Effectiveness of a Mobile Application Developed for Teaching Domain-specific Vocabulary in Higher Education

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Abstract—**This research investigates the limitations of conventional General English curricula in providing students with the specialized linguistic skills necessary for their academic disciplines. It examines the potential of Computer-Assisted Language Learning (CALL) and Mobile-Assisted Language Learning (MALL) technologies to address these challenges, particularly through the integration of Android-based applications like the DoVocab App into traditional education. This approach offers learners personalized, flexible, and self-paced language acquisition outside the conventional classroom, enhancing domain-specific vocabulary learning and supporting broader educational reform. The study emphasizes the importance of vocabulary acquisition in language learning, focusing on the effectiveness of both incidental and intentional strategies in promoting understanding and retention. Employing a quasi-experimental design, the study involved 64 ESL students from the BSc Computer Science program at Sri Ramakrishna College of Arts & Science in Coimbatore, divided into experimental and control groups. The experimental group used the DoVocab App to enhance their domain-specific vocabulary acquisition. Data collected through pre-tests, post-tests, and student feedback was analyzed using IBM SPSS. The findings demonstrate that integrating MALL, especially through applications like DoVocab, significantly enhances vocabulary acquisition and language proficiency, supporting broader educational reform goals.**

Index Terms—**MALL, Domain-specific Vocabulary acquisition, Quasi-experimental design,**

1. INTRODUCTION

Language is the cornerstone of human interaction, facilitating the expression of thoughts, ideas, and emotions, and fostering connections among individuals. The mastery of English, in the context of globalization, has transcended the realm of mere intellectual display to become an imperative skill.

The pursuit of English as a Second Language (ESL) emphasizes the comprehensive development of the four pivotal language faculties: listening, speaking, reading, and writing.The enrichment and expansion of domain-specific vocabulary in a non-native language are greatly enhanced by employing a multifaceted approach. This includes strategies such as extensive reading, leveraging flashcards, engaging in targeted vocabulary exercises, immersing oneself in authentic listening materials, and participating in dialogues with native speakers. The conventional pedagogical approach, characterized by a uniform General English curriculum across various academic disciplines, needs to improve in equipping students with the specialized linguistic capabilities essential for their specific fields. Consequently, this gap necessitates the exploration and adoption of innovative methodologies like Computer-Assisted Language Learning (CALL) and Mobile-Assisted Language Learning (MALL). Such technologies enable personalized and pace-adjustable language learning experiences, particularly through the use of Android applications, offering a tailored approach to acquiring and enhancing English language proficiency outside the traditional classroom setting.

1.1 Literature Review

Vocabulary is undeniably at the heart of language acquisition, serving as the essential toolkit without which communication is unattainable. This assertion is supported by a body of scholarly work that highlights the critical nature of vocabulary knowledge in language learning[1], [2], [3], [4], [5]. To augment one's lexical repository, a blend of incidental and explicit instructional strategies is imperative. Incidental acquisition, often described as implicit learning, occurs without a deliberate focus on learning, allowing vocabulary to be

absorbed naturally through exposure[2][6]. Schmitt (2010) posits that a mere ten exposures to a new term can significantly enhance vocabulary retention, as repeated encounters facilitate learning[7]. This concept is further corroborated by Soleimani et al. (2022), who found that repeated exposure to vocabulary items substantially benefits EFL learners' vocabulary expansion[8].

However, the transition from mere recognition to a deep understanding and retention of new words remains a nuanced challenge in the incidental learning process. Thus, a more structured approach, such as intentional learning, becomes crucial for comprehensive vocabulary acquisition[9]. Intentional learning strategies, emphasized by Zhang and Teng [10], involve explicit instruction and practice, enabling learners to process and utilize newly acquired language effectively [11]. The interplay of input, cognitive processing, and output is increasingly recognized as fundamental in second language acquisition, including the mastery of vocabulary[12].

In this era of digital learning, the integration of Mobile-Assisted Language Learning (MALL) and Android applications into traditional educational frameworks offers a promising avenue for effective vocabulary development. By merging the advantages of educational technology with conventional learning methods, learners can achieve a harmonious balance in their educational journey, significantly enhancing vocabulary acquisition and overall language proficiency[13]. This hybrid approach caters to the diverse needs of ESL students, providing a flexible and individualized learning experience that aligns with the specific vocabulary demands of their academic and professional domains.

