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The Impact of Mobile-Assisted Vocabulary Practice on English Vocabulary Development among ESL Learners

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Abstract

This study explored the effect of mobile-assisted vocabulary practice on the English vocabulary development of ESL learners. The research adopted a quasi-experimental pre-test and post-test design with two groups: an experimental group that received vocabulary instruction through mobile-assisted learning activities and a control group that followed traditional classroom-based vocabulary instruction. A total of 60 ESL learners participated in the study, with 30 learners assigned to each of the two groups. A vocabulary achievement test was administered as a pre-test and post-test to measure learners' vocabulary knowledge before and after the intervention. The instructional treatment was implemented over a six-week period, during which the experimental group engaged in regular mobile-based vocabulary practice, while the control group relied on conventional teaching methods. The collected data were analysed using descriptive statistics and inferential statistical tests. Paired samples t-tests were conducted to examine vocabulary improvement within each group, and an independent samples t-test was used to compare post-test performance between the two groups. The results indicated that both groups showed statistically significant improvement in vocabulary knowledge over time. However, the experimental group demonstrated substantially greater gains than the control group. The post-test scores of the experimental group were significantly higher, and effect size calculations revealed a strong practical impact of mobile-assisted vocabulary practice on learners' vocabulary development. Overall, the findings confirm that mobile-assisted vocabulary practice is more effective than traditional vocabulary instruction in enhancing ESL learners' vocabulary acquisition and suggest that mobile learning can play a valuable role in modern language education.

Keywords: Mobile-Assisted Learning, Vocabulary Acquisition, Esl Learners, Mobile Technology, English Language Teaching

Introduction

Mobile technologies have become an integral part of everyday communication and learning, leading to growing interest in their pedagogical potential for second language acquisition. In the field of English as a Second Language education, mobile-assisted language learning has attracted particular attention for its ability to support vocabulary development beyond traditional classroom settings. Mobile-assisted vocabulary practice refers to the use of smartphones and mobile applications to engage learners in vocabulary learning activities such as digital flashcards, spaced repetition exercises, quizzes, and gamified word practice. According to Lin and Lin (2019), mobile-assisted approaches offer flexible and learner-centred environments that can enhance vocabulary learning outcomes when compared with conventional methods.

Vocabulary knowledge is a foundational component of second language proficiency, influencing learners' reading comprehension, writing accuracy, listening skills, and oral fluency. Despite its importance, vocabulary learning remains a persistent challenge for ESL learners due to limited exposure, insufficient practice opportunities, and difficulties with retention. Mihaylova et al. (2022) argue that mobile technologies

are well-suited to address these challenges because they allow frequent, short learning sessions that align with cognitive principles such as spaced learning and retrieval practice. These principles are known to promote long-term retention and deeper lexical knowledge.

One of the main advantages of mobile-assisted vocabulary practice is its capacity to support learning anytime and anywhere. Okumuş Dağdeler (2023) notes that mobile devices enable learners to integrate vocabulary study into their daily routines, thereby increasing time-on-task without increasing classroom workload. This flexibility is particularly beneficial in ESL contexts where instructional time is often limited, and learners rely heavily on self-directed learning. Furthermore, mobile applications frequently provide immediate feedback, pronunciation support, and contextualised examples, which can facilitate both receptive and productive vocabulary development.

Empirical research has increasingly examined the effectiveness of mobile-assisted vocabulary learning through experimental and quasi-experimental designs. Lin and Lin's (2019) meta-analysis of ESL and EFL studies found a moderate to strong overall effect of mobile-assisted vocabulary instruction on learners' vocabulary gains, especially when compared to traditional paper-based methods. Similarly, Mihaylova et al. (2022), in their meta-analysis of mobile-assisted language learning applications, reported positive effects on vocabulary acquisition while emphasising that instructional design and task quality significantly influence learning outcomes.

Recent studies have also explored specific mobile tools, such as digital flashcards, to determine their effectiveness. Zarrati et al. (2024) compared vocabulary learning outcomes from smartphone-based flashcards and computer-based flashcards and found that mobile users demonstrated higher engagement and better delayed retention. These findings suggest that portability and frequent access may play a key role in strengthening vocabulary consolidation. Ji and Aziz (2021), in their systematic review, similarly reported that learners using mobile-assisted vocabulary tools showed improved motivation and autonomy, which are critical factors in sustained language learning.

