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Effectiveness of mobile applications to improve English vocabulary: A systematic review of the recent research literature

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1. Introduction

Mobile learning, particularly integrated mobile technology in education, has converted the traditional pedagogical approaches. After the widespread use of mobile devices, researchers have paid close attention to Mobile-Assisted Language Learning (MALL). These mobile devices provide flexibility in several domains, such as higher education; hence, mobile-assisted learning has turned out to be one of the burning issues in practical application and academic research. According to Burston (2021), approximately 3000 research studies on MALL point out a remarkable amount of attention has been paid to this area.

Several reasons have contributed to the popularity of MALL. First, mobile devices have been widely used for several life-related purposes by individuals, such as education, information sharing and access, online transactions, banking, communication, and entertainment. It will, therefore, be constructive in language education to utilise this trend in mobile devices. Mobile devices could make learning very motivational and entertaining for learners. The second characteristic is that mobile learning is featured "anytime and anywhere" (Kukulska-Hulme & Shield, 2008) and offers flexibility to the learning processes.

With these benefits, however, also come a few disadvantages, which include tiny displays, limited functionality of the mobile device, devices' cost, insufficient battery life, and storage issues (Al-Said, 2015; Fujimoto, 2012), to name a few. Nevertheless, as time went by, continuous development has lessened these issues. Moreover, as a teacher myself, I have noticed trends wherein students no longer need printed materials during lessons. Instead, the books, dictionaries, and other printed materials are read using handheld devices. In addition, the costs of smartphones have been declining gradually over the years. Even with such advancements, there are problems with unequal distribution of devices and internet access, inability to follow the progress of the students, and uncertainty about the efficiency of using these devices (Mcquiggan et al., 2015). However, according to Ozdamli and Cavus (2011), MALL remains at the forefront of education discussions since it bears all the characteristics of e-learning.

1.1. Vocabulary Learning in the Second Language / Foreign Language

All four language skills (listening, speaking, reading and writing) are built on the foundation of vocabulary. With word mastery, learners can significantly improve their language learning process. Thornbury (2002) points out that language learners often struggle to use words accurately to express their intended meanings, especially with limited vocabulary. This challenge is exacerbated by traditional school methods involving memorising word lists, leading to boredom and disengagement among students, as Khansarian-Dehkordi and Ameri-Golestan (2016) noted. Moreover, Zoghi and Mirzaei (2014) have highlighted that contextualised vocabulary training can add to these difficulties, making the process of learning vocabulary tedious and seemingly irrelevant to real-world situations.

Pinter (2017) recommends that to tackle these issues, teachers should employ a variety of methods to introduce vocabulary. This could involve using real objects in the classroom, citing

real-life examples, and utilising visual aids to bring vocabulary to life. Effective ways to communicate word meanings include translation, actions, definitions, and contextual situations, though it is advised to use translation sparingly to avoid overdependence.

Visual aids are instrumental in bridging the gap between learners' existing knowledge and new vocabulary, thereby improving retention. Rukmini and Sutopo (2013) have shown that incorporating pictures into vocabulary games can progressively enhance student motivation and vocabulary understanding. The use of visual aids not only supports vocabulary retention but also increases student engagement.

Furthermore, studies indicate that both deliberate (intentional) and natural (incidental) learning approaches play a significant role in acquiring vocabulary (Ahmad, 2012; Meganathan et al., 2019). Karami and Bowles (2019) observed that blending intentional and incidental vocabulary learning strategies leads to more lasting vocabulary retention. Therefore, educators need to combine these strategies to maximise the efficiency of vocabulary learning processes.

1.2. Role of Mobile Assisted Language Learning Understanding (MALL)

Different studies have shown how technology massively supports learning, particularly through MALL, which empowers mobile phones to develop different language skills. Algorithms in mobile apps can enhance the listening skills of language learners (Azar & Nasiri, 2014), speaking (Kusmaryani et al., 2019), reading (Lin, 2014), and especially writing (Fattah, 2015).

According to a study by Azar and Nasiri (2014), learners benefited from MALL in enhancing second language listening comprehension by using audiobooks on mobile phones compared with traditional CD-ROM or cassette audio. They established that the participants using mobile audiobooks outperformed their peers and perceived MALL to be more effective in listening comprehension enhancement. Kusmaryani et al. (2019) also reported positive results in university students' English-speaking skills development and critical thinking using mobile apps; students responded positively, too.

Apart from that, MALL in vocabulary learning has also been the interest of researchers. For instance, Anandha et al. (2021) maintained that the competitive feature in Kahoot enabled special needs students to learn English vocabulary. Rahimi and Miri (2014) reported that mobile dictionaries have improved the English language compared to traditional paperback ones. They believed that was because of the different kinds of tools available for learning in mobile dictionaries and their portability.

Although MALL still faces technical difficulties, inconsistent mobile connectivity, and small screen sizes, which are considered the factors that detract from its effectiveness in vocabulary learning with the help of mobile devices (Azabdaftari & Mozaheb, 2012; Finardi et al., 2016). Besides, financial difficulties might hinder several learners from accessing mobile devices and internet data to access MALL. Limited opportunities for social interaction in some MALL applications may further restrict vocabulary practice in real-life conversation situations (Finardi et al., 2016).

All in all, MALL provides considerable language learning advantages through better access and flexibility. However, MALL's limitations must be overcome to maximise the effectiveness

of teaching and vocabulary learning. Knowing the strengths and challenges of MALL will better inform instructional strategies that support language development.

1.3. Comparison with Traditional Learning Methods

For many years, vocabulary pedagogy focused on procedural teaching methods such as rote learning and word cards, such as "oral recitation" and a large amount of reading. Nevertheless, MALL has brought major vocabulary acquisition and learner engagement modifications to these conventional approaches (Burston, 2021). The effectiveness of MALL and traditional vocabulary learning can be compared in three important aspects: motivation, flexibility, and individualised learning and retention.

Traditional vocabulary acquisition is based on boring, monotonous and redundant exercises that easily cause boredom in learners (Chen, 2015). On the other hand, MALL constantly utilises gamification features like point systems and badges to enhance motivation and lead to improved engagement. Research has indicated that gamification improves the learning experience and is also related to enhanced performance and persistence (Stewart-McKoy & Anderson-Chung, 2016).

Traditional tools used in vocabulary learning are mostly confined to usage within the classroom or with a structured study schedule, limiting their application beyond these areas of use (Ozdamli & Cavus, 2011). On the other hand, MALL can help users access "anytime and anywhere," using mobile devices for learning (Kukulska-Hulme & Shield 2008), such as vocabulary acquisition in their free time throughout the day. This ease of access makes learning more convenient and helps practising spaced repetition to help learners review vocabulary in less time yet with greater frequency, which, as Eredinghaus (in Rahimi and Miri 2014) stated, could lead to better storage costs. Therefore, MALL allows learners to incorporate language practice into their broader activities more easily than traditional methods. Traditional methods often follow the one-size-fits-all way of learning, with few extra opportunities for individual or personalised experiences (Pinter, 2017). This is opposed to mobile applications, which use adaptive algorithms and will customise the content of knowledge based on the learning rate (speed) and proficiency score that a learner achieved. By way of illustration, applications like Quizlet and Duolingo adapt the difficulty level of vocabulary tasks according to user performance, improving the learning experience by making it more efficient and customised (Finardi et al., 2016). Adaptive learning like this one has been shown to improve vocabulary acquisition, as learners can go at their own pace and focus on where they need more practice (Chen, 2015).

The key difference between MALL and traditional language learning methodologies is retention. Usual ways, such as textbook exercises or paper flashcards, do not effectively support spaced repetition (a research-backed technique for enhancing long-term reminiscence of vocabulary, e.g., McQuiggan et al., 2015). However, many mobile learning applications also integrate spaced repetition algorithms, meaning that vocabulary reviews are scheduled at intervals based on how well a learner has been doing thus far (Azabdaftari & Mozaheb 2012). Such a practice accords with the cognitive theories of memory and forgetting in language

learning, i.e., learners are expected to be reminded about licit activities just before they are on the verge of forgetting them. Therefore, their retaining faculty is refreshed (Kusmaryani et al., 2019).

1.4. Learning Vocabulary Using Gamification Tool

Over the years, gamification has become mainstream for language learning mobile applications. Indeed, the authors note studies reporting a significant increase in motivation or engagement within gamified learning environments that eventually lead to improvement in the outcomes of foreign language acquisition. A very apt example is Chen (2015), who embedded game mechanics into one mobile app for learning English, increasing learner motivation and improving proficiency in English. Similarly, Stewart-McKoy and Anderson-Chung (2016) discovered that a gamified Spanish learning app heightened learner engagement and improved performance. This trend also cuts across French language apps, as observed by Cruaud's (2018) study, which recorded the positive influence of gamification on motivation and performance.

The adoption of gamification in language apps has risen over the last few years, with the work of Yu et al. (2021) underlining its potential to motivate, engage, and further enhance performance in foreign language learning. According to them, this aspect of gamification is motivational as it allows feedback and builds up a learner's confidence. Further, Wang et al. (2017) said in a study in which they focused on an online English e-learning mobile application in China, the users of the gamified version performed much better than its non-gamified version. However, though gamification is quite effective in language learning, it is important to consider game elements concerning the cultural and educational contexts to have different groups of users who have an effective and engaging experience.

