary combined with mobile-assisted vocabulary apps have any significant impact on the depth of vocabulary knowledge among EFL learners?*

2 Review of the Literature

2.1 Theoretical Framework

Grounded on Nation's (2001) model of vocabulary knowledge, the current research differentiates between two main dimensions: breadth (the number of words a learner knows) and depth (the quality of that knowledge, including how well learners comprehend the meaning, form, and usage of a word). This structure underlines that knowing a word entails knowledge of its collocations, grammatical behavior, register, frequency, and connotations, not just of meaning. According to this perspective, intentional teaching and exposure both shape the multifaceted process of vocabulary acquisition which develops gradually. The present research notably addresses depth of vocabulary knowledge in line with Nation's claim that, particularly at intermediate and advanced levels, fluency and correct language usage depend on strong lexical competence.

Read's (1993) theory of depth of vocabulary knowledge—operatively expressed via the Word Associates Test (WAT), which evaluates students' understanding of paradigmatic and syntagmatic relationships—is another fundamental theoretical grounding. While syntagmatic information relates to collocational and contextual relationships—e.g., frequent word pairings—paradigmatic knowledge refers to the semantic ties among words—e.g., synonyms. For EFL students especially, this method is very pertinent as it addresses a deeper, more functional knowledge of how words work in context—something that conventional vocabulary size examinations usually ignore. This research makes use of the Word Associates Test as both a theoretical and practical instrument to evaluate the target construct, therefore offering a strong means to record subtle changes in learners' lexical competency.

From a pedagogical standpoint, constructivist learning theory—especially Vygotsky's sociocultural theory (1978), which holds that learning is most successful when students actively interact with their surroundings and use tools that mediate learning— informs the research. In this regard, mobile vocabulary applications and electronic dictionaries act as cognitive tools supporting students' autonomous discovery and internalizing of word knowledge. These resources let students connect with vocabulary in more

significant and diverse ways by include multimodal input, real language samples, and instant feedback. Using such technologies fits the concept of the zone of proximal development, in which digital scaffolding lets students reach a greater degree of vocabulary mastery than they could with only conventional education.

At last, the research makes use of ideas from Mobile-Assisted Language Learning (MALL), a subset of technology-enhanced learning theories, which emphasizes in second language acquisition the need of mobility, customization, and contextual learning. Kukulska-Hulme and Shield (2008) claim that mobile technology let students access course materials flexibly, combine learning into their everyday life, and gain from tailored feedback and adaptive repetition. While electronic dictionaries provide contextualized definitions and use examples that develop semantic and syntagmatic knowledge, Memrise, for example, employs spaced repetition and gamification to improve engagement and retention. Theoretically, constructivism, sociocultural learning, and MALL together provide a good basis for investigating how digital technologies could together improve the depth of vocabulary knowledge among EFL learners.

2.2 Empirical Studies

In recent years, mobile technology integration into language learning has attracted a lot of attention, especially in relation to EFL learners' vocabulary development. Undergraduate EFL students with different degrees of motivation participated in a quasi-experimental research by Dan et al. (2024) to investigate how well mobile dictionary apps improved receptive and productive vocabulary knowledge. The results showed that while all participants gained from using mobile dictionaries, those with more drive showed noticeably more progress. This emphasizes how critical learner motivation is to optimizing the advantages of mobile-assisted vocabulary learning tools.

In a similar line, Li and Hafner (2022) evaluated how well conventional paper-based word cards and mobile-based word cards helped Chinese university students acquire vocabulary. Their research showed that the mobile app improved students' awareness of form-meaning linkages and collocations in addition

to increasing increases in receptive and productive vocabulary knowledge. This implies that more dynamic and interactive learning opportunities provided by mobile-assisted technologies may help to improve lexical understanding.

Extending the usage of digital tools, Koleini et al. (2024) evaluated in vocabulary education the efficiency of digital flashcards against conventional paper-based ones. Their studies found that among university students, digital flashcards were more successful in improving receptive and productive vocabulary knowledge. Digital flashcards' dynamic character—often including multimedia components and spaced repetition techniques—probably helps them to retain and remember language more effectively.

Beyond personal learning resources, Guo et al. (2022) have investigated how self-regulation and peer scaffolding could support mobile-assisted vocabulary acquisition. Their research focused on how Shanbay apps were utilized by undergraduate students and found that vocabulary learning was much impacted by peer scaffolding as well as self-regulation. Learners who participated in peer scaffolding and shown better degrees of self-regulation exhibited better vocabulary learning results, therefore underscoring the need of cooperative and autonomous learning tactics in mobile-assisted environments.