2. METHODOLOGY

Using multilevel growth model analyses, a study found that network patterns differed across domains, with social studies being notably distinct [14], This finding underscores the inherent variability in the development of academic vocabulary across different educational domains.

When applied to the context of higher education, this variability highlights the critical importance of teaching domain-specific vocabulary to enhance students' comprehension and expertise in their respective fields. In response to this need, this project aims to supplement students' learning of domain-specific vocabulary through a categorically designed Android application. By targeting the unique vocabulary demands of each academic discipline, the application serves as a tailored educational tool that supports students in developing the specialized language skills essential for success in their chosen fields of study.

2.1 Participants

In this case study, a cohort of 64 ESL students from the BSc Computer Science program at Sri Ramakrishna College of Arts & Science College in Coimbatore was engaged. These students, all of whom were intermediates in English proficiency and aged between 17 and 18 years, had been exposed to English learning for an average duration of 12 years. They were methodically divided into two groups: an experimental group consisting of 30 students and a control group comprising 32 students. A preliminary assessment, conducted to gauge the English proficiency levels across both cohorts, revealed no significant disparities in their initial capabilities.

2.2 Research Instrument

The pivotal tool employed in this research was the mobile application named DoVocab. This Android application serves as an innovative platform through which educators can introduce and reinforce domain-specific vocabulary. It facilitates students' engagement with critical terminologies, offering them the chance to delve into the nuances of each word through definitions and contextual example sentences. Additionally, DoVocab integrates intermittent quizzes, strategically designed to assess and bolster retention after the introduction of every ten new vocabulary items. This feature, alongside the self-assessment capability it offers students, positions DoVocab as a significant adjunct in the realm of domain-specific English language acquisition.
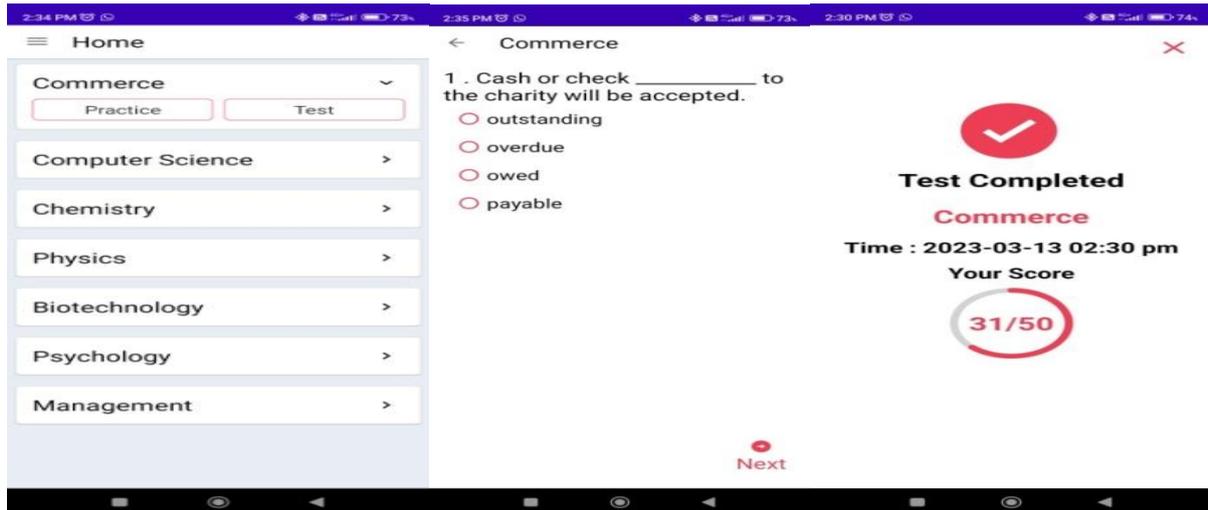
Figure 1 An overview of the application

This case study was conducted during the odd semester of 2023, spanning 10 weeks, intending to evaluate the efficacy of a mobile application—specifically, its impact on language proficiency enhancement and user satisfaction. Initial assessments were conducted through a pre-test administered to both the experimental and control groups to ensure equivalent language proficiency levels at the outset.

