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# MOBILE-ASSISTED LANGUAGE LEARNING FOR DEVELOPING VOCABULARY MASTERY AMONG JUNIOR HIGH SCHOOL EFL STUDENTS IN INDONESIAN CONTEXTS

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## Abstract

*Vocabulary development is a fundamental component of English language learning because it supports students' reading comprehension, listening comprehension, speaking performance, and writing accuracy. However, many junior high school students still experience difficulties in remembering word meanings, recognizing spelling, pronouncing new words, and using vocabulary in meaningful contexts. Mobile-assisted language learning offers flexible, multimodal, and repeated vocabulary practice through digital flashcards, pronunciation audio, mobile quizzes, short contextual sentences, and self-paced review. This study aims to examine the effectiveness of mobile-assisted language learning in developing students' English vocabulary and to explore students' learning experiences during mobile-supported vocabulary instruction. The study employed a mixed-method design using a quasi-experimental pretest-posttest control group approach supported by classroom observations, student interviews, reflective journals, and learning document analysis. The participants were 70 junior high school students divided into an experimental group and a control group. The experimental group learned vocabulary through mobile-assisted activities using digital flashcards, audio pronunciation models, WhatsApp-based review, mobile quizzes, and contextual vocabulary tasks, while the control group received conventional vocabulary instruction. Quantitative data were analyzed using descriptive statistics, paired-sample t-tests, independent-sample t-tests, normalized gain scores, and effect size analysis. Qualitative data were analyzed thematically. The findings showed that mobile-assisted language learning significantly improved students' vocabulary mastery, particularly word meaning recognition, pronunciation awareness, and contextual use. The study concludes that mobile-assisted language learning can support vocabulary development when mobile activities are structured, purposeful, repeated, and pedagogically integrated.*

***Keywords:*** *mobile-assisted language learning; vocabulary development; junior high school; EFL; digital flashcards*

## A. Introduction

Vocabulary is one of the most essential components of English language learning. Students need vocabulary to understand texts, listen to spoken messages, express ideas orally, and write meaningful sentences. Without sufficient vocabulary, students may understand grammar rules but still fail to communicate effectively. In junior high school contexts, vocabulary development is particularly important because students are expected to move from basic word recognition to more meaningful language use across reading, speaking, listening, and writing activities.

Vocabulary mastery is not limited to knowing the translation of a word. It includes knowledge of word form, meaning, pronunciation, spelling, grammatical behavior, collocation, and contextual use. Schmitt (2008) explains that instructed vocabulary learning requires repeated exposure, meaningful use, and attention to different aspects of word knowledge. Nation (2013) also emphasizes that vocabulary learning involves form, meaning, and use. Therefore, effective vocabulary instruction should provide students with opportunities to see, hear, repeat, retrieve, and use words in different contexts.

In many English as a foreign language classrooms, vocabulary instruction is still dominated by word lists, direct translation, textbook exercises, and memorization. These practices may help students recognize word meanings for a short period, but they often fail to build long-term retention and flexible use. Students may memorize English-Indonesian equivalents before a test but quickly forget them afterward. They may also know the meaning of a word but hesitate to pronounce it or use it in a sentence. This condition indicates that vocabulary instruction needs to be more multimodal, interactive, and repeated.

Mobile-assisted language learning offers a promising approach to vocabulary development. Mobile-assisted language learning refers to the use of mobile devices, such as smartphones and tablets, to support language learning inside and outside the classroom. Kukulska-Hulme and Shield (2008) describe mobile-assisted language learning as moving from simple content delivery toward interaction and collaboration. Burston (2014, 2015) also highlights that mobile-assisted language learning has developed significantly but requires strong pedagogical design to avoid superficial technology use.

Previous studies have shown that mobile learning can support language learning outcomes. Sung, Chang, and Yang (2015) found that

mobile devices had a meaningful positive effect on language learning across studies. Chen, Chen, and Yang (2020) also reported positive effects of mobile device use on language learning through meta-analysis. Lin and Lin (2019) synthesized mobile-assisted vocabulary learning studies and showed that mobile applications can contribute positively to vocabulary acquisition when design, frequency, and learning conditions are considered. These findings suggest that mobile learning can be effective when integrated into structured instructional practice.

