A REVIEW ON THE USE OF MOBILE APPS IN ENHANCING VOCABULARY ACQUISITION FOR LANGUAGE STUDENTS

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Abstract. This research seeks to determine the efficiency of mobile applications as tools for acquiring vocabulary, especially within language learning environments. It also examines the impact of these tools on teaching processes, learner interaction, and the overall learning outcomes facilitated by their use. This review is grounded in existing empirical studies and meta-analyses conducted over the last decade. The inclusion criteria for selecting the research focused on the definition of vocabulary, methodological quality, and the diversity of mobile applications examined. Particular emphasis was placed on studies employing qualitative research, with data sourced from academic databases and peer-reviewed journals.

While existing studies highlight the important role of mobile applications in language learning, many focus narrowly on specific apps or short-term learning outcomes, often lacking a comprehensive synthesis of how various app features contribute to vocabulary acquisition. Moreover, inconsistencies in methodology and outcome measures across studies have left educators without clear, evidence-based guidance for app integration in curriculum design. This study aims to address these gaps by systematizing findings from high-quality research and identifying common pedagogical benefits and limitations across different app-based approaches.

The findings confirm that mobile apps significantly support vocabulary learning by enhancing interactivity, usability, and contextualized engagement. Features such as gamification, spaced repetition, and multimedia content were particularly effective in improving user retention and motivation. Unlike conventional teaching methods, mobile applications facilitate continuous, self-directed learning and provide immediate feedback in authentic contexts. By synthesizing these outcomes, this study offers a clearer understanding of the practical value of mobile apps in vocabulary development and strengthens the case for their broader integration into language learning programs.

Keywords.. Vocabulary acquisition, Mobile applications, Language learning, Gamification

1 INTRODUCTION

Against the backdrop of progressive development of technology in education, the use of Mobile applications (apps) has become one of the most consequential tools which has far-reaching consequences for learning foreign languages. The use of portable devices like smart phones and tablets has brought a change of approach to traditional forms of learning since learners can now approach content in a more dynamic and creative way (Fathi, 2018). As technology enhanced, particularly through mobile devices, the learning and mastery of the actual words and phrases, or the vocabulary has received new approaches for improvement of its outcomes.

According to Hoang (2010), English vocabulary is one of the most useful element for language learners in improving their language skills. Thus, building up the vocabulary is one of the most important components of learning any language to advance reading, speaking, and a wide range of literacy skills (Gafni, 2017). Old approaches to teaching and learning of words involves memorization techniques, mechanical practices such as drills, and extensive reading. Although these methods have been effective over time, they tend to be repetitive and boring in the present generation of learners who are used to better and more engaging ways of learning provided by advanced technology (Hao, 2019).

In this regard, there is an emergence of mobile applications with a focus on vocabulary learning. Some features such as adopting gamification, intelligent algorithms, multimedia, and spaced learning application, allows for developing incremental flexible and learner-centered approach (Kayra, 2024). For example, when incorporating gamification, which is a part of game-based popular features, in educational content, rewards, challenges, and progress are used to create motivation and interest. On the other hand, the mobile learning and adaptive learning algorithms will ensure that learning is done according to the user's pace and level as well as the learning style that the user has. Graphic images, sounds, and videos are useful in reaching

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out to learners with different modalities and aid in retrieving newly learned vocabulary in a more contextualized manner (Kohnke, 2019). Spaced repetition systems enhance the review process through allocating vocabulary reviews at intervals, which follow the retention theory in cognitive psychology.

Furthermore, mobile apps are highly portable hence learners can practice vocabulary at their convenience hence fitting into the crevices of life. Microlearning is even more helpful when it comes to constant and persistent daily learning of new words, which is ideal for meaningful knowledge retention and rehearsing in the long term (Ludwig, 2018).

However, the effectiveness of mobile apps for vocabulary development calls for a critical analysis in order to establish their credibility and assess their many impacts. Hence, the purpose of this review is to systematically analyse the existing literature on the subject of exploring mobile apps for learning vocabulary in terms of the methods invoked, observed results, and students' participation. It will also discuss challenges and limitations surrounding app-based vocabulary learning as well as digital divide, screen fatigue, and content sufficiency as the limitations (Rajendran, 2021).

This review aims to present educators, developers, as well as researchers with a comprehensive overview of how mobile apps can be incorporated into language learning curricula by synthesizing the existing literature. In addition, it seeks to establish best practices and make suggestions on how the design and deployment of these tools could be improved.

2 LITERATURE REVIEW

The use of mobile application in social learning environment has received a significant interest in the last few years especially in enhancing word recognition. Many works have focused on the possibilities and effectiveness of mobile applications in the acquisition of vocabulary in various contexts. Many studies have supported the statement that mobile applications provide a viable solution for students to improve their lexical skills interactively and efficiently.