Subsequently, the experimental group engaged with the DoVocab Application as part of their language learning journey. This process involved a three-stage approach: initially, new vocabulary was introduced within the conventional classroom setting; this was followed by the utilization of the DoVocab Application to further process and internalize the introduced vocabulary; finally, the newly acquired vocabulary was actively employed in context. Conversely, the control group continued with a traditional learning approach throughout the study period.

Upon concluding the intervention with the DoVocab Application, a post-test was administered to all participants to measure the learning outcomes. Additionally, students in the experimental group were invited to provide feedback on their experiences with the DoVocab Application, including its utility and features, thereby offering insights into its perceived value and effectiveness in the context of language learning.

2.3 Data Collection and Analysis
In alignment with Yin's case study methodology[15], this investigation employed a blend of quantitative and qualitative techniques for the collection and analysis of data. The study sought to gauge the linguistic proficiency of participants before and after engagement with the DoVocab Application, utilizing a series of standardized pre-tests and post-tests within the quasi-experimental framework. The analysis of these test outcomes was facilitated by the IBM SPSS Statistics 26 software.

Following the intervention period with the DoVocab Application, a questionnaire survey was implemented to supplement the quasi-experimental data, offering additional insights into the effectiveness of the mobile learning tool. The compilation of quantitative data thus acquired was subjected to a thorough examination using descriptive statistical methods, enabling a comprehensive understanding of the impact of the DoVocab Application on language learning outcomes. For a better understanding, the research design is provided in Figure 2.
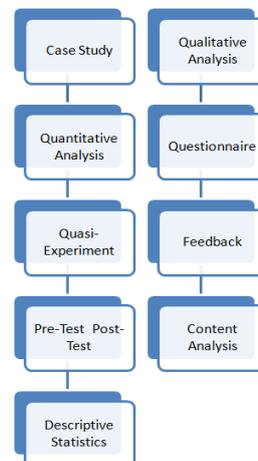

Figure 2 Research Design

3. RESULTS & DISCUSSION

The primary objective of this study was to evaluate the effectiveness of the DoVocab Application in enhancing English language learning. The findings derived from the quasi-experimental design, questionnaires, and participant feedback collectively underscore the application's utility across several dimensions. Key areas of focus included learners' performance, satisfaction, motivation, the quality of the content, and the ease of use of the mobile application. The ensuing sections detail the comparative analysis and interpretation of these pivotal outcomes.

3.1 Quantitative Approach to the Research

The participant pool, consisting of 62 students, was bifurcated into two distinct cohorts: an experimental group ($n1 = 30$) engaged with the DoVocab Application for language learning, and a control group ($n2 = 32$) adhered to traditional instructional methods without the application's assistance. The comparative analysis of students' performance was anchored in the data collected through pre-tests and post-tests, with the IBM SPSS Statistics 26 software facilitating the computation of results. A significance threshold of 5% was applied in the statistical analysis to ensure the reliability of the findings.

The initial step involved administering a pre-test to both groups to ascertain that their English language proficiency was comparable at the study's outset. The subsequent presentation of results, delineated in Table 1 as success percentages and visually in Figure 3, offers a granular view of the comparative achievement levels across both student groups.

Table 1 Analysis of the results of the Pre-Test

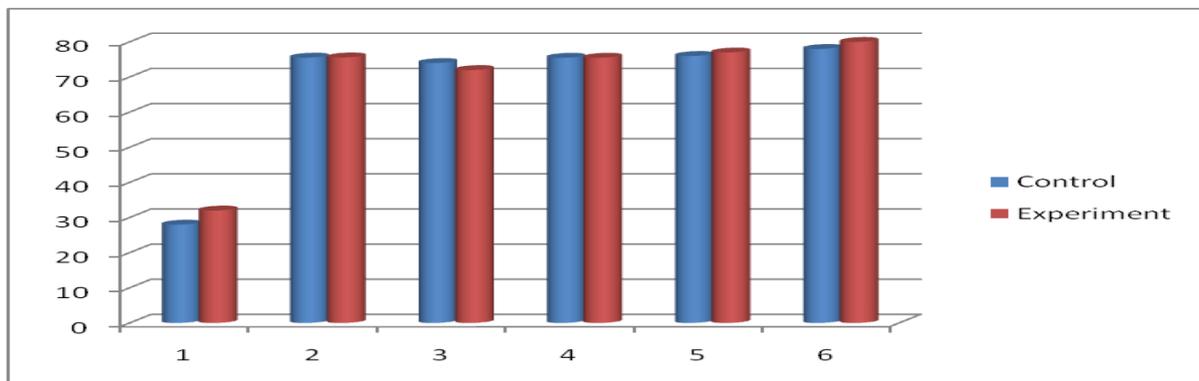| Group	Count	Mean	Std Dev	Min	Median	75th Percentile	Max
Control	30	75.535	1.137969	74	75.5	76	78
Experimental	32	75.5937	1.846695	72	75.5	77	80