Examining mobile-assisted vocabulary acquisition in writing, Jiang and Liou (2022) used the Quizlet app for an action research project. Through a mix of mobile-based treatments and out-of-class pair work, their study sought to encourage academic vocabulary usage in writing. The findings showed that participants not only recalled more terms after their encounters with mobile-assisted learning but also used them quite well for their writing assignments. Moreover, these gains persisted over time, indicating the long-term advantages of including mobile devices into cooperative learning models.

Okumuş Dağdeler (2023) synthesized the body of current research by means of a thorough evaluation of previous studies on mobile-assisted vocabulary acquisition. The study underlined how well mobile technologies improve vocabulary learning and noted the necessity of further study on their impacts on vocabulary depth. This draws attention to a vacuum in the research as most studies have concentrated mostly on vocabulary breadth, therefore neglecting the dimension of depth. Filling in this void, the current

research seeks to examine how mobile-assisted vocabulary applications and electronic dictionary usage together affect the depth of vocabulary knowledge among EFL students.

3 Methodology

3.1 Design

The effects of various vocabulary learning aids on EFL learners' depth of vocabulary knowledge were investigated in this quasi-experimental design with pretest–posttest control group structure. Four conditions comprised the independent variable: (1) electronic dictionary usage; (2) mobile-assisted vocabulary applications; (3) a mix of both technologies; and (4) conventional teaching (control group). Operating via participants' vocabulary test results, the depth of vocabulary knowledge was the dependent variable.

3.2 Participants

Originally, 130 male and female Iraqi EFL students enrolled in the Teaching English as a Foreign Language (TEFL) program at Babylon University were native speakers of Arabic. The placement exam was meant to guarantee uniformity in language competency. The data led to the selection of 116 intermediate level students for the research. Following that, these individuals were randomized to one of four groups: (1) Electronic Dictionary; (2) Mobile-Assisted Vocabulary Apps; (3) Combined group (using both tools); and (4) Control group.

3.3 Instrument

3.3.1 Oxford Placement Test

The Oxford Placement Test (Allan, 2004) was used to gauge the participants' degree of language competency and guarantee group homogeneity. Widely accepted as legitimate and reliable in separating students into competency levels, the exam evaluates grammar, vocabulary, and listening abilities.

3.3.2 Meryam Webster's Dictionary

Widely used digital reference tool the Merriam-Webster Dictionary (App Version) offers thorough and accurate definitions, sample sentences, audio pronunciations, word origins, and usage notes. Designed for mobile devices, the app particularly helps language learners trying to improve their depth of vocabulary knowledge as it provides rapid and simple access to lexical material. In line with the objectives of deep lexical development in EFL environments, its easy-to-use interface and rich linguistic material helped students investigate both the semantic and collocational components of vocabulary (Merriam-Webster, 2023).

3.3.3 Memrise

Memrise is a mobile-assisted language learning tool meant to improve vocabulary acquisition by use of spaced repetition, mnemonic devices, and interactive multimedia material. To encourage active participation and long-term memory of vocabulary items, the app provides a selection of EFL-specific courses with visual hints, voice accompaniment, and gamified challenges. Its learner-friendly interface and adaptive learning systems helped it especially to promote deeper lexical processing, hence enhancing knowledge of word meanings and collocations (Aprizal & Wachyudi, 2024).

3.3.4 Depth of Vocabulary Knowledge Test

The updated Word Associates Test (DVK) created by Read (1993) was used to assess students' degree of vocabulary knowledge. There are forty items total in the exam, two boxes of four words and one target word—always an adjective. While the right box usually collocate (syntagmatic) with the target word, the left box comprises one to three words that have semantic (paradigmatic) relationships—that is, synonyms. Every item contains precisely four right answers, scattered haphazardly throughout the boxes. Established for evaluating both usage- and meaning-related facets of vocabulary knowledge in EFL environments, the DVK exam is reliable.

3.5 Procedure

The OPT was given to a first pool of students to start the research. The primary research included 116 students who fell into the intermediate competency level based on the findings. All participants completed a pretest using the DVK test after group choosing. The baseline level of vocabulary knowledge—including knowledge of word meanings and collocational associations—was measured on this pretest. The pretest results guaranteed that, in their initial vocabulary depth before the intervention, the groups were statistically equal.