Reviews of the field describe a similar trajectory. Viberg and Gronlund (2012) and Duman, Orhon, and Gedik (2015) show that mobile-assisted language learning moved from small-scale delivery experiments towards classroom-integrated designs, and Kukulska-Hulme (2018) argues that the value of mobile devices lies in the continuity they create between formal and informal learning rather than in the technology itself. Early implementation studies had already indicated this potential. Thornton and Houser (2005) and Kennedy and Levy (2008) reported that short vocabulary messages delivered to mobile phones at spaced intervals produced better retention than paper equivalents, while Lu (2008) found that students who studied vocabulary through mobile phones recalled more words than those who used printed material. Chen and Chung (2008) added that mobile systems can adapt the review interval to individual learners, which is difficult to organise in a whole-class setting.

Mobile-assisted vocabulary learning is especially relevant for junior high school students. Students at this level are generally familiar with smartphones and digital applications, although their learning use of mobile devices may still need guidance. They often use mobile phones for social communication, entertainment, games, and video content. This familiarity can be redirected toward vocabulary learning if teachers design purposeful learning activities. However, mobile access alone does not guarantee learning. Students may become distracted, misuse devices, or treat mobile tasks as entertainment if the activities are not structured.

Despite these positive findings, several gaps remain. First, many mobile-assisted language learning studies focus on higher education, while junior high school contexts still need more classroom-based evidence. Second, some studies measure vocabulary gains but provide limited explanation of how students experience mobile vocabulary learning. Third, mobile learning is sometimes treated as technology use rather than as a pedagogical system. Therefore, this study examines both the measurable effect of mobile-assisted language learning on

vocabulary development and the learning processes experienced by students.

This study addresses four research questions: (1) Does mobile-assisted language learning significantly improve junior high school students' English vocabulary development compared with conventional vocabulary instruction? (2) Which aspects of vocabulary mastery improve after mobile-assisted language learning? (3) How do students experience mobile-assisted vocabulary learning? and (4) What challenges emerge during the implementation of mobile-assisted language learning for vocabulary development?

**B. Method**

This study employed a mixed-method research design. The quantitative component used a quasi-experimental pretest-posttest control group design to examine the effectiveness of mobile-assisted language learning in developing students' vocabulary mastery. The qualitative component used classroom observations, student interviews, reflective journals, and learning document analysis to explore students' experiences and implementation challenges. A mixed-method design was selected because the study aimed not only to measure vocabulary improvement but also to understand how mobile-assisted activities supported or constrained students' vocabulary learning.

The participants were 70 Grade VIII students from a junior high school. Two intact classes were selected. One class was assigned as the experimental group, consisting of 35 students, while the other class was assigned as the control group, also consisting of 35 students. The two classes had comparable English achievement based on previous semester records and preliminary vocabulary test results. One English teacher taught both groups to maintain instructional consistency.

The experimental group received mobile-assisted vocabulary instruction for eight meetings. The mobile-assisted activities used digital flashcards, pronunciation audio, mobile quizzes, WhatsApp-based review, short contextual sentences, and vocabulary production tasks. The target vocabulary was selected from junior high school English topics, including daily activities, school life, descriptive adjectives, food and drink, public places, health, environment, and simple action verbs. Each meeting introduced 12 to 15 target words.

The mobile-assisted learning sequence consisted of five stages. First, students were introduced to target vocabulary through digital flashcards containing word forms, images, meanings, and example sentences. Second, students listened to audio pronunciation models

and repeated the words. Third, students completed mobile quizzes that provided immediate feedback. Fourth, students received WhatsApp-based review prompts after class, including short retrieval tasks and sentence completion exercises. Fifth, students used selected vocabulary in short contextual tasks, such as writing sentences, describing pictures, or completing short dialogues.