In one of the most extensive works, Shahbaz (2017) turned his attention to the benefits that mobile applications offer compared to the existing methods of learning and practicing vocabulary. In this study, students who used a special vocabulary application for students had higher motivation levels and better learning outcomes than students relying on flashcards and methods based on memorization. The identified elements of Louisville scholar app, including its ability to make learning a game and providing an immediate response, were specifically helpful in maintaining students' engagement. In addition, the study showed that the flexibility of using the app on portable devices helped the learners fit the vocabulary practice into their regular schedules and activities, leading to more practice experience.

In a similar vein, Wang et al. (2014) observed the effects of teaching with mobile apps on vocabulary development for ESL students. Based on their research, they observed that there was a positive effect in the scores of learners who used an interactive vocabulary app in contrast to a group without one. The visual and auditory support that the app included in the form of pronunciations, images, contextual sentences played a big role in the understanding of the new word. Also, the ability to introduce new vocabulary was brought in a structured and progressive manner depending on the learner's performance by the use of adaptive learning algorithms which made the learning process more personalized.

Similarly, comparative analysis has also supported the efficiency of mobile apps in the learning of vocabulary. For example, Rajendran (2021) conducted an experiment where one group of students received traditional method of instructions while the other group had access to vocabulary applications. Among the findings, it was found that not only did students using mobile apps perform better on the vocabulary tests but also had a more positive attitude towards learning. This shift in attitude is essential as it demonstrates that the learners are more committed and self-motivated, aspects that are vital for progressive language learning.

Ludwig (2018) also conducted a review of studies in English and the findings of the study also revealed strong evidence for the applicability of mobile apps in vocabulary acquisition. Stockwell in his study of the effect of using mobile application and Japanese university students, discovered that besides enhancing the regular study materials the application could be used as supplementary way of providing extra practice on acquired vocabulary. Specifically, the focus was made on contextual approach to teaching the vocabulary, which should be introduced through real-life situations, thus making the process informative and impactful.

Another recent study conducted by Kohnke (2019) addressing the use of mobile applications for autonomous learning demonstrated that such applications effectively encouraged self-regulated learning

practices among students. The participants in the study revealed enhanced language acquisition through mVocab since they took the responsibility of initiating learning sessions, formulating individual learning objectives, and evaluating their progress in enhancement of language achievement. As for the functionalities of the app, being able to track the progress and receiving personal feedback enabled the learners to be more proactive and to actively participate in the learning process.

According to a meta-analysis by Kayra (2024) evaluating mobile assisted vocational learning, the findings from different studies revealed that mobile application is more advantageous than other conventional approaches. These factors identified by the authors as having a positive impact on mobile apps were the incorporation of multimedia, the completion of learning tasks, and the training of vocabulary in different contexts. Furthermore, using the mobile devices, learners were able to learn in a continuous and explicit manner given the mobility of the devices hence formally and informally.

3 RESEARCH QUESTIONS

The rapid advancement of mobile technology has transformed language learning, making vocabulary acquisition more interactive and accessible through mobile applications. Numerous published studies have explored the effectiveness of these applications, highlighting their potential to enhance learner engagement and retention. To better understand the impact of mobile-assisted vocabulary learning, this review synthesizes findings from existing research, focusing on key benefits, features, and challenges, by answering the following research questions

3.1. What are the key findings from existing studies regarding the effectiveness impacts of mobile applications in enhancing vocabulary acquisition?

3.2. What common features and functions of mobile applications have been identified as most beneficial for vocabulary learning in previous research?

3.3. What challenges and limitations of using mobile apps for vocabulary acquisition have been highlighted in existing literature, and what solutions have been proposed?

4 METHODOLOGY

4.1 Research Design

In this study, the systematic review method is used to assess the effectiveness of mobile applications in the learning of vocabulary. The systematic review framework was chosen to yield a synthesis of current literature in a more methodical, objective way. The selection criteria for studies include relevance to vocabulary acquisition, methodological rigor, and coverage of diverse mobile app features. The analysis involves identifying key themes, trends, and conclusions drawn from existing research, providing a comprehensive overview of the role, benefits, and limitations of mobile applications in vocabulary learning. Findings from multiple studies are compared and contrasted to establish patterns and inform recommendations for future research and practical applications.

4.2 Data Sources

The databases which were used to select research articles in this preliminary review were PubMed, Google scholar, Educational resources Information center (ERIC), JSTOR and Scopus database, since they offer a wide range of articles on educational and technological research. To this end, the selection of these databases was intended to retrieve the trustworthy peer-reviewed journal articles that might provide a wide range of evidence on the use of mobile apps in vocabulary learning. The high quality articles from these databases that researched and published by authors and researchers all over the world provided different language teaching contexts, research methods, and deeply analysis related to mobile applications in vocabulary teaching and learning.

4.3 Search Strategy

To help locate all relevant studies, a thorough and comprehensive search plan was created using keywords and operators. Keywords used in the search process were “mobile apps”, “vocabulary acquisition”, “language learning”, “educational technology”, and “Mobile assisted language learning” and the search was filtered by year to include only the articles of the last 10 years as to focus on the recent innovations in the field of mobile technology’s application in teaching and learning.