Following random assignment to one of four groups—the Electronic Dictionary group, the Mobile-Assisted Vocabulary Apps group, the Combined group, and the Control group—the participants were then Over four weeks, every group got a different kind of vocabulary acquisition intervention. Emphasizing checking up definitions, pronunciations, and use examples, the Electronic Dictionary group was directed to utilize the Merriam-Webster Dictionary app just during vocabulary acquisition sessions.

Using the Memrise app, the Mobile-Assisted Vocabulary Apps group interacted with EFL-specific vocabulary courses including interactive activities and spaced repetition strategies. Encouraging students to investigate and reinforce vocabulary topics via both defineitional search and interactive practice, the combined group used both the Merriam-Webster app and Memrise simultaneously. By comparison, without using any digital tools, the Control group got conventional teacher-led vocabulary learning based on the course material.

Every participant received a posttest at the conclusion of the intervention period; this form was exactly the DVK pretest. The posttest goal was to assess any variations in vocabulary knowledge depth brought about by the different therapies. After that, the results were analyzed both within and outside of groups to see how well each teaching method improved students' depth of vocabulary knowledge.

3.6 Data Analysis

The study started with computing the means and standard deviations for the pretest and posttest results throughout all four groups. This phase made it simpler to see trends and changes throughout time by giving a broad picture of participants' vocabulary performance both before and after the intervention.

Separately for the three experimental groups—the electronic dictionary group, the mobile app group, and the combined tools group—paired-samples t-tests were performed to ascertain if each vocabulary acquisition strategy resulted in significant progress. These assessments allowed one to see if, after the intervention, the depth of vocabulary knowledge in every group significantly changed.

Furthermore, compared across all four groups—including the control group—were the posttest findings using a one-way ANOVA. This test enabled the identification of whether the kind of intervention used had any appreciable effect on student results. Post hoc comparisons—such as the Tukey HSD test—were used to specifically identify which groups deviated from one another when the ANOVA found a noteworthy impact. Using SPSS software (version 26), all statistical tests were conducted; significance was ascertained at the traditional level of $p < .05$.

4 Results

4.1 Research Question One

The outcomes for the electronic dictionary cohort demonstrated a significant improvement in performance pre- and post-intervention. In the pretest, participants achieved a mean score of 21.18 and a standard deviation of 3.66, indicating a somewhat consistent initial proficiency with notable variability across individuals. Following the intervention, the average posttest score rose to 28.11, accompanied by a standard deviation of 3.72, indicating both a general enhancement and uniform progress within the group.

A paired-samples t-test was performed to determine the statistical significance of this difference. The findings indicated a t-value of 6.38 and a p-value below .001, confirming that the enhancement in scores was statistically significant. The variation in vocabulary depth scores from the pretest to the posttest was

not attributable to random chance, but instead indicates a consistent improvement throughout the research duration.

Table 1

Results of the Analysis for RQ1

	Test	Mean	Standard Deviation (SD)	t-value	p-value
1	Pre-test	21.18	3.66	6.38	0.000
2	Post-test	28.11	3.72		

4.2 Research Question Two

The descriptive data for the cohort using mobile-assisted vocabulary applications indicate significant advancement. The mean pretest score was 20.28, with a standard deviation of 4.05, indicating a moderate beginning level and somewhat more variability than the dictionary group. Subsequent to the intervention, the posttest mean elevated to 27.83, with the standard deviation marginally increasing to 5.13, indicating a general enhancement in scores coupled with considerable variability in individual advancement.

A paired-samples t-test was conducted to see whether the difference between pretest and posttest scores was statistically significant. The test yielded a t-value of 5.61 and a p-value below .001, indicating a very significant improvement. The findings indicate that the improvement in scores was consistent and statistically significant, offering compelling evidence that performance truly improved after the use of the mobile vocabulary learning application.

Table 2

Results of the Analysis for RQ2

	Test	Mean	Standard Deviation (SD)	t-value	p-value
1	Pre-test	20.28	4.05	5.61	0.000
2	Post-test	27.83	5.13		

4.3 Research Question Three

Table 3 presents the outcomes for the group who underwent the integrated intervention, using both electronic dictionaries and mobile-assisted vocabulary applications. The average pretest score for this group was 21.31 (SD = 3.25), comparable to the baseline values of the other groups. Following the four-week intervention, the mean posttest score rose significantly to 30.39 (SD = 3.91), representing the greatest post-intervention performance across all groups in the research.