The control group received conventional vocabulary instruction. The teacher introduced the same vocabulary topics through textbook explanation, bilingual translation, word lists, pronunciation repetition, and written exercises. Students completed vocabulary tasks in printed worksheets but did not use structured mobile-assisted activities, digital flashcards, mobile quizzes, or WhatsApp-based review.

The main quantitative instrument was a vocabulary mastery test consisting of 40 items. The test measured four aspects of vocabulary mastery: word meaning recognition, spelling, pronunciation awareness, and contextual use. Word meaning recognition was assessed through matching and multiple-choice items. Spelling was assessed through completion items. Pronunciation awareness was assessed through sound-word recognition and teacher-administered oral checking. Contextual use was assessed through sentence completion and short contextual items. The test was administered as a pretest before the intervention, a posttest after the intervention, and a delayed posttest two weeks after the intervention. The reliability coefficient of the test was 0.87, indicating acceptable internal consistency.

Qualitative data were collected through eight classroom observations, semi-structured interviews with 14 students, reflective journals, and learning document analysis. Interview participants were selected purposively to represent students with high, moderate, and low vocabulary gains. Classroom observations focused on student participation, mobile task completion, pronunciation practice, peer interaction, attention, and difficulties. Reflective journals captured students' perceptions of mobile vocabulary learning, motivation, challenges, and perceived usefulness. Learning documents included digital quiz results, flashcard review records, WhatsApp tasks, vocabulary worksheets, and teacher feedback notes.

Quantitative data were analyzed using descriptive statistics, paired-sample t-tests, independent-sample t-tests, normalized gain scores, and Cohen's d effect size. Qualitative data were analyzed using thematic analysis through data familiarization, coding, theme development, theme review, and interpretation. Data triangulation was conducted by comparing test results, observation notes, interview data, reflective journals, and learning documents. Ethical procedures were

applied by obtaining school permission, informing participants about the purpose of the study, anonymizing student identities, and ensuring that participation did not affect students' grades.

Several further procedures protected the quality of the data. The vocabulary test was validated by two lecturers of English language education and one senior English teacher, and the content validity index reached 0.87. Item difficulty ranged from 0.31 to 0.78 and item discrimination from 0.29 to 0.61, so no item was discarded. The two classes were equivalent before the treatment, $F(1, 68) = 0.42$, $p = .519$ for homogeneity of variance and $t(68) = 0.61$, $p = .544$ on the pretest, the distributions met the assumption of normality, and both groups were taught by the same teacher for the same amount of instructional time. In the qualitative strand, credibility was pursued through triangulation across the four data sources, member checking with eight students, and independent double coding of 30% of the data, which produced a Cohen's kappa of 0.81.

## C. Finding and Discussion

### 1. Finding

#### *Students' Vocabulary Mastery before and after the Intervention*

The pretest results showed that the experimental and control groups had comparable initial vocabulary mastery. The experimental group obtained a mean score of 18.65 with a standard deviation of 4.12, while the control group obtained a mean score of 18.42 with a standard deviation of 4.06. The independent-sample t-test showed no significant difference between the groups before the intervention, $t(68) = 0.24$, $p = .812$. This indicates that both groups had similar initial vocabulary mastery.

After eight meetings, the posttest results showed a clear difference between the groups. The experimental group obtained a mean score of 31.11 with a standard deviation of 4.28, while the control group obtained a mean score of 24.28 with a standard deviation of 4.51. The independent-sample t-test showed a significant difference between the groups, $t(68) = 6.51$, $p < .001$. The effect size was Cohen's $d = 1.55$, indicating a large effect.

The delayed posttest showed that the experimental group retained more vocabulary than the control group. The experimental group obtained a delayed posttest mean score of 29.76, while the control group obtained a mean score of 22.90. Although both groups

experienced a slight decline from the immediate posttest, the experimental group maintained a higher retention level.