4.4 Inclusion and Exclusion Criteria

There are so many research related to mobile application and vocabulary acquisition, so setting preliminary criteria for the selection of evidences to eliminate irrelevance and inadequate quality in the studies to be included in the review is very vital for the authors. The selection also greatly affects the research process, analysis and evaluation of research results.

Table 1. The inclusion and exclusion criteria that studies were included or not

Criteria	Inclusion criteria	Exclusion criteria
1	examined the use of mobile applications that had been developed for the purpose of vocabulary acquisition	considered applications other than those designed to support vocabulary learning
2	did not limit the participants by their age	were informal articles such as opinions, editorials, or personal narrations
3	were written in English	were not written in English
4	used quantitative, qualitative or mixed methods approaches	relied on weak methodological norms of research or failed to present quantitative data
5	were conducted in second or foreign language learning environment	were conducted in multilingual learning environment or/and in countries where English is spoken as a native language

While researching, so many articles related to the topic were found . However, some of them were not chosen as the data because they did not response the preliminary criteria that we set as in table 1. Careful selection of related articles helped us have trustworthy data to synthesize and analyze research aspects in depth and with high scientific value.

4.5 Data Extraction

A data extraction form for each of the included studies was designed to ensure the assessment of all the relevant data. The following information was considered as data points: The authors of the studies, year of publication, number of participants, demographic characteristics of the participants, study design, type and length of the intervention (mobile apps), type of outcome measures, the results obtained. This form enabled a systematic comparison across the studies and also ensured compliance with specific guidelines when reporting the results.

4.6 Data Synthesis

Because of the variety of existing study designs and outcomes, it was considered fitting to present a narrative synthesis. This method enabled identification of similar and different trends and findings of the various studies; the advantages and disadvantages of mobile app interventions in vocabulary learning. Thus, to simplify the presentation of quantitative data, they were analyzed with the help of descriptive statistics, whereas to reveal motifs and ideas behind the qualitative data, a thematic analysis was conducted.

4.7 Limitations

It is necessary to recognize that this systematic review has some limitations. First, the inclusion criteria excluded articles in languages other than English, which might have excluded potentially helpful articles. Second, the use of published studies in particular might have included publication bias as studies with negative results are less likely to be published. Finally, the methodological differences in the apps being used, participants and outcomes also presents some challenges when making conclusions.

5 FINDINGS AND DISCUSSION

5.1 Review of Mobile Apps for Vocabulary Acquisition

5.1.1 Categorization of Mobile Apps

Observing a vast number of applications which are aimed at vocabulary learning, several categories of applications can be distinguished. These applications can generally be grouped into several distinct categories: There are flashcard applications, applications based on games, applications based on contextual learning, and all-inclusive language acquisition applications.

Flashcard-Based Apps: Among all the learning tools that have been shifted from the real world into the digital one, flashcards are perhaps the oldest. Anki and Quizlet are some of the applications that incorporate SRS to improve retention of material. Such applications enable the user to develop own deck or to utilize the deck, which has been developed by different persons. The role of flashcards in enhancing vocabulary incorporates the efficacy of SRS that has been postulated in research such as Hao (2019). These applications offers a more advanced and customizable learning experience, especially appealing to those who prefer simplicity, flexibility. Collaborative features, and gamification elements is also suitable for language young learners who prioritize ease of use and community-generated content.

Gamified Learning Apps: Games in the status of applications, like Duolingo and Memrise are based on points, levels, and rewards to encourage learners and motivate them. These apps make learning not a chore, but rather an interesting and fun filled activity. In a study done by Gafni (2017) proved that gamification in learning enhances user motivation and consequently enhancing vocabulary mastery. Especially, these applications can be used by language learners outside their classroom, both as a form of entertainment and as a simple, effective self-study method.

Context-Based Learning Apps: There are contextual learning apps like Babbel or LingQ that teach words as part of sentence(s) and real-world setting that enables better understanding and usage. The contextual approach is especially useful because it reflects the way people learn a language. Fathi (2018) argues that context based words are more likely to remain in the memory and be used in other contexts. Therefore, these applications help language learners remember vocabulary in context, while also enabling them to use vocabulary accurately and effectively in different situations, especially in everyday communication scenarios.

Comprehensive Language Learning Platforms: Services like Rosetta Stone or Babbel combine the process of learning individual words with other components of a particular language, including grammar, accent, and listening comprehension. These platforms offer an option to practice language within a language and not only memorize the vocabulary and be able to read it. This effective approach is supported by Çakmak (2021), who holds that it is best to employ various language skills for the improved general language performance. The practice methods to enhance learners' vocabulary, while also developing other language skills, will be very beneficial for language learners. At the same time, they create motivation for learning and do not cause boredom during the learning process.

5.1.2 Key Features and Functions

When comparing and contrasting the different apps used in teaching and learning of words, several characteristics were seen as being important in the performance of the applications. Some of the features are tailored learning sequences, multimedia and interactive content, adaptive learning applications, and progress reports that are detailed.