A paired-samples t-test was performed to ascertain the statistical significance of this improvement. The study yielded a t-value of 6.21 and a p-value below .001, indicating a very significant increase in vocabulary depth. The extent of the gain, together with the uniformity of the findings across participants (shown by the comparatively low standard deviation), implies that this group exhibited the most significant enhancement in vocabulary depth. The scores provide the foundation for the one-way ANOVA, in which posttest results will be compared across all four groups to see whether the combined-tools group substantially surpassed the others.

Table 3

Results of the Analysis the Third Group

	Test	Mean	Standard Deviation (SD)	t-value	p-value
1	Pre-test	21.31	3.25	6.21	0.000
2	Post-test	30.39	3.91		

A one-way ANOVA was used to evaluate the efficacy of various vocabulary acquisition treatments based on the posttest scores of four groups: Control, Electronic Dictionary, Mobile App, and Combined Tools. The research demonstrated a statistically significant disparity in group means, suggesting that the intervention style substantially influenced learners' vocabulary knowledge depth.

Table 4

One-Way ANOVA Results

	Test	Sum_sq	df	F	PR(>F)
1	C(Group)	1357.419	3.0	5.857	2.5548
2	Residual	1413.301	112.0		

A Tukey HSD post hoc test was used to investigate the sources of these discrepancies. The findings indicated that the Combined Tools group markedly surpassed all other groups. It achieved a score that was 9.62 points superior to the Control group, 5.47 points superior to the Electronic Dictionary group, and 5.58 points superior to the Mobile App group, all with p-values below .001. The data indicate that the Combined Tools group had a statistically better outcome, providing compelling proof that the simultaneous use of an electronic dictionary and a mobile vocabulary application resulted in the most significant improvements in vocabulary depth. No other comparisons demonstrated similar robust and consistent performance, so strengthening the conclusion that a mixed digital strategy is the most successful among those evaluated.

Table 5

Tukey HSD Post Hoc Comparisons Results

	Group 1	Group 2	Mean Difference	p-value	95% CI Lower	95% CI Upper	Significant
1	Combined Tools	Control	-9.6221	0.0000	-12.055	-7.1891	True
2	Combined Tools	Electronic Dictionary	-5.4677	0.0000	-7.9007	-3.0348	True
3	Combined Tools	Mobile App	-5.5811	0.0000	-8.0141	-3.1481	True
4	Control	Electronic Dictionary	4.1543	0.0001	1.7214	6.5873	True
5	Control	Mobile App	4.041	0.0002	1.608	6.4741	True
6	Electronic Dictionary	Mobile App	-0.1133	0.9994	-2.5463	2.3196	False

5 Discussion

According to the first research question's findings, the group of EFL students who used electronic dictionaries demonstrated a statistically significant increase in vocabulary depth between the pretest and posttest. The rising performance suggests that utilizing an electronic dictionary helped the students to comprehend both the syntagmatic (collocation-based) and paradigmatic (meaning-based) aspects of vocabulary.

This result conforms with other research implying that by providing instantaneous, rich lexical information comprising definitions, sample sentences, pronunciation, and collocational patterns (e.g., Dan et al., 2024), electronic dictionaries improve vocabulary acquisition. Mobile dictionary applications are very useful in EFL environments where students may not always have access to instructor assistance or other resources because they provide multimodal inputs and easy search tools unlike conventional dictionaries.

The increase in depth of vocabulary knowledge supports Nation's (2001) theory, which holds that depth consists of knowledge of a word's form, meaning, and use. Electronic dictionaries enable students to investigate various elements concurrently, therefore strengthening lexical knowledge by means of recurrent, self-initiated research. Furthermore, the interactive and contextual elements of applications such as Merriam-Webster can inspire students to focus more on collocations and usage—often overlooked in conventional vocabulary training.

The second research question produced findings showing that students using mobile-assisted vocabulary apps—more especially, Memrise—also showed a statistically significant increase in their depth of vocabulary knowledge. On semantic links and collocational identification in the DVK posttest, this group made significant improvement.