2. Research Objectives and Questions

The recent rapid increase of language learning mobile applications has opened new ways of vocabulary acquisition. These applications range from interactive exercises, gamified learning, and personalised feedback, which may benefit learners of a foreign language to acquire its vocabulary. However, there is a serious scarcity of systematic investigation concerning such impacts. Additionally, the results of the studies carried out before 2014 cannot give a proper outline of perceptions and practices of language learners regarding the use of mobile applications for learning vocabulary due to the rapid development and growth of mobile technology and its applications after these years. Therefore, there is a need for an up-to-date and holistic research examination into the role that mobile applications have started playing in learning English vocabulary.

This study will especially address the learners' vocabulary acquisition, while a detailed analysis of how mobile applications shape these aspects of vocabulary development will be given. Pulling together new empirical evidence, this study will attempt to provide a sound basis for informing the effectiveness of mobile apps in promoting vocabulary growth. The findings will contribute to best practices for educators, policymakers, and researchers in informing best practices in language teaching, guiding the effective development of mobile learning tools, and shaping future research agendas in technology-enhanced language learning.

The following research questions guide this review:

- RQ1. What is the extent of the impact of mobile applications for English vocabulary learning on learners' vocabulary acquisition and retention?
- RQ2. What factors influence the effectiveness of mobile applications for English vocabulary learning, and how do these factors interact with one another?
- RQ3. How do mobile applications for English vocabulary learning compare to traditional methods in terms of effectiveness and learner satisfaction?

3. Methodology

To comprehensively address the research questions, this study adhered to a systematic review methodology, which is primarily qualitative, descriptive, exploratory, synthesising, and thematic (Gough et al., 2012; Zawaczki-Richter et al., 2020). So, the method is used to explore, summarise and analyse the empirical research into the effects of mobile applications on learning English vocabulary. This collection of literature was built to provide an overview of the shifting role of mobile application tools in educational contexts, including their impacts on teaching strategies, learning outcomes, and levels of student engagement across diverse educational contexts.

3.1. Process of Systematic Literature Review

The systematic literature review followed the steps of the PRISMA protocol (Page et al. 2021a, 2021b). The review is organised into three primary phases: planning, conducting and reporting.

3.1.1. Planning the Review

The first phase focused on carefully designing and preparing for the systematic review process. This began with the clear formulation of research questions, providing a precise focus for the review. Subsequently, a detailed review protocol was developed, incorporating the methodology, search strategy, inclusion and exclusion criteria, and data extraction and synthesis techniques. This protocol served as a structured guide to ensure consistency and transparency, facilitating an organised and replicable approach throughout the review.

3.1.2. Conducting the Review

During the second phase, a comprehensive search was conducted across multiple databases to identify studies on mobile-assisted vocabulary learning. Selection of studies adhered strictly to predefined inclusion and exclusion criteria to ensure that only high-quality and relevant studies were considered. Following selection, data were systematically extracted from each study, emphasising elements that addressed the research questions and met quality standards. This step was vital to ensure that all data synthesised for analysis were accurate and relevant to the study's aims.

3.1.3. Reporting the Review

In the final phase, the findings of the systematic review were compiled into a coherent, thorough report. This report presented the synthesised data and analysis alongside a discussion of the study's limitations, implications for practice, and potential directions for future research. The aim was to deliver meaningful insights for researchers, educators, and practitioners interested in mobile-assisted vocabulary learning, contributing significantly to the existing knowledge in this area.

3.2. Eligibility Criteria

The following systematic review presents an overview of the current research landscape into using gamification for vocabulary acquisition in primary and secondary education when using MALL. This study will achieve this through a careful, systematic identification and selection of studies. The steps of selection were done in a multi-tier manner to ensure that only highly relevant and qualitative research was selected.

Searches have been conducted across several academic databases using multiple keyword combinations on gamification, vocabulary learning, mobile learning, and primary and secondary education. Proper screening through title and abstract was conducted to narrow down such searches. This initial screening excluded studies that were clearly out of the scope, such as those targeting different educational levels or language skills.

The rest of the full-text articles were read and assessed after the initial screening process to determine their appropriateness for inclusion in the systematic review. This was further reviewed to determine the depth of the research methodology, data analysis, and findings and to ensure these studies would meet the high standards of a systematic review.

Inclusion and exclusion criteria were established and applied to refine the selection of studies further to maintain a clear focus. These, therefore, led to carefully crafting the inclusion/exclusion criteria to ensure that the studies that would finally remain after selection should bring out a coherent and meaningful singular representation of research on gamification in MALL for vocabulary learning. The full list of retrieved articles is available in Excel format here: [Screening](#).

3.2.1. Inclusion Criteria

The study had to be a peer-reviewed empirical article/study in English. The study had to be carried out in children enrolled within primary and secondary education (school) settings: 6–18 years old. The study had to be English language learning research based on ESL (English as a Second Language) or EFL (English as a Foreign Language). Fulfilling this criterion was necessary for studies to be included in the review because it directed our focus on gamification concerning English vocabulary acquisition. The study had to focus on vocabulary instruction and learning, not the teaching of other language skills. This criterion was used to ensure the review focused on how gamified elements affect vocabulary acquisition. The research had to include some MALL, and the device or software used in most cases should have been a smartphone. This criterion was to include articles related only to the aspect of using gamification in a mobile learning context.

3.2.2. Exclusion Criteria

We excluded studies conducted in other contexts (worksites, public spaces) to keep the focus on this specific academic environment of primary and secondary education. Studies of teaching non-English languages were not included, keeping the review concentrated strictly on English vocabulary instruction. Any studies concerning other language skills—listening, speaking,

reading, and writing—were excluded to keep the focus specifically on vocabulary learning. As part of a specific focus on MALL, this review did not consider research in computer-assisted language learning or digital computer games.

3.3. Search Strategy

To collect a comprehensive selection of literature according to the impact of mobile applications on English vocabulary learning from 2013 to 2024. This search covered electronic databases relevant to language learning and technology, including platforms such as ERIC (Educational Resources Information Centre), Web of Science, and SpringerLink. The first two are among the two largest citation databases for science, and the latter indexes more than a thousand academic journals in the education area; therefore, they enable highly comprehensive searches of related fields when combined. Google Scholar was also searched for additional records, and personal and professional contacts were reached out. However, these efforts did not yield any new results.

The approach to searching involved formulating specific terms connected to learning vocabulary, mobile application usage, and technology in ESL education. These terms were sharpened through an initial search of existing literature and previous studies that put more focus on the use of technology in language learning. Following this, a series of preliminary searches using both singular and combined terms were carried out to refine and pinpoint the most precise and relevant keywords, which were put together and displayed in Table 1. The initial keywords for the database search were chosen to represent a wide range of terminologies appropriate for the study. Terms contained "word learning," "lexical acquisition," and "vocabulary development." Regarding mobile application types, terms included "language app," "vocabulary app," and "mobile learning app." Measures of effectiveness included terms such as "impact," "efficacy," and "performance."

The search strategy was iterative and dynamic. Initial searches using such broad terms showed that further refinement would be required for the results to be more accurate and related to the topic. Some terms, like "mobile application," were so general that they resulted in thousands of irrelevant articles. With the terms qualified either by more specific descriptors, such as "vocabulary-building app," or in turn with more specific synonyms—namely, names of specific language learning apps like "Duolingo" or "Memrise"—this iterative process was informed by a review of the abstracts of articles retrieved. It was meant to ensure comprehensive coverage in the target set of keywords relevant to the impact of mobile apps on English vocabulary learning. This was intended to limit a specific search for studies that explored mobile apps for vocabulary acquisition without other focuses on language learning or other educational domains.

Table 1. Keywords identified for database search

Vocabulary terms	Mobile Application terms	Effectiveness terms
• English vocabulary • word learning • lexical acquisition • word retention • language proficiency • vocabulary acquisition • vocabulary skills • word mastery • lexical knowledge • language development • vocabulary enhancement • ESL • memory • vocabulary development • word expansion • EFL	• mobile application • language app • vocabulary app • mobile learning app • vocabulary-building app • language learning app • language study app • vocabulary enhancement app • mobile vocabulary app • vocabulary improvement application • Memrise • Busuu • Duolingo • mobile-assisted language learning (MALL) • Quizlet • Kahoot	• effectiveness • efficacy • impact • efficiency • outcomes • performance • success • achievement • efficacy • efficiency

The systematic search employed the following search chain: (("English vocabulary" OR "word learning" OR "lexical acquisition" OR "word retention" OR "language proficiency" OR "vocabulary acquisition" OR "vocabulary skills" OR "word mastery" OR "lexical knowledge" OR "language development" OR "vocabulary enhancement" OR ESL OR "vocabulary development" OR "word expansion" OR EFL) AND ("mobile application" OR "language app" OR "vocabulary app" OR "mobile learning app" OR "vocabulary-building app" OR "language learning app" OR "language study app" OR "vocabulary enhancement app" OR "mobile vocabulary app" OR "vocabulary improvement application" OR Memrise OR Busuu OR Duolingo OR "mobile-assisted language learning" OR Quizlet OR Kahoot) AND (effectiveness OR efficacy OR impact OR efficiency OR outcomes OR performance OR success OR achievement)) AND ((primary OR elementary OR secondary OR middle OR high) AND (education OR school)) AND PUBYEAR > 2013 AND PUBYEAR < 2024 AND (LIMIT-TO (LANGUAGE, "English"))).