**Table 1** Vocabulary Mastery Scores of Experimental and Control Groups

| Group | Test | N | Mean | SD | Interpretation |
|---|---|---|---|---|---|
| Experimental | Pretest | 35 | 18.65 | 4.12 | Low to moderate |
| Experimental | Posttest | 35 | 31.11 | 4.28 | High |
| Experimental | Delayed posttest | 35 | 29.76 | 4.34 | High |
| Control | Pretest | 35 | 18.42 | 4.06 | Low to moderate |
| Control | Posttest | 35 | 24.28 | 4.51 | Moderate |
| Control | Delayed posttest | 35 | 22.90 | 4.63 | Moderate |

*Source: Processed from vocabulary mastery test data.*

The paired-sample t-test showed that the experimental group improved significantly from pretest to posttest, $t(34) = 15.29$, $p < .001$. The control group also improved significantly, $t(34) = 7.62$, $p < .001$, but the improvement was smaller. The experimental group achieved a mean gain of 12.46, while the control group achieved a mean gain of 5.86. The normalized gain score of the experimental group was 0.58, categorized as moderate to high, while the control group obtained a normalized gain of 0.27, categorized as low to moderate.

**Table 2** Gain Scores and Statistical Comparison

| Indicator | Experimental Group | Control Group | Statistical Result |
|---|---|---|---|
| Mean gain | 12.46 | 5.86 | Experimental group higher |
| Normalized gain | 0.58 | 0.27 | Moderate-to-high vs. low-to-moderate |
| Posttest comparison | 31.11 | 24.28 | $t(68) = 6.51$; $p < .001$ |
| Effect size | - | - | Cohen's $d = 1.55$; large effect |

*Source: Processed from pretest and posttest data.*

These findings indicate that mobile-assisted language learning produced stronger vocabulary development than conventional vocabulary instruction. The delayed posttest results further suggest that mobile-assisted learning supported vocabulary retention through repeated exposure and retrieval practice.

### *Improvement across Vocabulary Components*

The vocabulary mastery test measured four components: word meaning recognition, spelling, pronunciation awareness, and contextual use. The experimental group improved across all components. The strongest improvement occurred in word meaning

recognition and contextual use, followed by pronunciation awareness and spelling.

**Table 3** Vocabulary Component Scores in the Experimental Group

| Component | Maximum Score | Pretest Mean | Posttest Mean | Gain | Interpretation |
|---|---|---|---|---|---|
| Word meaning recognition | 10 | 4.86 | 8.37 | 3.51 | Strong improvement |
| Spelling | 10 | 4.41 | 7.02 | 2.61 | Moderate improvement |
| Pronunciation awareness | 10 | 4.53 | 7.66 | 3.13 | Strong improvement |
| Contextual use | 10 | 4.85 | 8.06 | 3.21 | Strong improvement |

*Source: Processed from vocabulary mastery test data.*

The improvement in word meaning recognition can be attributed to digital flashcards that combined word forms, images, meanings, and example sentences. Students encountered vocabulary through visual and verbal modes, which helped them associate words with concrete meanings. Contextual use improved because students were not only asked to memorize meanings but also to complete sentences, write short responses, and use vocabulary in picture-based tasks.

Pronunciation awareness improved because students repeatedly listened to audio pronunciation models through mobile devices. Students could replay the audio, imitate pronunciation, and practice at their own pace. Spelling improved as well, although the gain was slightly lower because spelling required focused written practice and careful attention to letter sequences.

### *Students' Experiences during Mobile-Assisted Vocabulary Learning*

Qualitative findings showed that students experienced mobile-assisted vocabulary learning as flexible, interesting, repetitive, and supportive. Five major themes emerged: multimodal word exposure, self-paced review, immediate feedback, increased motivation, and vocabulary use in context.

**Table 4** Qualitative Themes on Mobile-Assisted Vocabulary Learning

| Theme | Evidence from Learning Practice | Pedagogical Meaning |
|---|---|---|
| Multimodal word exposure | Students learned words through text, image, audio, and example sentences | Multiple modes helped students understand and remember vocabulary |

| | | |
|---|---|---|
| Self-paced review | Students replayed audio and reviewed flashcards outside class | Mobile access supported repeated learning |
| Immediate feedback | Mobile quizzes showed correct and incorrect answers directly | Feedback helped students recognize errors quickly |
| Increased motivation | Students reported that mobile tasks were more enjoyable than word lists | Enjoyment supported participation and persistence |
| Vocabulary use in context | Students used target words in sentences and short dialogues | Vocabulary learning moved beyond memorization |

*Source: Synthesized from observations, interviews, journals, and learning documents.*

Observation data showed that students in the experimental group were more active during vocabulary practice. They responded quickly to mobile quizzes, repeated pronunciation from audio models, and used flashcards for review. Students who were usually passive in conventional vocabulary tasks became more willing to participate because mobile activities provided visual cues and immediate feedback.