Personalized Learning Paths: Most of these applications have flexible learning models that allow the learner to follow the learning patterns that suits them best like Anki and Memrise. Customization is a tremendously valuable parameter because it can help users concentrate on certain aspects of vocabulary they find difficult or essential. Studies by Ahmad (2017) further remarks that interactive strategies can improve the learners and the extent of learning by addressing specific individual needs.

Interactive and Multimedia Content: It is important to also include audio, images, and video into the vocabulary learning and practice to make the learning process more interesting. For example, Rosetta Stone utilizes both the pictorial and vocal mode where users are presented with pictures, spoken words, and written text in an effort to make linkages between the sources of sound and meaning. This helps accommodate learners who have different modalities and increases retention, which is in accordance with the cognitive theory of multimedia learning by Wang et al. (2014) The theory states that people learn better when using words and pictures as opposed to only words.

Adaptive Learning Technologies: Scaffolded instruction consists of teaching strategies that provide hints and support depending on the learner's performance, and such applications as Quizlet and Duolingo apply

adaptive learning technologies to their interface. This makes sure that learners are always confronted but not overburdened with what they have to learn thus keeping on progressing. According to Rezaei (2014), despite the present day dissatisfaction with technology used in education evident in the literature, effective adaptive systems can complement learning by offering optimal support to a learning process; this means that learning will become more effective and requite less time to produce results.

Comprehensive Progress Tracking: Some users prefer vocabulary apps that have quality progress tracking tools that can be used to track the progress of the learner and the areas that require improvement. For instance, Babbel and Memrise allow learners to track their progress, define achievement milestones, and display visual data, such as graphs and charts, to spark intrigue and engagement. Monitoring progress not only contributes to the perception of accomplishment but also provides insight into the effectiveness of the learning protocols implemented based on research by Nguyen (2022), since self-monitoring increases self-regulation and motivation.

The suggestions of this review stand in support of the existing evidence on the vocabulary acquisition and mobile assisted language learning (MALL). For example, the division of apps according to their functionality as flashcards, games, contexts, and extensive platforms is within the same taxonomic classifications that other researchers have pointed out or identified for their particular educational methods, as argued by Ludwig (2018).

Furthermore, primary functions as learning maps and adaptive learning technologies are backed up by cognitive and educational theories, as regulated by Klimova (2020) and Kassim (2020). They are not only consistent with established theoretical frameworks but are also supported by actual users' feedback and performance in different settings.

5.2 Impact on Vocabulary Acquisition

5.2.1 Effectiveness of Mobile Apps

The use of the mobile application in teaching and learning of vocabulary has been the topic of concern in many research works. Our review identified several engaging features in mobile apps, such as games, multimedia, and other elements as well as intelligent approaches to learning vocabulary that play a crucial role in the enhancement of the learning process. For example, in Karya study (2024), it was ascertained that students with vocabulary apps had a retention rates of 30% higher than the students with the traditional approach. These apps commonly employ spaced repetition algorithms are known to improve the long-term memory of the learnt vocabulary (Huwari, 2023).

Furthermore, mobile applications generally offer evidence-based flexibility and skills for learner self-mastery. This is in line with Hasnine (2021) noting that timely feedback mechanism in the learning of vocabulary applications assist learners to correct their mistake and reinforce the correct forms hence enhancing the speed of acquisition.

5.2.2 User Engagement and Motivation

Another significant aspect of language learning is motivation and participation of the learner, and as such, the use of the smart mobile applications has proven to have positive performance outcomes. The use of mobile apps that are fun, interesting, and packed with rewards and quizzes ramps up learner engagement levels magnificentally. The research by Gafni (2017) shows that usage of points, badges, leaderboards will encourage learners to use apps more often and will help them retain more vocabulary terms.

Moreover, most mobile applications also use multimedia features like audio to pronounce the words, graphics, and contextual sentences which help students learn more effectively. This multimodal approach corresponds to Gangaiamaran (2017) cognitive theory of multimedia learning which argues that learners understand better when instructed using visuals and text than using only text. Thus, learners get motivated to use the apps often, as suggested by the study done by Elaish (2017), where the percentage of students who preferred using mobile apps to textbooks was revealed to be 75% due to the interesting and diverse content.

5.2.3 Comparative Analysis with Traditional Methods

In most of research about using mobile apps, learners who use these apps perform better than those who rely on rote learning or textbooks and dictionaries. They also do not incorporate the feedback and interaction that one gets from using an actual app as they are less engaging than using an app. For instance, in a comparative study regarding an app teaching vocabulary to students, Çakmak (2021) observed that students

using the vocabulary app scored 40% better in their vocabulary tests compared to students using conventional flashcards or textbooks.

Mobile applications have proven to be highly effective tools for vocabulary development among language learners, often outperforming traditional methods in several key areas. Unlike conventional approaches that typically rely on rote memorization, printed flashcards, and fixed classroom instruction, mobile apps provide interactive and engaging learning experiences through gamification, multimedia content, and instant feedback. These features not only make vocabulary learning more enjoyable but also enhance retention and motivation. Additionally, mobile apps offer personalized learning paths and adaptive technologies that adjust to a learner's pace and proficiency, something traditional methods often lack. The convenience of accessing learning materials anytime and anywhere further supports continuous, autonomous learning.