3.4. Data Coding and Analysis

The targeted search across databases retrieved a total of 149 references. After removing 15 duplicates, another 25 through the automation tool Rayyan are excluded for reasons such as articles that weren't research studies (e.g., editorials, commentaries, book reviews), were outside the specified date range, and did not contain specific keywords or combinations of keywords deemed essential to the research question. Besides this, 10 were excluded for other reasons, including not focusing on the particular population of interest (e.g., wrong age group, different language learners), not investigating the intervention of interest (e.g., a different type

of mobile app, a non-technology-based intervention) and not measured the outcomes of interest (e.g., focused on grammar instead of vocabulary, used inappropriate assessment methods). Of the 99 screened records, 30 were excluded based on titles and abstract meaning. 69 reports were sought for retrieval, with 15 not retrieved. After examining 54 reports, exclusions were made for three major reasons: 15 because the articles were review articles, theoretical papers, or opinion pieces, not empirical studies with original research findings, 8 for reason because the studies did not include vocabulary as part of a broader language learning intervention but did not explicitly target vocabulary acquisition skills or strategies, and 13 for because the studies used mobile apps with features that were not relevant to the research question (e.g., apps focused on grammar or pronunciation). The selection methodology is depicted in the figure 1. below.

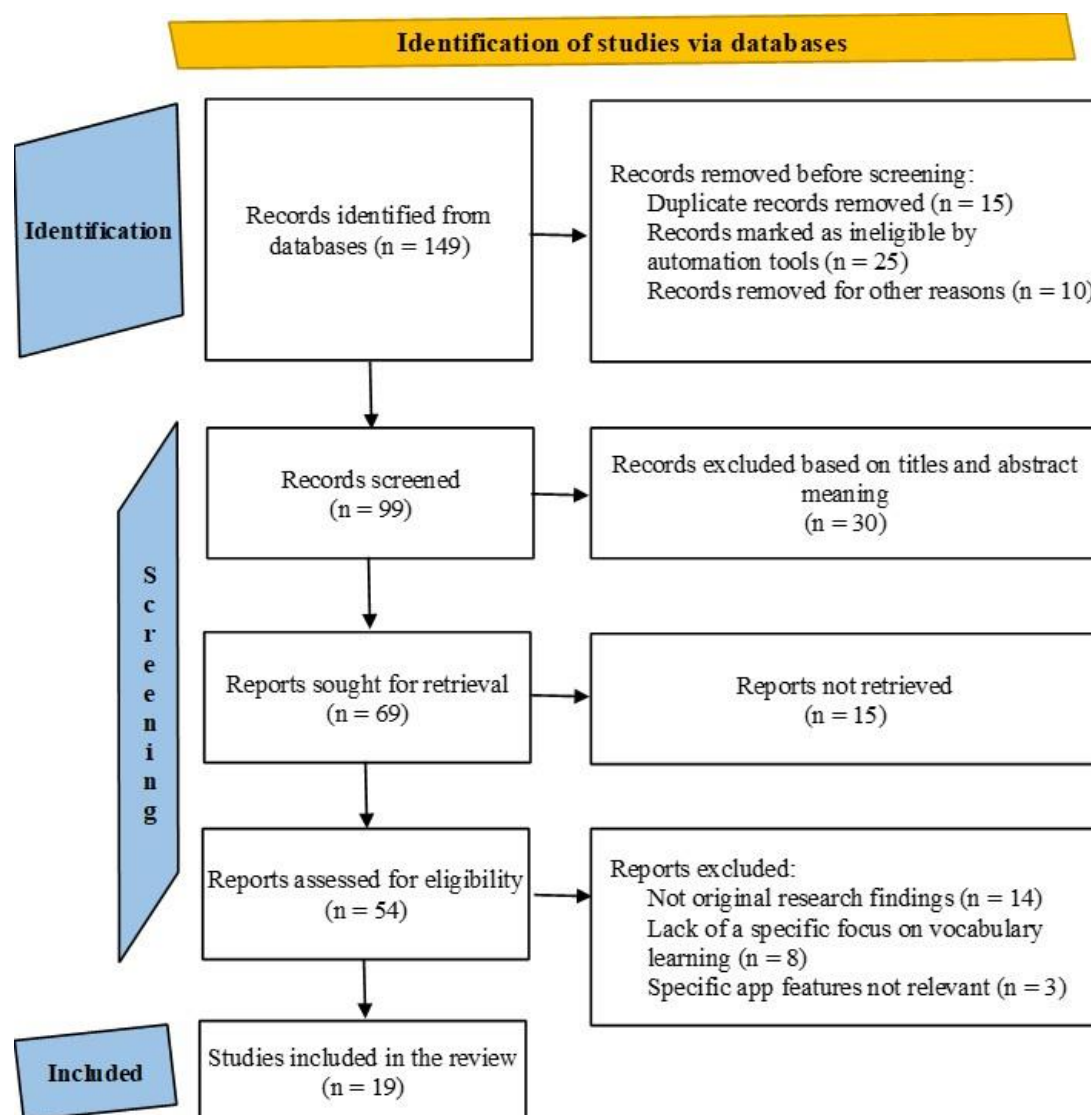


Figure 1. PRISMA Flow Diagram for Article Selection (based on Page et al., 2021a, 2021b)

Finally, 19 studies were inserted in the review, accompanying a thorough examination to ensure their quality and relevance to the research objectives. A list of finally selected articles can be found in Table 2.

Table 2. Articles analysed in the scoping review

Author(s)	Date of publication	Title of article	Publication venue
Ajisoko, P.	2020	The Use of Duolingo Apps to Improve English Vocabulary Learning.	International Journal of Emerging Technologies in Learning (iJET)
AlDakhil, M., & AlFadda, H.	2021	EFL Learners' Perceptions Regarding the Use of Busuu Application in Language Learning: Evaluating the Technology Acceptance Model (TAM)	English Language Teaching (J)
Alghameeti, A. A.	2022	Is TikTok an Effective Technology Tool in English Vocabulary Expansion?	English Language Teaching (J)
Azi, Y.	2023	Use of Mobile Apps for Enhanced Vocabulary Acquisition: A Comparative Study among Saudi EFL Students	Migration Letters (J)
Babacan, N., & Güler, Ç.	2022	The Effects of Plickers on English Vocabulary Achievement, Motivation and Anxiety	Education Quarterly Reviews (J)
Elaish, M. M., Abdul Ghani, N., Shuib, L., & Al-Haiqi, A.	2019	Development of a Mobile Game Application to Boost Students' Motivation in Learning English Vocabulary	IEEE Access (J)
Indrasari, H. A., Prasetyo, Y., & Putranto, H. R.	2024	Unlocking Language Proficiency: Exploring Duolingo's Impact on Vocabulary Learning	Journal of English Teaching, Literature, and Applied Linguistics (J)
Jedi-Sari-Biglar, L., & Liman-Kaban, A	2023	Exploring the effect of mobile-assisted task-based learning on vocabulary achievement and student attitude	Smart Learning Environments (J)
Montaner-Villalba, S.	2019	The use of Quizlet to enhance vocabulary in the English language classroom	CALL and complexity - short papers from EUROCALL 2019 (J)
Naftchi, T. W., Shaari, A. H., Hussin, S., & Abdulsahib, A. A.	2023	Determining the effectiveness of selected mobile-assisted learning apps in strengthening vocabulary learning strategies among ESL students in Malaysia	Migration Letters (J)
Özcan, M. S., & Kert, B. S.	2020	Use of Mobile Applications in Collocation Teaching	Cypriot Journal of Educational Science (J)

Poláková, P.	2022	Use of a mobile learning application in the process of foreign vocabulary learning	Procedia Computer Science (J)
Poláková, P., & Klímová, B.	2019	Mobile technology and generation Z in the English language classroom - a preliminary study	Education Sciences (J)
Poláková, P. & Klímová, B.	2022	Vocabulary mobile learning application in blended English language learning	Frontiers in Psychology (J)
Purwanto, A. A. & Syafryadin	2023	Students' Perception on Using Duolingo for Learning English Vocabulary	JET (Journal of English Teaching) (J)
Puspitasari, H., Maharani, R. F., Setyawan, W. H., & Primasari, Y.	2022	Android-Based Mobile Application for Vocabulary Learning	Jurnal Pendidikan Dan Pengajaran (J)
Rezaei, A., Mai, N., & Pesaranghader, A.	2013	Effectiveness of using English vocabulary mobile applications on ESLs' learning performance	2013 International Conference on Informatics and Creative Multimedia (C)
Setiawan, M. R., & Wiedarti, P.	2020	The effectiveness of Quizlet application towards students' motivation in learning vocabulary.	Studies in English Language and Education (J)
Tran, T. Q., & Nguyen, V. L. T.	2023	Insights Into Vietnamese Bilingual Students' Quizlet-Based English Vocabulary Learning	Journal of Language Teaching and Research (J)

Note. J = peer-reviewed journal article, C = reviewed conference paper.

Initial codes were developed after a thorough review of the selected papers, following the guidelines of Braun and Clarke (2006). For details about the charted data, refer to Table 3. The coding process identified three key types of factors related to the implementation of mobile applications for vocabulary learning:

- *Factors Favouring Implementation* that positively influence the use and effectiveness of mobile applications include improved vocabulary acquisition, retention, transfer, higher learner motivation and engagement, increased learning efficiency and flexibility, and features like gamification and spaced repetition.
- *Factors Hindering Implementation* include technical issues, mobile device limitations, lack of social interaction within certain apps, distractions, and limited teacher support or training.
- *Factors Affecting Implementation* can influence the application's effectiveness depending on the context. They include the study design, sample size, type of app, learning context, learner characteristics (motivation, learning style), and the teacher's pedagogical role.

A new theme or subthemes was created if the code did not fit into any of the previously labelled categories.