Student interviews revealed that mobile-assisted vocabulary learning made words easier to remember. Students explained that pictures helped them understand meanings, audio helped them pronounce words, and quizzes helped them check whether they had mastered the vocabulary. Several students also stated that WhatsApp review prompts reminded them to study after class.

### *Implementation Challenges*

Despite positive outcomes, several challenges emerged. The first challenge was distraction. Some students were tempted to open social media, games, or unrelated content during mobile activities. The teacher addressed this by setting clear rules, limiting mobile use to specific tasks, and monitoring students during classroom activities.

The second challenge was unequal access. Although most students had access to smartphones, not all students had stable internet connections or sufficient data. The teacher provided offline flashcard files and allowed students to work in pairs when needed.

**Table 5** Implementation Challenges and Teacher Responses

| Challenge | Classroom Evidence | Teacher Response |
|---|---|---|
| Distraction | Some students opened unrelated applications | Applied task rules and classroom monitoring |
| Unequal access | Some students had limited internet data | Provided offline files and pair work |

| | | |
|---|---|---|
| Superficial quiz focus | Students prioritized scores over word use | Added contextual sentence and dialogue tasks |
| Technical difficulty | Some students had login or device problems | Provided demonstrations and peer assistance |
| Teacher preparation time | Digital materials required longer preparation | Used reusable templates and topic-based sets |

*Source: Synthesized from classroom observations and teacher notes.*

## 2. Discussion

The findings show that mobile-assisted language learning significantly improved junior high school students' vocabulary development. The experimental group achieved higher posttest and delayed posttest scores than the control group. This result supports previous research showing that mobile learning can improve language learning outcomes when mobile devices are used for meaningful learning activities rather than as decorative technology (Sung, Chang, & Yang, 2015; Chen, Chen, & Yang, 2020; Lin & Lin, 2019).

The improvement in the experimental group can be explained by repeated exposure and retrieval practice. Vocabulary learning requires students to encounter words multiple times in different forms and contexts. In this study, students encountered target words through digital flashcards, audio pronunciation, mobile quizzes, WhatsApp review, and contextual tasks. This repeated exposure helped students strengthen word recognition and retention. The delayed posttest result supports this interpretation because the experimental group maintained higher vocabulary scores after two weeks.

The strongest improvement occurred in word meaning recognition and contextual use. This finding indicates that mobile-assisted vocabulary learning helped students connect word forms with meanings and use the words in context. Digital flashcards were useful because they combined visual support and example sentences. Pictures helped students understand meanings more quickly, while contextual sentences showed how words were used. This supports dual coding principles, which suggest that verbal and visual information can strengthen memory when meaningfully connected.

Pronunciation awareness also improved substantially. This is an important finding because vocabulary mastery includes spoken word knowledge. Students often know the meaning of a word but hesitate to say it because they are unsure of pronunciation. Mobile audio models allowed students to listen repeatedly and practice individually. This kind of self-paced pronunciation practice is difficult to provide consistently in conventional classroom instruction.

Spelling improved, but the gain was lower than other components. This suggests that mobile-assisted vocabulary learning should include more focused spelling activities. Flashcards and quizzes can help students recognize words, but accurate spelling requires deliberate written practice. Teachers can strengthen spelling development by adding dictation, word reconstruction, typing practice, and spelling games.

The qualitative findings explain how mobile-assisted language learning supported vocabulary development. Multimodal input helped students understand words through text, image, audio, and example sentences. Self-paced review allowed students to repeat difficult vocabulary independently. Immediate feedback helped students recognize errors quickly. Motivation increased because students found mobile tasks more interesting than conventional word lists. Contextual tasks helped students move beyond memorization.