Also, the use of mobile apps allows for active learning and that is a flexibility of learning at anytime and anywhere and this strongly improves the quantity and quality of times new terms are introduced. This affiliation differs markedly from the location-based experience of conventional classroom education that has dominated learning for decades. This is supported by a study by Azi (2023) concerning the use of mobile apps showing that students who were permitted to use the apps spent more time on cumulative vocabulary exercises than in classroom sessions alone, meaning, therefore, that they were likely to learn more words.

Notably, social learning in mobile apps is also enhanced through integrated applications to enhance collaborative elements like competitions, progress sharing, and forums. This social element enhances the learning, making it more creative and supportable as reiterated by Arumugam (2021) who observed positive changes in the general performance of the learners when social and interactive features were put in the teaching tools, particularly in the learning of the vocabulary.

Recapitulating the findings from different studies, it is seen that the use of mobile apps in vocabulary learning yields improved results and this might be because they are innovative, interesting and flexible. Mobile apps allow enhanced learning with better interaction as opposed to conventional methods and the overall usability increases with user engagement. It caters to the overall trend in education that has been leaning towards the use of technology in delivering content with focus on user experience and being available on demand.

5.3 Challenges and Limitations

Though there are numerous benefits of employing mobile apps in vocabulary learning, some drawbacks and limitation has been observed from the course of this review. These challenges have been grouped into technical challenges, challenges pertaining to the learners, limitations of the chosen pedagogy, and limitations of the research.

5.3.1 Technical Challenges

Technical issues are most likely of paramount important when it comes to the utilization of mobile apps in the learning of vocabulary. One major concern is compatibility. While there have been improvements to mobile apps, there are those that cannot work on one device or operating system making it difficult for some users to access them. For example, an application that works well with iPhone’s operating system may not operate efficiently with that of Android, thus locking the target market out (Ahmad, 2017).

Further, the availability and speed of the internet affects the quality of some apps with higher dependence on the internet. In areas where internet connectivity is still a problem, students may experience challenges in accessing these apps on a regular basis which will affect their learning. For instance, a research by Al-Sofi (2020) highlighted that due to poor connectivity, students in rural areas were often interrupted each time they tried to access language applications for learning.

The other technical difficulties are associated directly with the app design process. Most users complain that some interfaces of the apps are not friendly or easy to navigate. If the app is complex and hard to use or even to comprehend, this reduces the chances of learners using it to complete a course. According to Dizon (2016), user experience plays a crucial role in how often and efficiently a student continues to use educational applications.

5.3.2 Learner-Related Challenges

It is also found that learner-related issues present a different set of difficulties that can impact on the effectiveness of mobile vocabulary apps. One primary concern is the quest for motivation and self-

discipline from the learners. Mobile learning can sometimes require a student to be more of an autonomous learner than in traditional face-to-face classrooms. Learners may also not be motivated to use the app again after some time, thereby reducing its usability. Fathi (2018) made a similar observation in a study where he compared the performance of students who have higher self-regulation skills to those who have low self-regulation skills in the use of the vocabulary apps.

Aside from motivation, the learners' prior digital literacy may impact their adoption of mobile apps. Students who are undergoing digital learning for the first time or those who are elder in age may find it difficult to use these tools. For example, Gael (2021) found out that digital literacy is a strong determinant of the effectiveness of e-learning solutions, such as mobile applications.

5.3.3 Pedagogical Limitations

Another category of difficulties that can be distinguished within the framework of analytic research concerns pedagogical limitations, which arise in the process of putting the means of mobile application to use for vocabulary development. This has been described as a significant problem, mainly because there is little focus on modifying the teaching methods themselves inside the apps. Most of the apps have been developed with a one size fits all approach, which in most cases may not address individual learning ability and requirements across the users. For instance, one app could prioritize memorization, which could be beneficial to those learners who require more meaningful and realistic practice sessions. This concern is also depicted in the study by Hasan (2022) where the implementation of different teaching methods and techniques was stressed as essential given the existence of diverse learners.

In addition, the mobile apps let the users not receive the feedback that can be essential for the language acquisition process. In a conventional classroom setup, teachers give feedback that the learners can in turn rectify and enhance comprehension on their mistakes. Nonetheless, mobile apps can provide only general feedback, which may not always help individual learners correct their mistakes or overcome misconceptions they might have. This is in line with Hao (2019), who conducted a study and noted that while the use of technology is prevalent in learning environments, there are number of limitations which makes it challenging to provide the same feedback that could be obtained by face to face interaction.

5.3.4 Research Limitations

The current study is restricted to mobile application-based learning of vocabulary and it is important to note some major limitations of this research. First, there is a shortage of long-term research studies that would help to understand the effectiveness of such tools in the long-term perspective. The tests and assessments being used are mostly post-test, or immediate after-treatment tests, and most of the current research is of a short-term nature, and few studies investigate if the gains made are retained in the long term. It is an issue highlighted in recent work by John (2021) who advocated for longer research studies to determine schematic achievement of vocabulary apps via mobile applications.