Table 3. Charted data in the review

Criterion	Description
General information and date of publication	Authors, article title, journal, issue, year, pages, and DOI reference.
Location	Country (sample of the research).
Text genre	Journal articles, conference papers, book chapters, and others.
Learning theory	The learning theory that the research is based on.
ESL/EFL Context	Is the study conducted in an ESL or EFL setting?
School Level	Does the study involve primary and secondary education (general or VET)?
Subject Area	Is the subject area relevant to ESL learning?
Type of App	What type of mobile application is used? (e.g., game-based, flashcard app, dictionary app)
Features	What are the app's key features relevant to vocabulary learning? (e.g., gamification, spaced repetition, personalised feedback)
Vocabulary Acquisition	Is the impact on vocabulary acquisition positive, negative, or mixed?
Vocabulary Retention	Is the impact on vocabulary retention positive, negative, or mixed?
Assessment Methods	How is vocabulary learning assessed (e.g., pre- and post-tests, in-app assessments, teacher observations)?
Duration and Frequency of Use	How long and how often is the app used in the study?
Factors Affecting Effectiveness	What factors influence the effectiveness of the mobile app? (e.g., learner motivation, app design, teacher support)
Interaction of Factors	How do these factors interact with each other?
Effectiveness	Is the app more, less, or equally effective than traditional methods?
Learner Satisfaction	Are learners more, less, or equally satisfied with the app compared to traditional methods?
Research Design	Is the research design appropriate (experimental, quasi-experimental, etc.)?

The full analysis of the 19 articles included in the review is available in Excel format here: [Analysis of 19 articles](#).

4. Results

4.1. Characteristics of the Studies

4.1.1. Timeline, Locations and School-level of the Participants

The reviewed studies' period taken by the reviewed works ranges from 2013 to 2024. Notably, most studies on this topic have been published since 2019, indicating a growing research interest and deeper exploration of the subject in recent years (see Figure 2). Most of these papers are peer-reviewed journal articles (17); a few reviewed conference papers (2) complement the set. These range from cognitivism and constructivism to technology-enhanced language learning, thus allowing a wide range of instructional methodologies that have been analysed.

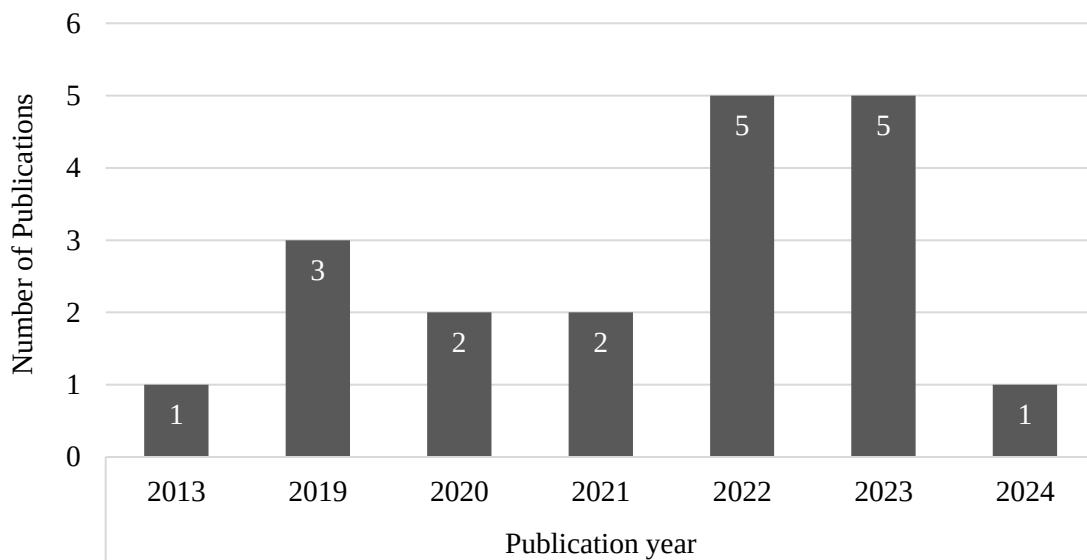


Figure 2. Timeline of research publications (2013–2024)

The systematic literature review includes studies from a wide range of countries, reflecting global interest in education among primary and secondary school-aged students. As shown in Figure 3, most studies originate from Indonesia, Saudi Arabia, Turkey, and Slovakia, representing diverse cultural and pedagogical perspectives. This distribution offers insights into teaching techniques and the application of mobile-assisted digital technologies in ESL education. Including countries from different continents underscores the global reach of ESL research and highlights how local educational goals shape teaching methods and outcomes.

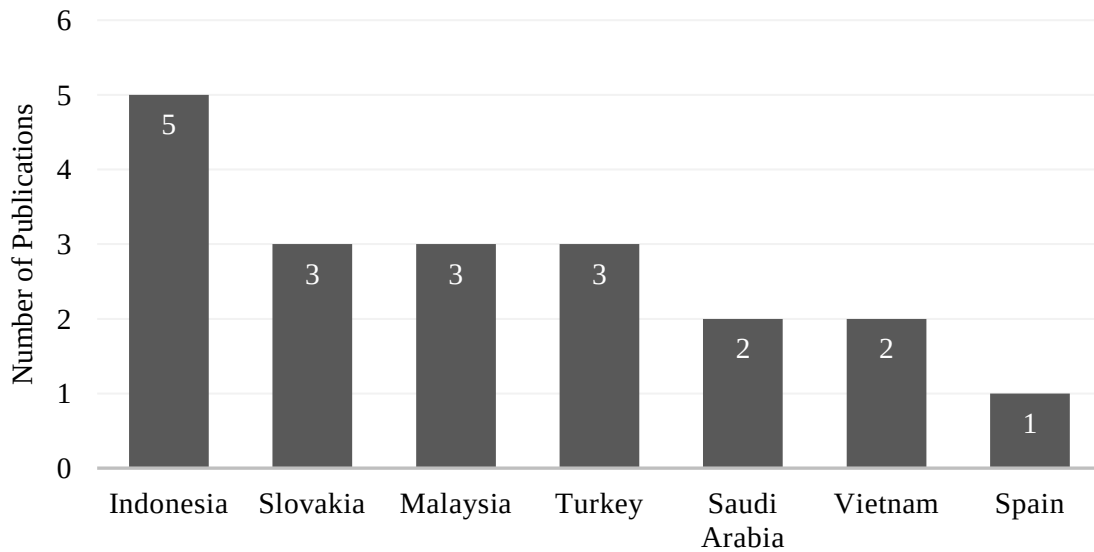


Figure 3. Geographic location

In terms of the level of schooling, most of the research has focused on secondary education, particularly the high schools (general upper secondary level), where the implementation of ESL methods is essential in setting a foundation for the students to pursue further avenues both in their academic and professional lives. There is also considerable focus on primary schools, junior high schools (lower secondary level) and vocational schools (vocational upper secondary level), emphasising that learning a language at tender-aged students is very important (see Figure 4). Research across these educational stages often concentrates on concepts such as language comprehension, vocabulary development, and using technology to boost student engagement. This wide-ranging coverage across school levels provides valuable insights for educators and policymakers on how ESL education advances to meet students' developmental needs at various stages.

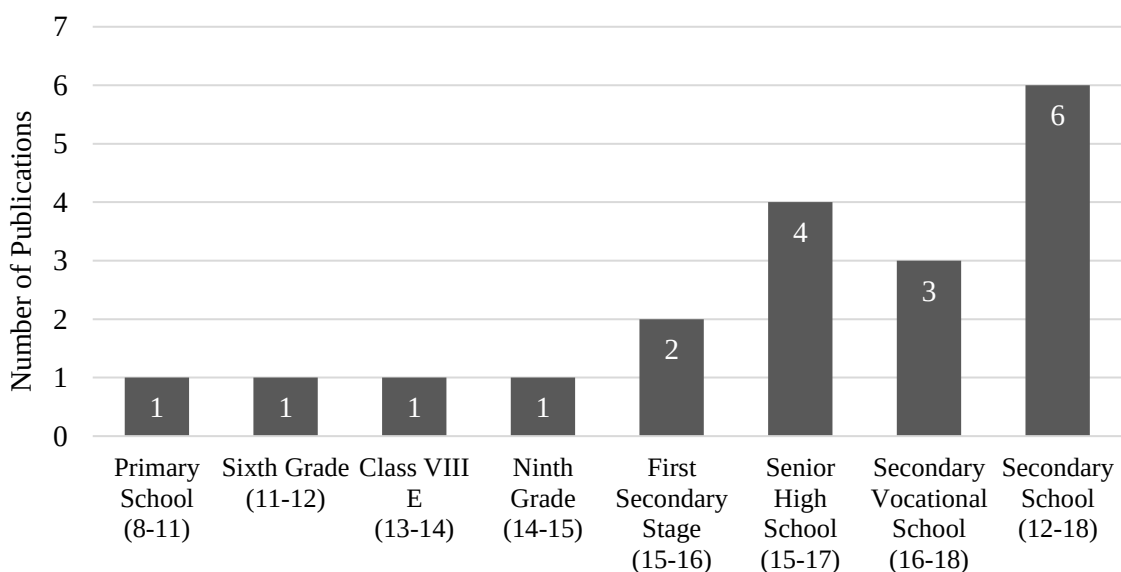


Figure 4. School-level and corresponding age range

Of the nineteen research reviewed, eight (Setiawan & Wiedarti, 2020; Poláková & Klímová, 2019; Elaish et al., 2019; Tran & Nguyen, 2023; Montaner-Villalba, 2019; Özcan & Kert, 2020; AlDakhil & AlFadda, 2021; Alghameeti, 2022) particularly investigate mobile applications built just for vocabulary learning, with an emphasis on student engagement and effectiveness. Five of these use gamification components like points, badges, and leaderboards to increase motivation and retention (Elaish et al., 2019; Tran & Nguyen, 2023; Montaner-Villalba, 2019; AlDakhil & AlFadda, 2021; Alghameeti, 2022). Another seven studies use game-based learning methods, using interactive elements such as quizzes, flashcards, and challenges to reinforce vocabulary development (Setiawan & Wiedarti, 2020; Poláková & Klímová, 2019; Tran & Nguyen, 2023; Montaner-Villalba, 2019; Özcan & Kert, 2020; Purwanto & Syafryadin, 2023; Babacan & Güler, 2022). Four studies combine gamification and game-based English as a second language learning methodologies in a mobile context to use both approaches to improve learning results (Elaish et al., 2019; Tran & Nguyen, 2023; Montaner-Villalba, 2019; AlDakhil & AlFadda, 2021). Additionally, six publications look over various instructional approaches to improve vocabulary retention, such as spaced repetition, multimedia features, and peer-to-peer interaction, with four cases using these strategies merely in a mobile setting (Setiawan & Wiedarti, 2020; Poláková & Klímová, 2019; Özcan & Kert, 2020; Purwanto & Syafryadin, 2023; Babacan & Güler, 2022; Poláková & Klímová, 2022).