Despite these promising findings, researchers caution against viewing mobile-assisted vocabulary practice as inherently effective in all contexts. Okumuş Dağdeler (2023) highlights challenges such as unequal access to mobile devices, limited digital literacy, and the tendency of some applications to prioritise entertainment over pedagogical depth. In addition, Lin and Lin (2019) emphasise the need for longer intervention periods and more rigorous experimental designs to better assess long-term vocabulary retention and transfer to communicative language use.

Overall, existing literature indicates that mobile-assisted vocabulary practice can have a positive impact on English vocabulary development among ESL learners when it is grounded in sound pedagogical principles. Studies consistently show that mobile tools are most effective when they incorporate spaced repetition, active recall, meaningful feedback, and alignment with classroom instruction (Mihaylova et al., 2022; Ji & Aziz, 2021). However, there remains a need for further research that examines diverse ESL contexts, learner proficiency levels, and the integration of mobile practice with formal instruction. Investigating these dimensions will help clarify how mobile-assisted vocabulary learning can be effectively implemented to support sustainable vocabulary development among ESL learners.

Significance of the Research

This study is significant because it provides empirical insight into how mobile-assisted vocabulary practice can enhance English vocabulary development among ESL learners in an era where mobile technology is already embedded in students' everyday lives. By examining vocabulary learning through mobile-based tools, the study contributes to existing ESL and MALL research by clarifying whether such practices meaningfully improve vocabulary acquisition and retention rather than merely increasing learner engagement. The findings are expected to inform ESL teachers, curriculum designers, and educational policymakers about the pedagogical value of integrating mobile vocabulary applications into formal instruction. In addition, the study addresses gaps identified in previous research, particularly in an era where mobile technology is already an integral part of instructional design and practical classroom implementation, offering evidence-based guidance on how mobile-assisted vocabulary learning can be used effectively to support autonomous learning and long-term vocabulary growth.

Research Objectives

To examine the impact of mobile-assisted vocabulary practice on the English vocabulary development of ESL learners

To compare the vocabulary learning outcomes of ESL learners using mobile-assisted vocabulary practice with those using traditional vocabulary learning methods.

Research Questions

What effect does mobile-assisted vocabulary practice have on the English vocabulary development of ESL learners?

Is there a significant difference in vocabulary learning outcomes between ESL learners who use mobile-assisted vocabulary practice and those who rely on traditional vocabulary learning approaches?

Literature Review

Vocabulary Learning in Second Language Acquisition

Vocabulary knowledge is a core component of second language proficiency, underpinning learners' abilities in reading, writing, listening, and speaking. Nation (2013) emphasises that vocabulary size and depth directly influence comprehension and communicative competence, while Schmitt (2010) argues that effective vocabulary instruction must address both form–meaning connections and opportunities for use. Traditional ESL vocabulary instruction has relied on textbooks, word lists, and teacher-led explanations. Although these methods remain valuable, they often provide limited opportunities for repeated exposure and individualised practice, which are essential for durable learning (Hulstijn, 2001).

Research in cognitive psychology has long demonstrated that repetition, recall, and spacing are critical to memory formation. Early experimental work by Thorndike (1914) showed that recall-based practice leads to stronger retention than simple repetition. These principles have informed modern approaches to vocabulary teaching, including digital and mobile-based tools that operationalise retrieval practice and spaced repetition. As learners increasingly rely on mobile devices in their daily lives, scholars have begun to explore how these technologies can be harnessed to support vocabulary development in ESL contexts.

Emergence of Mobile-Assisted Language Learning

Mobile-assisted language learning (MALL) refers to the use of portable digital devices, such as smartphones and tablets, to facilitate language learning across contexts. Kukulska-Hulme (2009) argues that mobility changes the nature of language learning by extending it beyond classroom boundaries and allowing learners to engage with language in authentic and personal settings. Godwin-Jones (2011) further notes that mobile applications provide flexible, learner-controlled environments that encourage autonomy and sustained engagement.