A methodological limitation is the fact that most of the studies included in the review were heterogeneous in terms of research design, and hence it was challenging to make direct comparisons across the studies. High heterogeneity in the participants, apps under study, and assessment techniques used further contributes to discrepancies in the results. For instance, while some research will rely on pre and post-tests to evaluate gains in the area of vocabulary, others might use other testing methods or units of analysis, which makes it difficult to make comparisons. This was also pointed out in a meta-analysis by Kannan (2023) where there was a plea for proper standardization of research methods to make the results more coherent and comparable.

Also, there are several researchers who seem not to have considered different factors that may affect acquisition of the second language vocabulary including prior knowledge experience, socio-economic status, or conditions within which learning occurs. Some of these variables can influence the results profoundly though they remain unrecognized in research studies. For instance, a study conducted by Kohnke (2019) recommended that achievement gaps by socio-economic status may impact the access to technology and learning environmental in a way that favors the higher economic classes.

Last but not the least, the present research has the following methodological limitations related to the selection of the samples; a majority of prior research has involved subject samples of limited size, and, in many cases, have been composed of participants from a narrow and possibly non-representative population base. Larger and more diverse samples could help generate more generalizable information that could apply to other learner population groups. This issue was clearly presented by Lei in the current review conducted

in 2018 and stressing the need for conducting more diverse and large-scale research focusing on the effectiveness of different mobile applications among different populations.

5.4 Best Practices for App Development

Based on the overview of the previous research and the presented case study, it is possible to stress that designing a successful mobile app that would help to teach vocabulary is not a simple and straightforward process. Following are the best practices identified for app development under relevant subheadings:

5.4.1 Design Principles

To achieve success with mobile apps regarding the teaching and learning of vocabulary, it is crucial to implement strong design principles. Ease of use should remain a main priority in design, considering that navigation significantly determines the level of learning engagement by the users. For instance, Makoe (2018) consider cognitive load theory important in design stating that screens and information overload in applications, should be discouraged. By way of clean layouts and navigation elements including potentially fun and game-like quizzes and flashcards, learners can work with content more efficiently.

In addition, beauty if accompanied by good instructions and feedback systems improves on appearance thus creating a better learning environment. The research conducted by Rajendran (2021) revealed that colorful and interactive website design increases time spent on a website as it leads to an increased utilization of the more words each learner knows.

5.4.2 Content Relevance

Relevance of the content is a key success factor for any educational application. Learners should be understood so as to provide tailored learning experiences, meaning apps should be designed based on their needs and competence levels. This can be done with the help of adaptive learning technologies where vocabulary exercises are customized depending on the results of users. For example, Shahbaz (2017) explain the advantages of using adaptive algorithms that allow increasing the vocabulary size by modifying the difficulty of presented tasks depending on the user's performance.

Furthermore, besides teaching of vocabulary, the incorporation of contextually oriented content has the advantage of enhancing retention and utilization of the taught vocabulary. Wang (2014) discovered that learners learn new concepts better when they are in a rich context, which may include sentences or situations, which are familiar to the learners. Some of these principles are applied by the design of Duolingo and Memrise, where new words are learnt in the context of a story or frames of a given topic.

5.4.3 User Feedback and Iteration

Another important aspect that is inseparable from the process of creating applications is users' feedback. The community feedbacks regarding user experience and the problems they face can help developers to better understand the application's interfaces and make improvements. This process should not be a one-time thing, and changes and improvements should be made frequently based on feedback obtained from the users (Nguyen, 2022).

Klimova (2020) focused on one particular aspect pointing out that incorporating feedback into educational applications leads to more satisfied users and improved learning. Many apps, such as Anki and Quizlet, embrace this iterative method, engaging users with in-app satisfaction surveys and using the provided feedback for future application updates, allowing for users-centered approaches.

In addition, the option for immediate formative feedback within the app is invaluable to the process of learning. As stated by Kayra (2024), when it comes to apps that give instantaneous corrective feedback, it is more helpful since learners are able to learn from their errors. Besides, it maintains the learner's interest while learning new words and phrases and, at the same time, increases the effectiveness of their comprehension and retention in words and phrases.

5.4.4 Integration with Other Learning Methods

As with other concepts, the best practices in vocabulary acquisition may incorporate a combination of various approaches. Mobile apps should not stand alone but instead work hand in hand with other educational materials and approaches. Multimodal learning is useful for learners and can be achieved through the combination of listening, speaking, reading, and writing practice, which helps accommodate different learning modalities and enhance the retention of the learned vocabulary (Hasnine, 2021).

Mobile app integration with the classroom instruction as a hybrid model of learning is expounded by Gangaiamaran (2017). In their research, the authors discussed about the effectiveness of using the mixture of both conventional classroom techniques and an innovative tool, namely a mobile app; the authors noticed

a statistically significant increase in the learning results when it came to the expansion of student's vocabulary when the content was supplied both in a class and mobile setting. undefined For example, applications like Microsoft Teams and Google Classroom can easily be incorporated into lessons, therefore improving the flow of learning.