The comparison of research designs in the nineteen papers displayed a tendency towards employing quasi-experimental and mixed methods which are common in educational research due to the difficulties associated with having total experimental control (Setiawan & Wiedarti, 2020; Poláková & Klímová, 2019; Özcan & Kert, 2020; Purwanto & Syafryadin, 2023; Babacan & Güler, 2022; Poláková & Klímová, 2022). A few studies have used quasi-experimental designs which enable the inclusion of control groups in an experiment without random allocation, which seeks a measure of experimental balance with desirability (Setiawan & Wiedarti, 2020; Poláková & Klímová, 2019; Özcan & Kert, 2020). As is often the case in education studies, the mixed methods design, which combines qualitative and quantitative data, offers a broader picture by capturing what is measurable and what is observed within the context (Purwanto & Syafryadin, 2023; Babacan & Güler, 2022; Poláková & Klímová, 2022). Other designs are classified as pre-experimental or before-after designs, which focus on measuring changes within single groups over time, and descriptive qualitative research, which involves probing into the experiences of the participants without interventions. This variety in the design reflects a dual approach in linguistics research where English is treated as a second language, which is relevant to educational practice.

4.1.2. Learning Theories

Looking at the 19 studies, we can see a blend of learning theories exercised in language acquisition (see Table 4). The leading theory highlighted mainly is Cognitivism, as stated in the papers by Setiawan and Wiedarti (2020) and Montaner-Villalba (2019). They concentrate on cognitive processes like information processing and retention, which are prominent in learning foreign languages. MALL is another significant factor, where Poláková and Klímová (2019) highlight the advantages of mobile technologies in dynamic learning settings. Elaish et al.

(2019) discussed the features of Persuasive Technology and explained how interactive mobile applications can enhance learner engagement and motivation.

Another relevant line is Constructivism; for instance, Alghameeti (2022) promotes learning as technology-mediated and active. Some researchers, for example, Tran and Nguyen (2023), are not limited to a single perspective, suggesting a more integrated approach to foreign language teaching and its theory. Also very important is Mayer's Cognitive Theory of Multimedia Learning, which Rezaei et al. (2013) mentioned concerning the use of multimedia tools in vocabulary acquisition.

To sum up, the interpretation of several theories and their application to the problem points to a multifaceted view of the problem of language learning with technology integrating the cognitive engagement of the learner.

Table 4. Distribution of learning theories in reviewed studies

Study	Learning theories
Ajisoko (2020)	Self-Determination Theory, Gamified Learning Theory
AlDakhil & AlFadda (2021)	Interaction Hypothesis, Social Constructivism
Alghameeti (2022)	Constructivism and TELL
Azi (2023)	Vocabulary Acquisition, MALL, and Gamification
Babacan & Güler (2022)	Affective Filter Hypothesis, Motivation Theory
Elaish et al. (2019)	Intrinsic and Extrinsic Motivation Theory, Persuasive Technology Framework
Indrasari et al. (2024)	Flow Theory, Gamification in Education
Jedi-Sari-Biglar & Liman-Kaban (2023)	Task-Based Language Teaching (TBLT), Mobile-Assisted Language Learning (MALL)
Montaner-Villalba (2019)	Retrieval Practice, Spaced Repetition
Naftchi et al. (2023)	Cognitivism and Constructivism
Özcan & Kert (2020)	Cognitive Load Theory, Lexical Collocation Framework
Poláková (2022)	Cognitivism, Constructivism, and MALL
Poláková & Klímová (2019)	Constructivist Learning Theory, Digital Natives Concept (Prensky)
Poláková & Klímová (2022)	Blended Learning Framework, Scaffolding Theory
Purwanto & Syafryadin (2023)	Gamification Theory, Behaviorist Learning Theory
Puspitasari et al. (2022)	Cognitivism, Constructivism, and MALL
Rezaei et al. (2013)	Socio-Cultural Theory, Multimedia Learning Theory
Setiawan & Wiedarti (2020)	Cognitivism and Sociocultural Theory
Tran & Nguyen (2023)	MALL Framework, Constructivism

4.1.3. Type of Mobile Applications

The nineteen studies have found various mobile applications for ESL learning, which have different aims and foster student engagement (see Figure 5).

One of the best-suited applications for vocabulary acquisition is the digital flashcard program called Quizlet, which is quite interactive. For such works as Montaner-Villalba (2019) and Setiawan and Wiedarti (2020), the focus is on enhancing students' motivation and vocabulary through repetition.

Another important voluntary contributor to the topic is Kahoot, which is a game-based learning. Elaish et al. (2019) caught the attention of how competitions in quizzes and real-time feedback make learning fun. Duolingo also stands out, especially in Purwanto and Syafryadin's (2023) research, which delves into how students perceive its impact on vocabulary learning.

Even TikTok is stated. For instance, Alghameeti (2022) explored its ability as an instrument for vocabulary expansion, indicating how non-traditional applications can be involved in language learning. Other apps like Busuu and Plickers have also appeared in several studies, reflecting a trend towards gamification and interactive features in language acquisition.

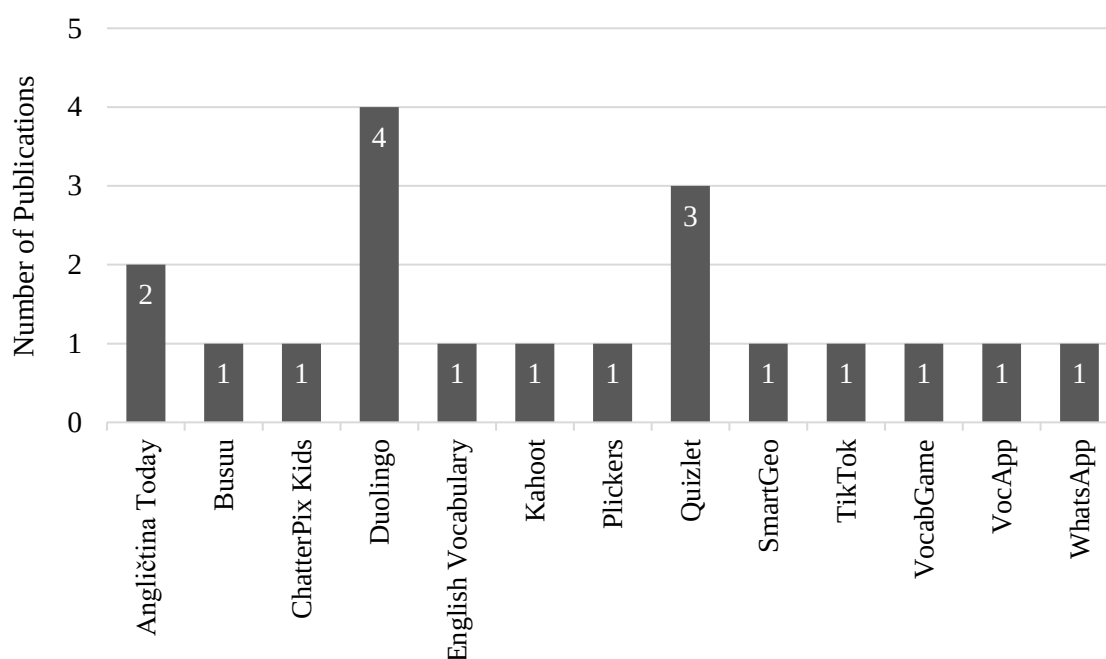


Figure 5. Types of mobile applications used in studies

4.2. Impact of Mobile Apps on Vocabulary Acquisition and Retention (RQ1)

The review of 19 studies found that mobile apps are effective tools for improving vocabulary acquisition and retention (see Table 5). Mobile apps have been shown to significantly enhance vocabulary test scores, increasing them by 15% to 35% in various contexts. For example, research by Tran and Nguyen (2023) found that Quizlet increased retention by 30% due to its interactive features (flashcards and pronunciation tools) and ease of use. Setiawan and Wiedarti (2020) found an increase of 12% for Quizlet. Similarly, Duolingo users scored average 18%

higher on post-test scores, according to Azi (2023), Indrasari et al. (2024), and Purwanto and Syafriyadin (2023), thanks to its structured repetition and adaptive learning approach. Kahoot has also shown success, encouraging active engagement and increasing scores by 34% compared to control group using traditional methods that improved learning by only 18% (Poláková & Klímová, 2019).