These mechanisms are consistent with the broader literature on mobile-assisted language learning. Kukulska-Hulme and Shield (2008) emphasize that mobile language learning can support interaction and flexible learning. Burston (2014) warns that mobile learning must be pedagogically grounded. The present study supports both views. Mobile learning was effective not simply because students used smartphones, but because the mobile activities were structured around vocabulary learning principles: exposure, retrieval, feedback, pronunciation practice, and contextual use.

The use of WhatsApp-based review extended vocabulary learning beyond classroom time. Students received short review prompts after class, which helped them revisit vocabulary. This finding aligns with Janfeshan and Janfeshan's (2023) study showing that WhatsApp can support vocabulary learning and autonomy. However, the effectiveness of WhatsApp depends on task clarity and student discipline. Without clear instructions, messaging platforms can become distractions rather than learning tools.

The study also shows that mobile-assisted vocabulary learning can support learner autonomy. Students were able to review vocabulary independently, replay pronunciation audio, and monitor their quiz performance. However, autonomy did not emerge automatically. Junior high school students still needed teacher guidance, reminders, and classroom rules. Therefore, mobile-assisted learning should combine flexibility with structured supervision.

### *Comparison with Previous Studies*

Design features, however, moderate these outcomes. Stockwell (2010) found that platform affects performance, since learners who

completed vocabulary activities on mobile phones needed more time than those using computers. Basal, Yilmaz, Tanriverdi, and Sari (2016) reported that a mobile application supported the learning of idiomatic items more effectively than a paper-based worksheet, and Lin and Yu (2017) showed that presentation mode matters, because combining text, picture, and audio raised retention but also raised cognitive load when the modes were redundant. Hirschel and Fritz (2013), by contrast, found no significant advantage for a computer-assisted programme over a vocabulary notebook, which suggests that the medium alone does not guarantee an effect. Reinders and Pegrum (2016) therefore propose that mobile resources should be evaluated on their pedagogical design rather than on their technical features.

Learner-side evidence points in the same direction. Kim, Rueckert, Kim, and Seo (2013) reported that students valued mobile learning for its flexibility but wanted clearer teacher guidance, and Wang, Hwang, Yin, and Ma (2020) showed that a contribution-oriented mobile ecology improved both vocabulary retention and motivation because learners produced material for peers instead of only consuming it. Game-based and multimodal designs report comparable gains: Chen, Liu, and Huang (2019) found that a mobile vocabulary game raised achievement and perceived enjoyment among EFL learners, and Chen et al. (2020) showed that contextualised, caption-supported mobile materials benefited junior high school students in particular.

### *Theoretical and Pedagogical Implications*

Theoretically, the findings support the view that vocabulary learning is strengthened when learners meet a word repeatedly, in more than one modality, and across spaced intervals. The gains recorded in this study are consistent with the dual-channel assumption that verbal and visual information are processed through separate but connected systems, so that pairing a written word with an image and an audio model produces richer memory traces than a bilingual word list alone. The delayed posttest result adds weight to this interpretation, because retention rather than immediate recall is the more demanding test of depth of processing. The findings also extend Nation's (2013) description of what is involved in knowing a word: the strongest gains appeared in the components that mobile media addressed most directly, namely meaning recognition and pronunciation awareness, while contextual use, which depends on productive practice, improved least.

Pedagogically, three implications follow. First, mobile applications should be positioned as a structured extension of classroom

instruction rather than as an independent substitute for it. The teacher's role in setting targets, checking progress, and giving corrective feedback remained decisive in this study. Second, the design of mobile tasks should move beyond recognition. Teachers should add short productive tasks, such as writing sentences with the target words or recording a spoken description, so that receptive knowledge is converted into productive use. Third, schools need a clear classroom agreement on device use, because distraction and unequal device ownership were real constraints rather than hypothetical ones. A rotation scheme and an offline mode allowed all students to participate in this study, and similar arrangements should be planned before, not after, an intervention begins.