The final strategic approach described by Çakmak (2021) is the use of spaced repetition systems (SRS) in mobile applications. These systems are used to display words to learners at progressive interval, which enable the learners to memorize and recall easily. SRS, a technique employed by apps such as Anki and Quizlet, enhances the learning of new vocabulary by an impressive extent across the long term.

Additionally, integrating the spaces with other learning activities and other forms of technology can enhance the process of learning. For instance, learners may install mobile applications that are compatible with the desktop programs or e-reading gadgets that can be used interchangeably. This approach was highlighted in a study conducted by Arumugam (2021) where it was revealed that learners who applied the of mobile apps and other digital devices, recorded enhanced language usage, especially in terms of the vocabulary gained.

5.5 Future Directions and Research

5.5.1 Emerging Trends

The ever-shifting nature of mobile app development is creating innovations in educational software, especially in the area of vocabulary improvement. One of the emerging trends that has been implemented in app development is the incorporation of artificial intelligence and machine learning within apps to enhance personalized learning. For instance, AI can detect the progress of a user and modify the level of difficulty of the vocabulary exercises to facilitate more effective learning pathways (Ahmad, 2017).

Also, the trend of the use of game design elements in educational applications is growing, as more and more apps feature educational content. Duolingo and Memrise have implemented point systems, leaderboards, and achievement badges with success, which enhances the learning experience. Dizon's (2016) findings in a similar study have shown that gamification can improve user motivation, which is essential for fixed learning like vocabularies.

In addition, there has been an increase in speech recognition technology in vocabulary applications. It uses features, which enable users to practice pronunciation and provide feedbacks that enhances the users' listening and speaking skills. Some of these features are already available in applications such as Babbel and Rosetta Stone giving the learners a better package for learning the language. For instance, Gael (2021) affirm that embracing speech recognition technology can help language acquisition, increase vocabulary recall and pronunciation.

5.5.2 Areas for Future Research

However, several aspects need further study to tap into the full potential of mobile applications for vocabulary learning. First, more longitudinal research is required to understand the impact of using these apps in the longer term. To the researcher's knowledge, there is a dearth of research exploring long-term effects of using vocabulary apps on language acquisition which is why more studies like Hao, (2019) and Kannan, (2023) highlight short-term impacts.

Another important issue is the availability and inclusiveness of these applications for various groups of users. Although there is a high number of apps that proclaim to have a universal appeal, very few studies have investigated their effectiveness on students of different age, with different socio-economic status, and students with learning disabilities. Researching these factors enables an understanding of how we can construct better and more accessible learning tools, as stated by Klimova (2020) and Makoe (2018).

Moreover, there is an opportunity to study the effects of group learning supported by mobile applications. Additional motivational boosts and learning also appears to be possible if the applications provide functions that enable learners to collaborate or compete, share updates on their progress, etc. Some recent studies by Rezaei (2014) and Wang (2014) suggest that views of social interaction and collaborative learning are profound and effective on learning and memory enhancement. Exploring these social aspects to incorporate into vocabulary apps might expand the possibilities of improving the language learning process.

5.5.3 Innovations in Personalized Learning

Mobile applications in particular are an exciting innovation that holds significant possibilities for enhancing vocabulary learning through differentiated learner interfaces. The use of AI and ML to create individual learning paths that can consider the learner's interests, proclivity, or lack of familiarity with specific

terminologies can enable the design of unique vocabulary exercises. These adaptive learning systems are already being used in modern applications such as Quizlet and Anki, that deliver content according to the needs of the learner (Nguyen, 2022).

These include innovations in the participation of special needs learners and the use of multi modalities. For instance, by using visual displays, sound, and motion, applications can be developed to enhance vocabulary acquisition and address different learning modalities. According to the study conducted by Lei (2018), it became clear that learning through the use of multiple senses could also help in teaching and learning especially where the use of language is involved.

One of the more promising innovations can also be found in the application of augmented reality (AR) and virtual reality (VR) technologies. These technologies can create conditions that imitate real-life scenarios where learners can apply vocabulary, and this will help them to remember what they have learned as well as apply it. For instance, there is Mondly where apps use AR to design scenarios in which the user can interact with objects and characters to learn new sets of words. Research by Kassim (2020) has shown that the learning impact and stake in an educational context is greatly boosted with the use of AR.

In addition, biometric feedback using which learning activities can be personalized is quite an appealing and innovative concept. Thus, using the feedback on the levels of concentration and stress by tracing the eye movements or skin conductance, the corresponding application can increase or decrease the level of difficulty of the performed tasks. A preliminary study done by Huwari (2023) suggests a positive future for the use of biometric data to enhance learning environments.

6 CONCLUSION

The review highlights the importance of mobile applications in enhancing the understanding of vocabulary in different learning environments. Mobile applications are an effective, versatile, and interactive approach to help learners increase their vocabulary in today's growing mobile environment. Overall, several factors have been identified based on a review of the literature and previous research findings, and there are beneficial aspects as well as issues related to the implementation of mobile apps in the learning of vocabulary.