Over the past two decades, research on MALL has expanded rapidly. Burston's (2015) meta-analysis of twenty years of MALL research shows a steady increase in empirical studies examining language skills, with vocabulary emerging as one of the most frequently investigated areas. This trend reflects the suitability of mobile technologies for vocabulary practice, given their capacity to deliver short, repetitive, and multimedia-rich learning activities.

Theoretical Foundations of Mobile Vocabulary Practice

Mobile-assisted vocabulary learning is grounded in several well-established learning theories. Dual coding theory suggests that combining verbal and visual input enhances memory, a principle frequently applied in mobile applications through the use of images, audio pronunciation, and contextualised examples. Multimedia learning environments are particularly effective for vocabulary acquisition because they support deeper cognitive processing (Nation, 2013).

Another key theoretical foundation is spaced repetition. Hulstijn (2001) highlights that distributed practice over time leads to better long-term retention than massed practice. Many mobile vocabulary applications incorporate algorithms that schedule review sessions based on learners' performance, thereby aligning practice with individual learning needs. Retrieval practice, which requires learners to actively recall word meanings rather than passively review them, has also been shown to strengthen memory traces and facilitate vocabulary retention (Schmitt, 2010).

Learner autonomy is another important dimension. According to Oxford (2017), autonomous learning strategies empower learners to take control of their language development. Mobile-assisted vocabulary practice supports autonomy by allowing learners to choose when, where, and how they engage with vocabulary tasks, thus fostering self-regulated learning behaviours.

Empirical Evidence on Mobile-Assisted Vocabulary Learning

A substantial body of empirical research has investigated the effectiveness of mobile-assisted vocabulary practice. Lin and Lin (2019), in their systematic review and meta-analysis of ESL and EFL studies, report that mobile-assisted vocabulary learning has a moderate to strong positive effect on vocabulary outcomes compared to traditional methods. Their analysis indicates that studies employing spaced repetition and interactive tasks tend to produce larger effect sizes.

Similarly, Mihaylova et al. (2022) conducted a meta-analysis focusing on mobile-assisted language learning applications and found significant positive effects on vocabulary acquisition and delayed retention. However, they also caution that the effectiveness of mobile tools depends heavily on instructional design, duration of intervention, and learner engagement. These findings suggest that mobile technology itself does not guarantee learning gains; rather, pedagogically informed use is essential.

Systematic reviews further support these conclusions. Ji and Aziz (2021) reviewed studies on mobile-assisted vocabulary learning platforms and found consistent improvements in learners' vocabulary knowledge, motivation, and autonomy. Okumuş Dağdeler (2023) also reports that most studies show positive outcomes, though methodological limitations such as small sample sizes and short treatment periods remain common.

Digital Flashcards and Vocabulary Retention

Digital flashcards are among the most widely studied mobile tools for vocabulary learning. Stockwell (2010) compared vocabulary learning via mobile phones and desktop computers and found that mobile users engaged more frequently with vocabulary tasks, although learning outcomes depended on task design and learner preferences. This suggests that portability and accessibility may increase practice frequency, a key factor in vocabulary development.

More recent research by Rahmani, Asadi, and Xodabande (2022) examined out-of-class mobile-assisted vocabulary learning using digital flashcards. Their quasi-experimental study revealed that learners who used mobile flashcards significantly outperformed control groups on both immediate and delayed vocabulary tests. These findings align with Zarrati et al. (2024), who compared smartphone-based and computer-based digital flashcards and found higher engagement and better retention among mobile users.

These studies collectively indicate that mobile flashcards can be particularly effective for receptive vocabulary learning, as they facilitate repeated exposure and active recall. However, researchers note that productive vocabulary gains may require additional contextualised practice beyond what flashcards typically offer (Schmitt, 2010).