Figure 3 Analysis of Pre-Test Result

The Shapiro–Wilk test results indicated that the distribution of students in both the experimental (E) group (p-value of 0.062) and the control (C) group (p-value of 0.272) conformed to a normal distribution, suggesting that the selections from both groups were drawn from a normally distributed population. The equivalence of variances between the groups was further supported by Levene's test ($F = 0.0239$, p-value = 0.878), affirming that the variances were statistically indistinguishable. To evaluate the comparability of the groups at the study's outset, a t-test for two independent samples with equal variances was applied to the pre-test results ($t = -0.268$, p-value = 0.790). The analysis did not refute the hypothesis that the mean scores of both groups were equal, implying that the initial English proficiency levels of the students in both groups were statistically similar. The research hypothesis posited was as follows:

H: Students engaging with the DoVocab Application demonstrate significantly superior learning outcomes compared to those who do not use the application.

The comparative analysis of the post-test outcomes, as illustrated in the box plot shown in Figure 4,

revealed that students in the experimental group (E) outperformed their counterparts in the control group (C), aligning with the anticipated results. This differential achievement was not merely observational but was substantiated through meticulous calculation. Descriptive statistics detailing the post-test outcomes are enumerated in Table 2, providing a quantitative foundation for this conclusion.

Table 2 Analysis of Post-Test Scores

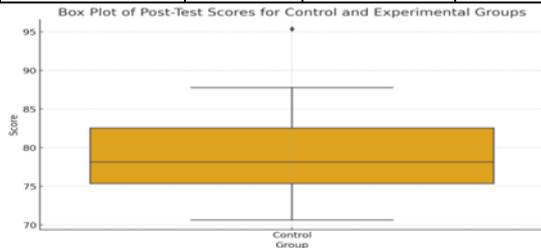| Group	Count	Mean	Std Dev	Min	Median	75th Percentile	Max
Control	30	79.31	5.41	70.65	78.15	82.55	95.37
Experimental	32	88.99	4.92	82.08	88.76	92.57	97.44

Figure 4 Box plot of Post-Test for Control and Experimental Group

The Shapiro–Wilk test confirmed that the distributions for both the experimental group (p-value = 0.598) and the control group (p-value = 0.110) were consistent with a normal distribution of students. Levene's test further indicated no significant difference in variances between the groups (F = 0.001, p-value = 0.976), suggesting homogeneity of variance.

A t-test for two independent samples with equal variances was employed to analyze the post-test results (t = 3.400, p-value = 0.002), which led to the rejection of the hypothesis that the mean scores of both groups were equal. This analysis, conducted at a 5% significance level, highlighted a statistically significant difference in post-test outcomes between the experimental and control groups as shown in Figure 5. This outcome supports the acceptance of hypothesis H, which posits that students utilizing the DoVocab Application would achieve significantly better results.
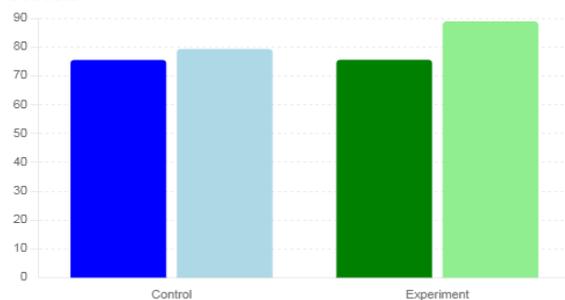

Figure 5 Comparison of Pre-Test and Post-Test Mean Scores

To further explore the impact of the DoVocab Application on individual learning progress, a paired t-test compared the pre-test and post-test scores of students in the experimental group (t = 13.949, p-value < 0.001). The significant difference between the pre-test and post-test scores, particularly with post-test scores being higher, indicates a substantial improvement in language learning outcomes attributable to the use of the mobile application.