Features such as play, repetition, and interactivity emerged as critical components of success. For instance, Busuu's gamified, interactive and collaborative features, as well as Kahoot's game-based questions, increased engagement, autonomy and motivation, while Quizlet's flashcards and collaborative tools, such as "Quizlet Live", encouraged individual and group learning. Duolingo's game-based lessons and personalised learning paths provide consistent daily practice, while TikTok allows for exposure to authentic language through short, real-world videos that reinforce contextual understanding. Features such as instant feedback and multimedia elements enhanced retention as long-term memory was reinforced. The studies reviewed highlight the potential of mobile apps to meet the diverse needs of learners, increasing their autonomy and motivation.

However, challenges to mobile-assisted vocabulary learning have also been observed. Dependence on the internet has been a persistent limitation, especially when a stable connection is not available, and resources are limited. Device availability has also been another barrier, preventing some learners from using these apps regularly. In addition, apps with non-educational features or advertisements can sometimes distract learners from their goals. At the same time, the ability of these tools to combine innovative features with a personalised learning experience highlights their relevance in modern education.

Table 5. Structured results for vocabulary acquisition and retention

Study	App Name	Impact on Vocabulary Acquisition	Impact on Vocabulary Retention	Additional Observations
Ajisoko (2020)	Duolingo	Post-test average: 87% correct answers after 30 days of practice using Duolingo.	The gamified interface boosted retention, and notable retention improvements were made with repeated practice.	It increased confidence in speaking and writing new vocabulary.
AlDakhil & AlFadda (2021)	Busuu	75% of participants reported a noticeable improvement in vocabulary size after two months of using the app.	Higher retention due to interactive, gamified learning.	It fostered learner autonomy and reduced cognitive fatigue.
Alghameeti (2022)	TikTok	Learning 5–10 new words weekly with authentic language exposure.	Not explicitly identified.	It encouraged real-world language use and pronunciation improvement.
Azi (2023)	Duolingo	18% improvement in post-test scores.	Teachers observed higher retention rates and better application of learned vocabulary in real-life contexts.	It fostered motivation and engagement in flexible and interactive learning.
Babacan & Güler (2022)	Plickers	15–20% higher test scores with engaging and easy-to-use app features.	Improved vocabulary recall in classroom discussions.	It was easy to use, with effective vocabulary-building features.
Elaish et al. (2019)	VocabGame	20% higher post-test scores in the experimental group with enhanced motivation.	Improved retention with engaging, game-based methods.	It helped maintain interest and increased classroom participation.
Indrasari et al. (2024)	Duolingo	All 10 participants showed improved vocabulary scores (average increase: 18%).	Students praised the app's use of images and pronunciation features for aiding memory retention.	Its interactive features promoted independence and strategy development.
Jedi-Sari-Biglar & Liman-Kaban (2023)	ChatterPix Kids	The experimental group scored 35% higher on vocabulary tests than the control group after six weeks of mobile-assisted task-based learning.	Teachers reported higher classroom engagement and reduced reliance on rote memorisation.	Its interactive features made learning enjoyable.
Montaner-Villalba (2019)	Quizlet	22.5% improvement in vocabulary test scores over the academic year.	Flashcard repetition helped retain vocabulary longer.	Its collaborative features, like Quizlet Live, motivate learners.

Naftchi et al. (2023)	SmartGeo	30% higher scores due to interactive features.	Vocabulary recall improved significantly after repeated app-based practice sessions. Multisensory experiences improved retention and understanding.	It encouraged interactive learning and reduced fatigue.
Özcan & Kert (2020)	WhatsApp	18% higher scores on vocabulary tests, with notable spelling and pronunciation improvements.	The app reduced cognitive load and made vocabulary learning meaningful.	Its elements were praised for maintaining interest.
Poláková (2022)	Angličtina Today	15% higher vocabulary test scores in the experimental group.	Teachers observed improved vocabulary recall during classroom discussions.	It supported learner independence and engagement.
Poláková & Klímová (2019)	Kahoot	Post-test scores improved by 34% in the experimental group; the control group improved by 18%.	Higher retention rates due to repetition and collaborative tools.	It improved motivation and engagement, particularly in collaborative settings.
Poláková & Klímová (2022)	Angličtina Today	The experimental group (using the app) saw a 34% improvement in post-test scores.	Gamified features and immediate feedback improved retention.	It helped create a more relaxed learning environment.
Purwanto & Syafryadin (2023)	Duolingo	18% higher improvement in test scores and stronger daily practice habits.	Consistent retention due to gamified daily practice.	It encouraged consistent learning habits and confidence.
Puspitasari et al. (2022)	VocApp	25% improvement in post-test scores with gamified features.	Not explicitly identified.	It created a more supportive environment.
Rezaei et al. (2013)	Learn English Vocabulary	25% higher vocabulary test scores and better engagement.	Improved retention with consistent daily practice.	Its format made learning enjoyable (self-paced learning, instant feedback) and it reduced teacher dependence.
Setiawan & Wiedarti (2020)	Quizlet	The experimental group scored 12% higher in post-tests.	Improved retention with gamified learning, interactive features, and immediate feedback.	Students found it enjoyable and easy to integrate into their study routines.
Tran & Nguyen (2023)	Quizlet	Quizlet's flashcards and pronunciation tools significantly improved pronunciation and understanding.	30% increase in retention through interactive (flashcards and pronunciation) tools.	Students praised its ease of use and encouragement for daily practice.

4.2.1. Specific Applications and Their Unique Contributions



Angličtina Today provides daily vocabulary updates, cultural insights, and interactive exercises. This approach keeps learning fresh and relevant by regularly introducing new words and concepts. The inclusion of cultural insights adds depth to vocabulary acquisition, while interactive exercises make learning more engaging (Poláková & Klímová, 2022).



Busuu emphasises practical, conversational vocabulary that learners can instantly apply in real-life contexts, facilitating retention because of the immediate relevance of the material. The application also incorporates a social interaction feature that enables learners to engage with native speakers, receiving early feedback on their usage. Research, for instance, AlDakhil and AlFadda (2021), indicates that this interactive feature enhances vocabulary retention and increases user satisfaction, encouraging continued use.



ChatterPix Kids - Apps on Google Play *ChatterPix Kids* encourages visual storytelling and vocabulary development through creative expression. The application helps children understand and remember new words in a fun and interactive way by animating pictures and allowing them to add their own voices. This approach encourages active learning and deeper engagement with vocabulary (Jedi-Sari-Biglar & Liman-Kaban (2023).



Duolingo introduces vocabulary within sentence contexts, aiding comprehension and retention by locating words within meaningful linguistic frameworks (Purwanto & Syafryadin, 2023; Indrasari et al., 2024). The application's gamified element, which incorporates rewards, streaks, and levels, encourages regular engagement, a critical factor for retention (Purwanto & Syafryadin, 2023; Indrasari et al., 2024). Well-designed with a user-friendly interface, Duolingo is accessible for beginners and intermediate learners, promoting consistent study routines that positively influence vocabulary acquisition and retention outcomes (Purwanto & Syafryadin, 2023; Indrasari et al., 2024).



Learn English Vocabulary provides comprehensive vocabulary lists, example sentences, and quizzes. This structured approach ensures that learners can access a wide range of vocabulary and systematically test their understanding. Combining lists, examples, and quizzes support vocabulary acquisition and retention (Rezaei et al., 2013).



English Vocabulary in Use Features offers in-depth explanations, grammar integration, and practice exercises. This comprehensive approach helps learners understand the meaning of new words and how to use them correctly in context. The integration of grammar and the opportunity for practice further reinforces vocabulary acquisition and usage (Rezaei et al., 2013).



Kahoot's quiz framework makes learning competitive, increasing motivation and learner engagement to facilitate vocabulary acquisition. Moreover, this approach reduces learning anxiety in a group setting—that each of us may have otherwise experienced—which might result in increased retention. By pushing for speed in recall through its timer-embedded quiz design, Kahoot encourages active recall, a process that consolidates vocabulary retention (Poláková & Klímová, 2019).



Plickers provides educators with a real-time assessment tool for vocabulary knowledge, facilitating an environment with minimal learning anxiety by allowing learners to respond privately. This supportive environment fosters engagement and enables immediate identification of areas needing reinforcement, contributing to better retention. Real-time feedback allows learners to correct misunderstandings promptly, thereby supporting vocabulary retention through immediate clarification and subsequent practice (Babacan & Güler, 2022).



Quizlet's primary features—flashcards, multiple learning modes, and spaced repetition—benefit vocabulary acquisition. Research (e.g., Montaner-Villalba, 2019; Tran & Nguyen, 2023) underlines Quizlet's effective design in supporting memorisation, especially using interactive elements like matching games and the “Learn” mode (Montaner-Villalba, 2019; Tran & Nguyen, 2023). The spaced repetition function plays a central role in retention by prompting learners to review vocabulary at carefully timed intervals, therefore reinforcing long-term memory (Setiawan & Wiedarti, 2020; Poláková & Klímová, 2019). This structure has been regularly displayed to aid in continuous vocabulary recall (Setiawan & Wiedarti, 2020; Poláková & Klímová, 2019).



SmartGeo promotes location-based vocabulary learning through real-world exploration. This immersive approach connects vocabulary acquisition with tangible experiences, making learning more meaningful and memorable. Users can better understand their meaning and usage by encountering new words in their natural context (Naftchi et al., 2023).



TikTok's short video format exposes learners to vocabulary within authentic, contextualised settings, promoting incidental vocabulary acquisition. Learners often experience vocabulary naturally, which helps retention by situating words within familiar and diverse contexts. Due to its popularity among younger users, TikTok offers a recognisable and engaging medium that supports vocabulary acquisition in an informal yet effective manner. Continuous exposure to vocabulary across various content types reinforces learning (Alghameeti, 2022).