Learner Motivation and Perceptions

In addition to learning outcomes, researchers have examined learners' attitudes toward mobile-assisted vocabulary learning. Positive perceptions are often linked to higher motivation and sustained use. Godwin-Jones (2011) reports that learners appreciate the convenience and interactivity of mobile applications, which can reduce anxiety and increase willingness to practice vocabulary independently

Ji and Aziz (2021) similarly found that mobile-assisted vocabulary learning enhanced learner motivation and confidence, particularly among students who struggled with traditional classroom-based instruction. Oxford (2017) argues that such motivational benefits are crucial, as affective factors strongly influence language learning success. Gamified features, immediate feedback, and progress tracking in mobile apps further contribute to learner engagement and persistence.

Challenges and Limitations

Despite the overall positive findings, the literature also identifies several challenges associated with mobile-assisted vocabulary practice. Burston (2015) notes that many MALL studies lack rigorous experimental designs, limiting the generalizability of their results Short intervention periods and reliance on self-reported data are common weaknesses in the field.

Access and equity issues also pose challenges. Not all learners have equal access to smartphones or stable internet connections, which can exacerbate existing educational

inequalities (Kukulska-Hulme, 2009). In addition, teachers may lack training or confidence in integrating mobile tools into formal curricula, reducing their pedagogical effectiveness.

Another limitation concerns the depth of vocabulary knowledge. While mobile tools are effective for learning word meanings and forms, they may be less effective for teaching collocations, pragmatic usage, and productive skills unless combined with classroom-based instruction (Nation, 2013).

Overall, the literature demonstrates that mobile-assisted vocabulary practice has considerable potential to enhance English vocabulary development among ESL learners. Meta-analyses and systematic reviews consistently report positive effects on vocabulary acquisition, retention, motivation, and learner autonomy (Lin & Lin, 2019; Mihaylova et al., 2022; Okumuş Dağdeler, 2023). However, gaps remain regarding long-term effects, productive vocabulary development, and implementation in diverse ESL contexts.

Future research should employ longitudinal designs, larger samples, and mixed-method approaches to better understand how mobile-assisted vocabulary practice can be integrated with classroom instruction. Addressing these gaps will contribute to a more comprehensive understanding of how mobile technologies can support sustainable vocabulary development in ESL education.

Research Methodology

Research Design

This study adopted a quantitative quasi-experimental research design to examine the impact of mobile-assisted vocabulary practice on English vocabulary development among ESL learners. A quasi-experimental design was considered appropriate because it allows for comparison between an experimental group and a control group in an educational setting where random assignment is often impractical. The design involved a pre-test and post-test control group structure, enabling the measurement of vocabulary gains attributable to the mobile-assisted intervention.

Participants

The participants of the study were ESL learners enrolled in an English language course at the undergraduate level. A total of 60 students participated in the study and were divided into two groups: an experimental group (n = 30) and a control group (n = 30). Participants were selected using convenience sampling, as intact classes were used to facilitate classroom management and instructional consistency. All participants had a similar level of English proficiency, as determined by their course placement and pre-test scores.

Research Setting

The study was conducted in a formal ESL classroom setting at a higher education institution. All participants had access to smartphones and basic internet connectivity. The experimental group used mobile devices for vocabulary practice both inside and outside the classroom, while the control group received vocabulary instruction through traditional classroom methods, including textbooks and teacher-led explanations.

Instruments

Vocabulary Test

A researcher-developed English vocabulary test was used as both the pre-test and post-test to measure learners' vocabulary knowledge. The test consisted of multiple-choice and matching items designed to assess receptive vocabulary knowledge. The target vocabulary items were selected from the course syllabus to ensure relevance and content validity. The reliability of the test was established through a pilot study, yielding an acceptable Cronbach's alpha value.

Mobile-Assisted Vocabulary Tool

The experimental group used a mobile vocabulary application that provided digital flashcards, spaced repetition, pronunciation support, and immediate feedback. The application allowed learners to practice vocabulary independently and track their progress over time. The selected application was aligned with principles of retrieval practice and spaced learning to enhance vocabulary retention.

Treatment Procedure

The treatment lasted for six weeks. Both groups were taught the same target vocabulary items during regular classroom instruction. However, the mode of practice differed between the groups. The experimental group engaged in mobile-assisted vocabulary practice using the selected application for approximately 15–20 minutes per day, both during class and as out-of-class practice. The control group practised vocabulary using traditional methods such as paper-based exercises, word lists, and textbook activities.