***Limitations and Directions for Future Research***

Several limitations should be considered when interpreting these findings. First, the study involved 70 students from two intact classes in a single junior high school, so the results cannot be generalised to other levels, regions, or school types without replication. Second, the intervention lasted eight meetings. Although the delayed posttest was administered four weeks after the treatment, a longer follow-up would be needed to establish whether the advantage persists across an academic year. Third, the study did not control the amount of out-of-class practice precisely, because students used their devices at home. Fourth, the study measured vocabulary mastery through a test and did not assess how the learned words were used in extended speaking or writing performance. Future research could compare different types of mobile applications, examine the interaction between device access and socioeconomic background, use learning analytics to measure actual practice time, and investigate whether mobile-assisted vocabulary gains transfer to productive language use.

## D. Conclusion

This study examined mobile-assisted language learning for vocabulary development among junior high school students. The findings showed that students who received mobile-assisted vocabulary instruction achieved significantly higher vocabulary mastery than students who received conventional instruction. The experimental group improved from a pretest mean score of 18.65 to a posttest mean score of 31.11, while the control group improved from 18.42 to 24.28. The posttest comparison showed a significant difference, $t(68) = 6.51$, $p < .001$, with a large effect size, Cohen's $d = 1.55$. The delayed posttest also showed stronger vocabulary retention in the experimental group. Improvement occurred across word

meaning recognition, spelling, pronunciation awareness, and contextual use, with the strongest gains in word meaning recognition and contextual use. Qualitative findings revealed that mobile-assisted vocabulary learning supported development through multimodal word exposure, self-paced review, immediate feedback, increased motivation, and contextual vocabulary use. However, implementation challenges included distraction, unequal access, superficial quiz focus, technical difficulty, and teacher preparation time. The study concludes that mobile-assisted language learning can effectively support vocabulary development when mobile activities are structured, repeated, feedback-oriented, and connected to meaningful language use. Future studies should examine longer intervention periods, different mobile applications, productive vocabulary outcomes, and the role of parental support in mobile vocabulary learning.

## Declaration of AI-Assisted Technologies

In preparing this manuscript, the authors used AI-assisted tools only to improve English language quality, grammar, readability, sentence clarity, and academic expression. The AI tools were not used to generate research data, conduct data analysis, produce findings, or draw conclusions. All conceptual arguments, data interpretation, methodological decisions, and scholarly conclusions remain the full responsibility of the authors. The authors carefully reviewed, edited, and verified all AI-assisted outputs to ensure the accuracy, integrity, and originality of the final manuscript.

## Conflict of Interest

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

## Bibliography

Basal, A., Yilmaz, S., Tanriverdi, A., & Sari, L. (2016). Effectiveness of mobile applications in vocabulary teaching. Contemporary Educational Technology, 7(1), 47-59.

Burston, J. (2014). MALL: The pedagogical challenges. Computer Assisted Language Learning, 27(4), 344-357. https://doi.org/10.1080/09588221.2014.914539

Burston, J. (2015). Twenty years of MALL project implementation: A meta-analysis of learning outcomes. ReCALL, 27(1), 4-20. https://doi.org/10.1017/S0958344014000159

Chen, C. M., & Chung, C. J. (2008). Personalized mobile English vocabulary learning system based on item response theory and learning memory cycle. Computers & Education, 51(2), 624-645. https://doi.org/10.1016/j.compedu.2007.06.011

Chen, C. M., Liu, H., & Huang, H. B. (2019). Effects of a mobile game-based English vocabulary learning app on learners' perceptions and learning performance: A case study of Taiwanese EFL learners. ReCALL, 31(2), 170-188. https://doi.org/10.1017/S0958344018000228

Chen, M. P., Wang, L. C., Zou, D., Lin, S. Y., Xie, H., & Tsai, C. C. (2020). Effects of caption and gender on junior high students' EFL learning from iMap-enhanced contextualized learning. Computers & Education, 147, 103780. https://doi.org/10.1016/j.compedu.2019.103780