VocabGame offers gamified vocabulary practice, competitive learning, and leaderboards. This approach motivates learners by introducing game mechanics and opportunities to compete with others. Using leaderboards encourages continued engagement and provides a sense of progress (Puspitasari et al., 2022).



VocApp offers personalised vocabulary lists, spaced repetition, and gamified learning. This means that users can learn according to their needs and goals, and the app's spaced repetition system helps them remember words more effectively. The gamified learning environment makes vocabulary acquisition more interesting and enjoyable (Puspitasari et al., 2022).



WhatsApp can be used to practice informal vocabulary and social communication in a real-world context. Using the app to communicate with others in English, learners can practice using new vocabulary naturally and spontaneously. This informal approach can help to build confidence and fluency (Özcan & Kert, 2020).

4.2.2. Assessment Methods of Mobile Application

The main mobile vocabulary learning research methodologies are presented in Figure 6. These include comparing mobile apps to traditional methods and using pre- and post-tests to assess vocabulary growth. Usage analytics track learner behaviour and correlate app usage effectively, while quizzes and in-app assessments provide real-time feedback and reinforce learning. Surveys and questionnaires determine learner satisfaction and preferences, while observational data examine engagement and provide qualitative insights. Finally, retention tests assess long-term vocabulary retention through delayed post-tests. A variety of research examples highlight the effectiveness of these approaches.

Many studies used *pre- and post-tests* to measure vocabulary gain before and after the intervention. This method gives a numerical measure of the improvement, which, in turn, helps researchers compare the effectiveness of using mobile applications with traditional methods. For example, Setiawan and Wiedarti (2020) and Poláková and Klímová (2019) employed pre- and post-tests to evaluate vocabulary learning, indicating that mobile app users typically achieved higher gains.

Some studies used *delayed post-tests (retention tests)* to measure long-term retention. This approach investigates the durability of vocabulary learning through mobile apps, which is an important consideration for deeper learning. One notices that in the case of Elaish et al. (2019) and Tran and Nguyen (2023), follow-up tests were conducted weeks following the initial post-test. They found that learners who employed mobile applications outperformed the control group in retaining their vocabulary.

Mobile app-based research is based on quizzes, tests, and in-app assessments. The quizzes and tests incorporated into these apps offer immediate, consistent feedback regarding learner performance. For example, Montaner-Villalba (2019) and Rezaei et al. (2013) used apps like Quizlet and Duolingo that had in-app tests where learners themselves may regularly test their vocabulary knowledge and hence reinforce learning with repetition.

Survey and questionnaire methods are commonly used for assessing learner satisfaction, motivation, and perceived ease of use. These tools provide qualitative data, which can be used to understand the learner's attitudes towards using apps over traditional methods. Alghameeti (2022) and Puspitasari et al. (2022) conducted surveys and reported that learners tend to use mobile apps because of their interactive learning content when assessing user satisfaction.

Some papers include *interviews or focus groups* to gather in-depth qualitative feedback from participants. This helps the researcher gather personal experiences, preferences, and challenges learners face. Interviews by Poláková and Klímová (2022) and Naftchi et al. (2023) complemented quantitative data. They showed that the learners liked the convenience factor and the interactive elements in mobile applications.

Observational methods would also allow the researcher to observe the interaction of the participants, hence giving information on behavioural aspects of learning, such as time on task and engagement levels. AlDakhil and AlFadda (2021) and Azi (2023) utilised observational data to explore the dynamics of how learners interacted with the mobile apps versus the traditional method and found a higher engagement level in the mobile app group.

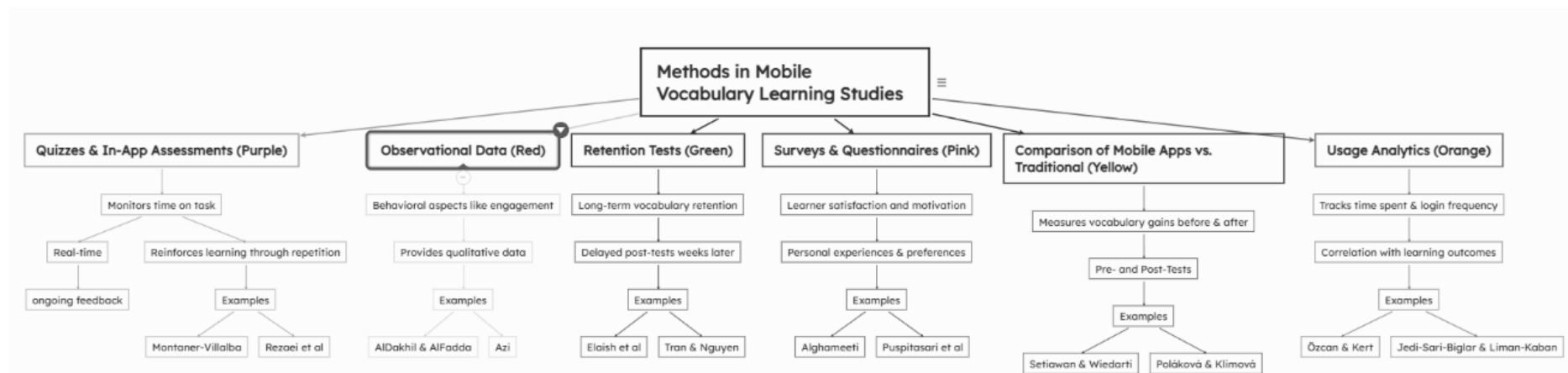


Figure 6. Main method used in studies

Most studies on mobile apps also included *usage analytics*, such as time spent in the app, logins, or progression. This gives the researchers an overview of the learners' engagement and uses it to correlate the usage patterns with learning outcomes. Indeed, Özcan and Kert (2020) and Jedi-Sari-Biglar and Liman-Kaban (2023) applied app analytics to sort frequent app users, which generally showed better retention and engagement of vocabulary

4.3. Key Factors Contributing to Vocabulary Improvement and their Interaction (RQ2)

4.3.1. Learner Motivation and Engagement

Motivation and engagement are repeatedly highlighted as crucial components for successful vocabulary acquisition, particularly in the context of MALL. Several studies, including Setiawan and Wiedarti (2020) and Alghameeti (2022), emphasise that motivation plays a central role in sustaining learner interest and encouraging persistence in vocabulary practice. Gamification elements, such as points, badges, and leaderboards, are particularly effective in driving motivation by giving learners a sense of accomplishment and progress. These features mimic game-like rewards, transforming what could be monotonous vocabulary drills into a stimulating activity that keeps learners invested in the learning process.

Moreover, brief dynamic videos and animations within language apps have been shown to captivate learners' attention, providing visual and auditory stimuli that reinforce engagement. These multimedia features, including short instructional clips and in-app animations, appeal to younger learners—particularly those in Generation Z, who are accustomed to consuming fast-paced multimedia content. According to Poláková and Klímová (2019), this generation expects an interactive and visually engaging experience, making game-based learning a powerful tool for enhancing motivation. Additionally, incorporating social elements such as collaborative learning or competitive modes (where learners can compare scores with friends) further drives engagement, as learners feel part of a community.

4.3.2. App Usability and Accessibility

The Technology Acceptance Model (TAM) explains how users accept and use new technologies. Core factors include perceived ease of use, perceived usefulness, and positive attitudes toward technology. AlDakhil and AlFadda (2021) have underlined the fact that if learners perceive the vocabulary app as helpful for their improvement in the language and easy to use, they will more probably use it consistently. In general, perceived usefulness for vocabulary apps concerns accomplishing a higher goal, such as better retention or more comprehension. Learners are more likely to incorporate an app into their routines if they believe their progress is tangible.

Usability is very relevant to mobile learning applications. It emerged that apps that are straightforward and easy to use will be frequently used, as the learners will not feel irritated or even get lost (AlDakhil & AlFadda, 2021). The straightforward, well-thought-out design and hierarchy, and easy access to features make it easier for learners of all ages and skills. Such a

guiding nature of apps ensures that users do not have to deal with the challenges of menu trees and related functions and can focus on learning new words. It also includes reducing the cognitive load and allowing learners to engage with the content without distractions.

Audience engagement and retention are two more aspects that affect how students integrate despite the hurdles to interaction. Apps that run offline or have a lighter version make it easier for learners to learn at different locations, irrespective of internet access. The possibility of use across mobile phones, tablets, and even personal computers makes it possible for learners to use various devices depending on the situation, be it for quick lessons during travel or more serious studies during periods of rest at home. This readiness is especially advantageous for learners in places where the internet is inaccessible and resources are limited, as it decreases the barriers to consistent practice.

Further motivational factor is a positive attitude toward the use of technology, which, in turn, makes people of all ages, especially young groups, adopt and use technology frequently. It has been proved that a group of learners holding a positive attitude toward technology are more receptive to the digital approach in learning and, hence, interact fully with app features, such as gamified elements or social learning tools. As for those learners who are resistant to this type of learning, early measurable progress can create more positive attitudes and motivation.

4.3.3. Frequency of Use of Mobile Application

The frequency of vocabulary use is a key factor influencing learning outcomes. Studies have shown that a variety of usage patterns, such as daily use or occasional use (e.g., twice a week), often yield better results. Polakova and Klimova (2022) showed an initial increase in vocabulary based on a short-term (three-week) intervention. Similarly, Azi (2023) reported that high-frequency app users in a Saudi EFL context showed improved acquisition and retention compared to low-frequency users. In a longer-term study, AlDakhil and AlFadda (2021) examined the use of Busuu for ten weeks. They found that learners who practised daily had significantly higher vocabulary retention scores than those with irregular usage patterns.