At the beginning of the study, both groups completed the vocabulary pre-test to establish baseline equivalence. At the end of the treatment period, the same test was administered as a post-test to measure vocabulary gains.

Data Collection Procedure

Data were collected in three stages. First, informed consent was obtained from all participants. Second, the pre-test was administered to both groups under identical conditions. Third, after the six-week intervention, the post-test was administered. All test scores were recorded and coded for statistical analysis. The collected data were analysed using Statistical Package for the Social Sciences (SPSS). Descriptive statistics, including mean scores and standard deviations, were calculated to summarise participants' performance. An independent samples t-test was conducted to compare post-test scores between the experimental and control groups. Additionally, a paired samples t-test was used to examine within-group differences between pre-test and post-test scores. The level of significance was set at $p < .05$.

Validity and Reliability

To ensure content validity, the vocabulary test items were reviewed by ESL experts and aligned with the course syllabus. Reliability was established through pilot testing and internal consistency measures. Instructional validity was maintained by teaching the same vocabulary items to both groups and controlling the duration of instruction.

Ethical Considerations

Ethical guidelines were strictly followed throughout the study. Participation was voluntary, and participants were informed of the purpose of the research. Confidentiality and anonymity were ensured by assigning codes to participants instead of using names. Participants were informed that they could withdraw from the study at any stage without penalty.

Data Analysis

Overview of Data Analysis Approach

Data analysis in this study was conducted to determine the effect of mobile-assisted vocabulary practice on the English vocabulary development of ESL learners. Since the research followed a quasi-experimental pre-test/post-test design, the primary focus of the analysis was to compare vocabulary gains between the experimental and control groups. Quantitative data were analysed using statistical techniques to assess differences within and between groups. The analysis also examined assumptions of normality and variance homogeneity before inferential testing, as recommended in similar intervention research designs (e.g., Abdulrahman & Arifin, 2024).

Descriptive Statistics

Descriptive statistics were calculated to summarise learners' performance. This included:

Mean scores for pre-test and post-test results for both the experimental and control groups.

Standard deviations to assess variability within each group

Minimum and maximum values for context on the score range.

These descriptive metrics provided an initial overview of performance differences before and after treatment and were essential for interpreting the impact of the mobile-assisted intervention.

Table 1 Descriptive Statistics of Vocabulary Test Scores for Experimental and Control Groups

Group	Test	N	Mean	SD	Minimum	Maximum
Experimental	Pre-test	30	41.27	6.18	30	**53**
Experimental	Post-test	30	56.83	5.94	45	**68**
Control	Pre-test	30	40.90	6.05	29	**52**
Control	Post-test	30	47.10	6.22	35	**58**

Note. Scores represent total correct responses on the vocabulary test.

Table 1 presents the descriptive statistics for the vocabulary pre-test and post-test scores of the experimental and control groups. The results show that both groups had comparable vocabulary knowledge at the pre-test stage, indicating initial group equivalence. The experimental group obtained a mean score of 41.27 (SD = 6.18), while the control group recorded a similar mean of 40.90 (SD = 6.05). The close similarity in mean scores and standard deviations suggests that both groups started with nearly the same level of vocabulary proficiency before the intervention.

Following the six-week instructional period, noticeable differences emerged between the two groups. The experimental group, which received mobile-assisted vocabulary practice, achieved a post-test mean score of 56.83 (SD = 5.94). This reflects a substantial increase of 15.56 points from the pre-test mean. The relatively lower standard deviation in the post-test indicates that learners' performance became more consistent after the intervention, suggesting that mobile-assisted practice benefitted most learners in the group.

In contrast, the control group, which followed traditional vocabulary learning methods, showed a more modest improvement. The post-test mean score for the control group was 47.10 (SD = 6.22), representing an increase of 6.20 points from the pre-test mean. Although this improvement suggests that conventional instruction contributed to vocabulary development, the gain was considerably smaller than that observed in the experimental group.