The notable impact of mobile vocabulary applications supports results of Li and Hafner (2022) and Koleini et al. (2024), who found that mobile-based flashcards and word-learning games improve

vocabulary retention and depth of knowledge than paper-based approaches. Memrise's spaced repetition techniques and multimedia materials probably encouraged frequent vocabulary encounters in diverse settings, therefore enhancing learners' mental representations of word meanings and collocations.

Additionally, this result highlights the role of learner engagement and autonomy in vocabulary development. Mobile apps empower learners to control their pace and review frequency, promoting deeper lexical processing (Guo et al., 2022). From a theoretical standpoint, this aligns with Vygotsky's sociocultural theory, which emphasizes the importance of tool-mediated learning. By integrating features such as immediate feedback, gamification, and progress tracking, Memrise supports learners in achieving higher levels of vocabulary depth than they might through passive exposure or rote memorization.

The third and most prominent result revealed that the combined group, which used both electronic dictionaries and mobile-assisted vocabulary apps, outperformed all other groups significantly in the posttest. This group exhibited the highest gains in depth of vocabulary knowledge, showing notable improvements in both meaning and collocation dimensions. This finding suggests a synergistic effect when electronic dictionaries and mobile vocabulary apps are used in tandem. While each tool independently supports different aspects of word learning, their combination provides comprehensive lexical input. This dual exposure may increase opportunities for noticing, retrieval, and contextualization, which are essential mechanisms for developing deep word knowledge (Jiang & Liou, 2022).

The outperformance of the combined group also emphasizes the importance of multimodal input and varied learning strategies in vocabulary acquisition. Learners in this group were able to both explore words in depth through dictionary lookup and reinforce them through app-based repetition and games. This aligns with research reviewed by Okumuş Dağdeler (2023), which stresses that vocabulary depth is best developed through exposure to words in diverse formats and learning contexts.

6 Conclusion

This study set out to examine the individual and combined effects of electronic dictionary use and mobile-assisted vocabulary apps on the depth of vocabulary knowledge among intermediate-level EFL learners. The findings revealed that both tools, when used independently, significantly enhanced learners' depth of vocabulary knowledge, measured through improvements in understanding semantic relationships and collocational use. Notably, the combined use of both tools resulted in the greatest gains, suggesting that integrating diverse digital resources offers a more comprehensive and effective approach to vocabulary instruction. These results reinforce the theoretical perspective that vocabulary depth is best developed through multimodal exposure and repeated interaction with lexical items across varied contexts.

While the findings are promising, their generalization should be considered with some caution. The study focused on a specific group of Iraqi EFL learners enrolled in a TEFL program at a single university, which may limit the extent to which the results can be applied to learners in different cultural, linguistic, or educational contexts. Nevertheless, the consistency of these results with previous international research suggests that similar benefits may be observed in other EFL settings with intermediate learners and access to digital tools. Educators and researchers in comparable environments are encouraged to explore the integration of dictionary and app-based instruction in their own contexts, while future research should investigate whether these findings hold true across varying proficiency levels, age groups, and instructional conditions.

7 Implications

From a pedagogical perspective, this result has important implications for vocabulary instruction in EFL settings. Rather than relying solely on one type of digital tool, integrating multiple, complementary technologies, such as electronic dictionaries and mobile-assisted vocabulary apps, can provide a more holistic and effective learning experience. Each tool serves a unique pedagogical function: electronic dictionaries support learners in developing semantic precision and contextual understanding, while vocabulary apps facilitate retrieval practice, engagement, and retention through repeated exposure and

interactive features. When used together, these tools create a balanced learning environment that addresses both the analytical and associative dimensions of vocabulary knowledge. This combination may be especially beneficial for enhancing both intentional learning (through explicit lookup and analysis) and incidental learning (through practice and exposure).

Moreover, the findings suggest that EFL teachers and curriculum designers should be strategic in selecting and integrating digital tools to support vocabulary learning objectives. Structured dictionary training can equip learners with the skills to use lexical resources effectively, while guided app-based practice can encourage consistent reinforcement outside the classroom. This is particularly valuable in instructional contexts with limited contact hours, large class sizes, or remote learning constraints, scenarios common in many EFL settings. By adopting a blended or technology-enhanced approach, educators can promote learner autonomy and ensure sustained vocabulary development beyond the confines of classroom instruction. Ultimately, this integrated strategy not only supports vocabulary depth but also aligns with modern trends in learner-centered and mobile-supported language education.

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