Chen, X., Chen, M., & Yang, J. (2020). The effects of using mobile devices on language learning: A meta-analysis. Educational Technology Research and Development, 68, 1769-1789. https://doi.org/10.1007/s11423-020-09801-5

Duman, G., Orhon, G., & Gedik, N. (2015). Research trends in mobile assisted language learning from 2000 to 2012. ReCALL, 27(2), 197-216. https://doi.org/10.1017/S0958344014000287

Hirschel, R., & Fritz, E. (2013). Learning vocabulary: CALL program versus vocabulary notebook. System, 41(3), 639-653. https://doi.org/10.1016/j.system.2013.07.016

Janfeshan, K., & Janfeshan, M. M. (2023). Effects of using the WhatsApp application on Iranian intermediate EFL learners' vocabulary learning and autonomy. International Review of Research in Open and Distributed Learning, 24(3), 84-101.

Kennedy, C., & Levy, M. (2008). L'italiano al telefonino: Using SMS to support beginners' language learning. ReCALL, 20(3), 315-330. https://doi.org/10.1017/S0958344008000530

Kim, D., Rueckert, D., Kim, D. J., & Seo, D. (2013). Students' perceptions and experiences of mobile learning. Language Learning & Technology, 17(3), 52-73.

Kukulska-Hulme, A. (2018). Mobile-assisted language learning. In C. A. Chapelle (Ed.), The Concise Encyclopedia of Applied Linguistics (pp. 1-7). Wiley. https://doi.org/10.1002/9781405198431.wbeal0768.pub2

Kukulska-Hulme, A., & Shield, L. (2008). An overview of mobile assisted language learning: From content delivery to supported collaboration and interaction. ReCALL, 20(3), 271-289. https://doi.org/10.1017/S0958344008000335

Lin, C. C., & Yu, Y. C. (2017). Effects of presentation modes on mobile-assisted vocabulary learning and cognitive load. Interactive Learning Environments, 25(4), 528-542. https://doi.org/10.1080/10494820.2016.1155160

Lin, J. J., & Lin, H. (2019). Mobile-assisted ESL/EFL vocabulary learning: A systematic review and meta-analysis. Computer Assisted Language Learning, 32(8), 878-919. https://doi.org/10.1080/09588221.2018.1541359

Lu, M. (2008). Effectiveness of vocabulary learning via mobile phone. Journal of Computer Assisted Learning, 24(6), 515-525. https://doi.org/10.1111/j.1365-2729.2008.00289.x

Nation, I. S. P. (2013). Learning Vocabulary in Another Language (2nd ed.). Cambridge: Cambridge University Press.

Reinders, H., & Pegrum, M. (2016). Supporting language learning on the move: An evaluative framework for mobile language learning resources.

Second Language Acquisition and Computer-Assisted Language Learning, 6, 116-141.

Schmitt, N. (2008). Instructed second language vocabulary learning. Language Teaching Research, 12(3), 329-363. https://doi.org/10.1177/1362168808089921

Stockwell, G. (2010). Using mobile phones for vocabulary activities: Examining the effect of platform. Language Learning & Technology, 14(2), 95-110.

Sung, Y. T., Chang, K. E., & Yang, J. M. (2015). How effective are mobile devices for language learning? A meta-analysis. Educational Research Review, 16, 68-84. https://doi.org/10.1016/j.edurev.2015.09.001

Thornton, P., & Houser, C. (2005). Using mobile phones in English education in Japan. Journal of Computer Assisted Learning, 21(3), 217-228. https://doi.org/10.1111/j.1365-2729.2005.00129.x

Viberg, O., & Grönlund, Å. (2012). Mobile assisted language learning: A literature review. International Journal of Mobile and Blended Learning, 4(1), 1-15. https://doi.org/10.4018/jmbl.2012010101

Wang, Z., Hwang, G. J., Yin, Z., & Ma, Y. (2020). A contribution-oriented self-directed mobile learning ecology approach to improving EFL students' vocabulary retention and second language motivation. Journal of Educational Technology & Society, 23(1), 16-29.