A comparison of post-test means further highlights the impact of mobile-assisted vocabulary practice. The experimental group outperformed the control group by 9.73 points, indicating that learners who used mobile-based vocabulary tools demonstrated higher vocabulary achievement than those who relied on traditional methods. Additionally, the narrower score range and reduced variability in the experimental group suggest that mobile-assisted practice may help reduce performance gaps among learners.

Overall, the descriptive statistics indicate that while both instructional approaches supported vocabulary learning, mobile-assisted vocabulary practice resulted in greater improvement and more consistent performance. These results provide preliminary evidence that mobile-assisted learning can enhance vocabulary development more effectively than traditional instruction alone. Inferential statistical analysis, such as paired and independent samples t-tests, is necessary to determine whether these observed differences are statistically significant.

Inferential Statistical Tests

Inferential statistical analyses were conducted to examine the impact of mobile-assisted vocabulary practice on ESL learners' vocabulary development. Both paired samples t-tests and an independent samples t-test were employed to address within-group and between-group differences. The level of significance for all tests was set at $p < .05$.

Paired Samples t-Test

Paired samples t-tests were performed to compare the mean pre-test and post-test vocabulary scores within each group separately. This analysis was used to determine whether learners demonstrated statistically significant improvement over time as a result of the instructional treatment they received.

Table 2 Paired Samples t-Test Results for the Experimental Group

Measure	N	Mean	SD	t	df	p
Pre-test	30	41.27	6.18			
Post-test	30	56.83	5.94	−16.64	29	**< .001**

Note. A negative t-value indicates higher post-test scores.

Table 3

Paired Samples t-Test Results for the Control Group

Measure	N	Mean	SD	t	df	p
Pre-test	30	40.90	6.05			
Post-test	30	47.10	6.22	−6.92	29	< **.001**

Analysis of Paired Samples t-Test Results

The paired samples t-test for the experimental group revealed a statistically significant difference between pre-test and post-test vocabulary scores, $t(29) = -16.64$, $p < .001$. The substantial increase in mean scores indicates that learners who engaged in mobile-assisted vocabulary practice experienced significant vocabulary gains over the treatment period. This result provides strong evidence that the mobile-assisted intervention was effective in enhancing vocabulary learning.

The paired samples t-test for the control group also showed a statistically significant improvement, $t(29) = -6.92$, $p < .001$. This finding suggests that traditional vocabulary instruction contributed to learners' vocabulary development. However, the magnitude of improvement in the control group was noticeably smaller than that observed in the experimental group, indicating that traditional methods were less effective than mobile-assisted practice.

Independent Samples t-Test

An independent samples t-test was conducted to compare the post-test vocabulary scores of the experimental and control groups. This analysis aimed to determine whether the mobile-assisted vocabulary intervention resulted in significantly different learning outcomes compared to traditional instruction.

Table 4 Independent Samples t-Test Results for Post-Test Vocabulary Scores

Group	N	Mean	SD	t	df	p
Experimental	30	56.83	5.94			
Control	30	47.10	6.22	6.21	58	< **.001**

Analysis of Independent Samples t-Test Results

The independent samples t-test revealed a statistically significant difference between the post-test scores of the experimental and control groups, $t(58) = 6.21$, $p < .001$. Learners who participated in mobile-assisted vocabulary practice achieved significantly higher vocabulary scores than those who received traditional instruction. This result indicates that the observed improvement in the experimental group cannot be attributed to chance alone and confirms the superior effectiveness of mobile-assisted vocabulary practice.

Effect Size Estimation

In addition to statistical significance, effect sizes (Cohen's d) were calculated to assess the practical significance of the observed differences.

Table 5 Effect Size (Cohen's d) for Vocabulary Test Results

Comparison	Cohen's d	Interpretation
Experimental Group (Pre–Post)	3.04	**Very large effect**
Control Group (Pre–Post)	1.26	**Large effect**
Post-test (Experimental vs. Control)	1.60	**Large effect**

Interpretation of Effect Sizes

The effect size for the experimental group indicates a very large practical impact of mobile-assisted vocabulary practice on learners' vocabulary development. Although the control group also showed a large effect size, the magnitude was considerably smaller. The large effect size observed in the post-test comparison further confirms that mobile-assisted vocabulary practice had a stronger educational impact than traditional vocabulary instruction.