An ANOVA with repeated measures was conducted to assess the overall effect of time/test (pre-test vs. post-test) and group (experimental vs. control) on student performance. The Mauchly test ensured the assumption of sphericity was met. The analysis revealed a significant time/test effect (F = 253.515, p-value < 0.001, correlation ratio = 0.882), indicating an overall increase in scores from pre-test to post-test. However, the group effect did not reach statistical significance (F = 2.636, p-value = 0.114, correlation ratio = 0.072), suggesting that group assignment (experimental or control) alone did not predict outcomes. Importantly, the interaction between time/test and group was statistically significant (F = 51.697, p-value < 0.001, correlation ratio = 0.603), demonstrating that students in the experimental group showed significantly greater improvements than those in the control group. These findings lend robust support to hypothesis H, confirming the efficacy of the DoVocab Application in enhancing language learning achievements.

3.2 Qualitative Findings on the DoVocab Application

3.2.1 Learners' Performance:

A significant portion of students (82%) reported enhanced vocabulary knowledge after using the DoVocab Application, with 57% noting improved retention and application in conversations. Moreover, 71% of students felt they could express

themselves more fluently, underscoring the application's role in bolstering language skills.

3.2.2 Learners' Satisfaction:

The satisfaction rate among students with the DoVocab Application stood at 82%, with many expressing appreciations for its accessibility, organization, and efficiency in learning. About 64% preferred it over traditional book learning, indicating a strong inclination towards integrating modern and traditional learning methods.

3.2.3 Learners' Motivation:

The use of the DoVocab Application was found to significantly motivate students (71%), making learning more enjoyable and less stressful. Enhanced learning outcomes and additional tests further spurred students' motivation, highlighting the application's dual role in enhancing both intrinsic and extrinsic motivation for language learning.

3.2.4 Mobile Application's Functions:

Students unanimously found the application's content clear and the corrective feedback particularly beneficial for faster vocabulary acquisition. However, issues such as notification glitches and the lack of offline access were noted as areas for improvement.

3.2.5 Ease of Use:

All students (100%) attested to the user-friendliness of the DoVocab Application, praising its convenience for anytime, anywhere learning, and the efficiency it offers over traditional study methods.

3.3. Discussion

This research aimed to assess the impact of a mobile application, designed specifically for enhancing domain-specific vocabulary among ESL students, on their language proficiency and overall satisfaction. The study yielded several important insights:

Firstly, the data collected through the feedback questionnaire highlighted positive user experiences with the DoVocab Application:

- There was a notable improvement in domain-specific vocabulary knowledge following the use of the DoVocab Application.
- Vocabulary retention rates were higher among students who utilized the application.
- Students reported a significant enhancement in their ability to articulate ideas fluently and accurately within their specific fields of study.
- Compared to traditional textbook methods, learning vocabulary through the DoVocab Application was perceived as more effective and fitting for the students' learning needs.
- The interface of the DoVocab Application was praised for its clarity, readability, and the seamless learning experience it offered.
- Overall, the DoVocab Application was found to be user-friendly, enhancing the ease with which students could revise and master domain-specific vocabulary.

The comprehensive analysis, utilizing both quantitative and qualitative methods, underscores the considerable efficacy of the DoVocab Application in enriching the domain-specific vocabulary learning experience for ESL students. The empirical evidence demonstrates that engagement with the application notably enhances post-test performance, vocabulary acquisition, and expressive fluency. Furthermore, the application's user-friendly design significantly bolsters learners' motivation towards language study. However, as noted by Klimova (2021), the optimal integration of such technology into educational frameworks necessitates active teacher facilitation to ensure both the effectiveness and meaningfulness of the learning process[16].

4. LIMITATIONS

This investigation acknowledges several limitations. The relatively small sample size constrains the breadth of statistically significant conclusions and the generalizability of findings. Additionally, the duration of the mobile application's utilization by the participants was limited, potentially affecting the depth of insights into its long-term impacts. The study also did not investigate long-term vocabulary retention among students' post-intervention, although existing literature corroborates the positive trends observed in this study regarding vocabulary retention over time.

5. CONCLUSION

This research illuminates the array of benefits and limitations associated with the incorporation of the DoVocab Application into blended ESL education. The consensus among participants is overwhelmingly positive, recognizing the app as a valuable adjunct to traditional learning methodologies.

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