Firstly, the mobility and convenience of application in a mobile environment provide a suitable approach to individualized learning. Vocabulary exercises can be implemented with an open model or in a flexible manner that allows the learners to choose whether and when they wish to engage in the exercises. This makes it easy for learners to become more academy centered hence essential for the process of language learning.

Additionally, mobile applications incorporate the principles of gamification and use multimedia components like audio, images, and interactive tasks, which makes users more attached to the application. In doing so, it does not only make the learning of vocabulary and other words pleasant but also contributes to the means that address the multiple intelligences to enhance the delivery of education.

However, the review also outlines some of the drawbacks and limitations that are worth considering. Concerns including the quality of apps that are used, risk of distraction, and complications in providing professional development to support teachers to enhance use and integration of such apps in teaching strategies are main considerations. Further, many apps demonstrate potential but differ in results, which suggests that more research must be conducted to determine which aspects have the biggest impact for vocabulary learning.

Moreover, although mobile application can complement the conventional teaching approaches, they cannot act as a cure-all solution. While the use of technology in language learning is inevitable and is a plus to the learning process, making usage of technology, combination of the technology and traditional learning methodology is the best structure of learning languages. It becomes the responsibility of educators and creators of apps to come up with mobile applications that are in compliance with most of the curriculums.

To sum up, the opportunities of vocabulary expansion with the help of mobile applications are great. Thus, as technology advances, so do the strengths and efficiency of such software applications. More research should be carried out in the long term impacts of gamification, and the possibility of combining new technologies like AI and augmented reality in gamification, as well as setting standards and guidelines for effective gamification. With a focus on eradicating current inhibitions and integrating the potential innovations with the help of modern technologies, the role of the mobile apps in the process of language learning can be extended and enhanced in terms of opportunities and results for global learners.

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ĐÁNH GIÁ VỀ VIỆC SỬ DỤNG CÁC ỨNG DỤNG DI ĐỘNG ĐỂ NÂNG CAO VIỆC TIẾP THU TỪ VỰNG CHO SINH VIÊN NGÔN NGỮ

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Tóm tắt. Nghiên cứu này nhằm xác định hiệu quả của các ứng dụng di động như những công cụ hỗ trợ việc phát triển vốn từ vựng, đặc biệt là trong các môi trường học ngôn ngữ. Đồng thời, nghiên cứu cũng xem xét tác động của các công cụ này đến quá trình giảng dạy, sự tương tác của người học và kết quả học tập tổng thể mà quá trình sử dụng ứng dụng mang lại. Bài báo này dựa trên các nghiên cứu thực nghiệm và phân tích tổng hợp đã được thực hiện trong vòng một thập kỷ qua. Tiêu chí lựa chọn nghiên cứu bao gồm định nghĩa về từ vựng, chất lượng phương pháp nghiên cứu và sự đa dạng của các ứng dụng di động được khảo sát. Đặc biệt chú trọng đến các nghiên cứu sử dụng phương pháp định tính, với dữ liệu được lấy từ các cơ sở dữ liệu học thuật và các tạp chí bình duyệt một cách cẩn thận.
Mặc dù các nghiên cứu hiện có nhấn mạnh vai trò quan trọng của ứng dụng di động trong việc học ngôn ngữ, nhiều nghiên cứu lại chỉ tập trung hẹp vào một số ứng dụng cụ thể hoặc kết quả học tập ngắn hạn, và thường thiếu một sự tổng hợp toàn diện về các đặc điểm khác nhau mà các ứng dụng góp phần vào việc tiếp thu từ vựng cho người học. Hơn nữa, sự không nhất quán trong phương pháp và cách đo lường kết quả giữa các nghiên cứu đã khiến các nhà giáo dục thiếu đi những hướng dẫn rõ ràng và có căn cứ để tích hợp ứng dụng vào thiết kế chương trình giảng dạy. Nghiên cứu này nhằm bổ sung những khoảng trống đó bằng cách hệ thống hóa các phát hiện từ những nghiên cứu chất lượng cao và xác định những lợi ích sư phạm cũng như hạn chế chung từ các phương pháp học từ vựng dựa trên ứng dụng.
Kết quả cho thấy các ứng dụng di động hỗ trợ đáng kể cho việc học từ vựng thông qua việc tăng cường tính tương tác, khả năng sử dụng và sự tham gia có ngữ cảnh. Những tính năng như trò chơi hóa, lặp lại cách quãng và nội dung đa phương tiện đặc biệt hiệu quả trong việc nâng cao khả năng ghi nhớ và động lực học tập của người học khi sử dụng. Khác với phương pháp giảng dạy truyền thống, ứng dụng di động cho phép học tập liên tục, tự định hướng và cung cấp phản hồi tức thì trong bối cảnh thực tế. Thông qua việc tổng hợp các kết quả này, nghiên cứu mang đến cái nhìn rõ ràng hơn về giá trị thực tiễn của ứng dụng di động trong việc phát triển từ vựng và củng cố luận điểm về việc tích hợp rộng rãi chúng vào các chương trình học ngôn ngữ.

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