Findings

This study examined the impact of mobile-assisted vocabulary practice on English vocabulary development among ESL learners using a quasi-experimental pre-test and post-test design. The findings are presented in relation to the research objectives and are based on descriptive and inferential statistical analyses.

Baseline Vocabulary Knowledge

The pre-test results indicated that both the experimental and control groups had comparable levels of vocabulary knowledge at the beginning of the study. The experimental group obtained a mean pre-test score of 41.27, while the control group recorded a mean score of 40.90. The similarity in mean scores and standard deviations suggests that there was no meaningful difference in initial vocabulary proficiency between the two groups prior to the intervention. This baseline equivalence ensured that any differences observed at the post-test stage could be attributed to the instructional treatment rather than pre-existing differences in vocabulary knowledge.

Vocabulary Gains within the Experimental Group

The findings revealed that learners in the experimental group demonstrated substantial improvement in vocabulary knowledge following the mobile-assisted vocabulary intervention. The post-test mean score of the experimental group increased to 56.83, representing a gain of 15.56 points from the pre-test. The paired samples t-test confirmed that this improvement was statistically significant. The large increase in mean scores and the very large effect size indicate that mobile-assisted vocabulary practice had a strong and meaningful impact on learners' vocabulary development.

Additionally, the reduction in score variability from pre-test to post-test suggests that the mobile-assisted intervention benefitted most learners in the experimental group, leading to more consistent performance across participants.

Vocabulary Gains within the Control Group

The control group, which received traditional vocabulary instruction, also showed improvement in vocabulary knowledge over the study period. The mean score increased from 40.90 in the pre-test to 47.10 in the post-test, reflecting a gain of 6.20 points. The paired samples t-test results indicated that this improvement was statistically significant.

However, the magnitude of improvement in the control group was notably smaller than that observed in the experimental group. The effect size for the control group, although large, was considerably lower than that of the experimental group, suggesting that traditional vocabulary instruction was less effective in promoting vocabulary growth compared to mobile-assisted practice.

Comparison of Post-Test Performance between Groups

A direct comparison of post-test vocabulary scores revealed clear differences between the experimental and control groups. The experimental group achieved a higher mean score than the control group, with a difference of 9.73 points. The independent samples t-test confirmed that this difference was statistically significant.

This finding indicates that learners who engaged in mobile-assisted vocabulary practice outperformed those who relied solely on traditional instructional methods. The large effect size further demonstrates that the difference between groups was not only statistically significant but also educationally meaningful.

Effect Size and Practical Significance

The calculation of effect sizes provided additional insight into the practical impact of the intervention. The very large effect size observed for the experimental group's pre-test and post-test comparison highlights the strong influence of mobile-assisted vocabulary practice on vocabulary learning. In contrast, the control group exhibited a smaller, though still meaningful, effect size.

The large effect size for the post-test comparison between groups underscores the superiority of mobile-assisted vocabulary practice over traditional methods. These results suggest that mobile-assisted learning does not merely produce marginal improvements but leads to substantial gains in vocabulary knowledge.

Conclusion

This study investigated the impact of mobile-assisted vocabulary practice on English vocabulary development among ESL learners. The findings show that learners who used mobile-based vocabulary tools demonstrated significantly greater improvement than those who followed traditional vocabulary instruction. While both groups showed progress over time, the experimental group achieved higher post-test scores and larger learning gains, indicating that mobile-assisted practice provided more effective support for vocabulary acquisition. The results confirm that integrating mobile technology into vocabulary instruction can enhance learning outcomes and promote more consistent improvement among learners.

In conclusion, mobile-assisted vocabulary practice proved to be a powerful instructional approach in ESL contexts. The large effect sizes and clear differences between groups highlight the practical value of mobile learning beyond statistical significance. These findings suggest that teachers and curriculum designers can confidently incorporate mobile-based vocabulary activities to strengthen learners' vocabulary development. Future research may explore long-term retention, learner attitudes, and the effectiveness of different types of mobile applications to further refine mobile-assisted language learning practices.

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