Apps such as Busuu are designed to teach vocabulary in a structured manner, while platforms such as TikTok can serve as a casual learning tool. Alghameeti (2022) found that TikTok's rich, authentic context and repeated exposure to the target vocabulary significantly contributed to learners' retention of new words, even when learning was informal. Such findings support Ahmad's (2012) discussion of the role of incidental learning in vocabulary acquisition, noting that it can complement intentional learning methods.

4.3.4. Personalisation and Adaptive Learning

Personalisation efforts are increasingly highlighted as indispensable to effective mobile learning, as students are incredibly diverse in their pace, preferences, and prior vocabulary knowledge. Elaish et al. (2019) investigate whether personalised learning paths, which modify contents based on the learner's current competence and learning style, would instigate retention since it ensures that not too high is the level of text utilised nor too low. This feature allows

individualised content engagement and enables every student to feel that their progress toward mastery is a genuine accomplishment. For example, when a learner has problems with a specified set of words, the adaptive learning algorithms can provide more resources and practice through varied techniques for reinforcement until retention is demonstrated.

Immediate feedback, such as corrections or explanations, is also effective in vocabulary learning, as this allows for immediate addressing by learners of their mistakes. Elaish et al. (2019) say that the immediacy of feedback creates a learning environment responsive to learners, whereby learners are urged to reflect on and correct their mistakes. It has been proven that the reflection and correction procedure helps deepen understanding and provides an avenue for long-term retention. In addition, personalised reminders and spaced repetition principles provided within apps, such as Duolingo, support memory since they help prompt learners to return to vocabulary at optimal intervals based on learner performance levels.

4.3.5. Cultural Relevance and Content Authenticity

Infusing significance and background into applications can significantly improve learners' understanding and memory retention, according to Naftchi et al. (2023). They suggest that incorporating content can make the learning experience more relatable and effective for ESL learners with diverse backgrounds. Vocabulary apps can help connect cultures and make the learning material more relevant and practical by including expressions, idioms, and cultural allusions to the learner's regions or communities. This relatability not only aids comprehension but also fosters a stronger emotional connection to the material, which can lead to increased engagement and a deeper understanding of vocabulary within context. It also creates a more profound emotional bond with the material itself. This can result in higher involvement and a better grasp of vocabulary in its context.

Language learning apps can enhance authenticity by incorporating real-life situations that learners typically face, like chatting in a restaurant or office or travelling. When words are introduced within contexts resembling life scenarios, learners' chances of recalling and using them effectively are improved. This emphasis on using language is especially advantageous for adults learning or getting ready for the English environments they will encounter in the world.

4.3.6. Dual Coding and Multimedia Elements

Under the dual coding theory, there is this belief that combining verbal with visual modalities strengthens memory retention by creating a duality of pathways in the brain. Rezaei et al. (2013) believe that applications built on such theory development of text-based vocabulary with images, audio pronunciations, or even video demonstrations can do much to enhance the learner's ability to remember and actively use new vocabulary. This is further enforced by, for example, showing a picture of an object with its vocabulary word or providing an audio clip of its pronunciation so that the connection between word and meaning is enforced through multiple sensory inputs. This is very helpful for visual and auditory learners because such a multimodal technique supports their learning style and increases retention.

4.4. Comparison of Mobile App-assisted Vocabulary Learning to Traditional Method (RQ3)

These studies comparing mobile app-assisted learning with traditional methods show that mobile apps significantly increase English language learning test scores (see Table 5), as well as engagement and student satisfaction (see Table 6). Apps studied consistently outperform traditional methods due to their interactive and flexible design. According to research by AlDakhil and AlFadda (2021), Busuu improved vocabulary, though some preferred traditional methods. WhatsApp reduced cognitive load and made vocabulary learning more meaningful compared to rote memorisation in traditional methods (Özcan & Kert, 2020). Kahoot caused better vocabulary retention and comprehension than traditional methods (Poláková & Klímová, 2019).

Most of the studies reported high satisfaction among learners with mobile apps. For example, Poláková and Klímová (2019) and Ajisoko, P. (2020) established that students in the experimental group using apps (Kahoot or Duolingo) found more enjoyable and satisfying than traditional methods; this was because of the interaction and multimedia features. Learners consistently found mobile applications enjoyable and engaging, especially those with visual and interactive elements, as AlDakhil and AlFadda (2021), Azi (2023), Purwanto and Syafryadin (2023), and Tran and Nguyen (2023) reported. Puspitasari et al. (2022) also reported that learners had higher satisfaction and engagement levels, experienced ease of access, and found mobile applications more enjoyable than traditional text-only methods. Applications were generally well-received, with learners appreciating the stimulating experience these apps provided compared to traditional methods.

The studies reviewed also show that multimedia (visual and audio) elements help students engage in learning more elaborately, which increases their satisfaction levels compared to traditional text-based methods. The use of mobile allows learners to study vocabulary on the go, at their own pace. This flexibility has also been valued in numerous studies, such as those by Rezaei et al. (2013) and Naftchi et al. (2023). At other times, satisfaction increased since mobile apps facilitated peer interaction. For instance, Poláková and Klímová (2022) established that a sense of community was higher in learners who could employ the group features in apps, something that is generally not possible with conventional approaches. Gamification-related elements, such as scores, badges, and levels, motivated and satisfied them, according to Elaish et al. (2019) and Poláková (2022). The features mentioned above made the apps rewarding to work with and further develop one's vocabulary.

Table 6. Learner satisfaction of mobile applications for vocabulary learning

Study	App Name	Learner Satisfaction
Ajisoko, P. (2020)	Duolingo	More satisfying than traditional methods.
AlDakhil & AlFadda (2021)	Busuu	Enjoyable and convenient, especially for independent learners.
Alghameeti (2022)	TikTok	Authentic content, which is found interesting and engaging, boosted motivation and satisfaction.
Azi (2023)	Duolingo	Enjoyable and effective.
Babacan & Güler (2022)	Plickers	Fun and motivating for vocabulary learning, reduced anxiety.
Elaish et al. (2019)	VocabGame	Positive satisfaction inferred; app enhanced engagement.
Indrasari et al. (2024)	Duolingo	Visual aids and exercises led to richer experiences, perceived as engaging and convenient.
Jedi-Sari-Biglar & Liman-Kaban (2023)	ChatterPix Kids	High satisfaction with engagement and motivation.
Montaner-Villalba (2019)	Quizlet	Viewed as effective and active-learning friendly, enhanced engagement.
Naftchi et al. (2023)	SmartGeo	Positive views on engagement and independent learning.
Özcan & Kert (2020)	WhatsApp	Positive perception was inferred from interviews, and cognitive load was reduced.
Poláková (2022)	Angličtina Today	Easy to use, effective and accessibility.
Poláková & Klímová (2019)	Kahoot	Students found Kahoot more enjoyable than traditional methods.
Poláková & Klímová (2022)	Angličtina Today	Highly appreciated for ease of use and effectiveness.
Purwanto & Syafryadin (2023)	Duolingo	Enjoyable and engaging, sustained enthusiasm for learning.
Puspitasari et al. (2022)	VocApp	Highly positive satisfaction, improved engagement and ease of access.
Rezaei et al. (2013)	Learn English Vocabulary	Positive attitude toward apps for confidence and participation.
Setiawan & Wiedarti (2020)	Quizlet	Greater satisfaction due to enthusiasm and reduced boredom.
Tran & Nguyen (2023)	Quizlet	Perceived as enjoyable and convenient for learning.

5. Discussion and Implications

Mobile applications offer the advantage of "anytime, anywhere" access, enabling learners to seamlessly integrate vocabulary learning into their daily routines, a flexibility that traditional methods cannot match (Sung et al., 2015; Wang et al., 2017). This systematic review also demonstrates that mobile applications are powerful tools for improving English vocabulary acquisition compared to traditional methods. The 19 studies reviewed show that the most significant benefits of MALL include increased learner motivation and satisfaction, accessibility, personalised learning paths and enhanced vocabulary retention.

According to Deterding et al. (2011) and Kim et al. (2018), key features such as gamification, spaced repetition, and adaptive feedback form the foundation for creating interactive and effective learning environments. High learner engagement is often achieved through gamified elements like points, badges, and leaderboards, encouraging sustained practice and improved retention (Hamari et al., 2014; Chen et al., 2020). Most mobile apps have successfully incorporated these gamified elements to increase learner motivation and practice time, leading to improved vocabulary acquisition results. Applications such as Angličtina Today (Poláková, 2022; Poláková & Klímová, 2022), Busuu (AlDakhil & AlFadda, 2021), ChatterPix Kids (Jedi-Sari-Biglar & Liman-Kaban, 2023), Duolingo (Ajisoko, 2020; Azi, 2023; Indrasari et al., 2024; Purwanto & Syafriyadin, 2023), Kahoot (Poláková & Klímová, 2019), Plickers (Babacan & Güler, 2022), Learn English Vocabulary (Rezaei et al., 2013), Quizlet (Montaner-Villalba, 2019; Setiawan & Wiedarti, 2020; Tran & Nguyen, 2023), SmartGeo (Naftchi et al., 2023), TikTok (Alghameeti, 2022), VocabGame (Elaish et al., 2019), VocApp (Puspitasari et al., 2022), and WhatsApp (Özcan & Kert, 2020) have significantly impacted vocabulary acquisition and retention across diverse contexts.

This review outlines several key design elements for successful mobile language learning applications. The success of mobile-assisted vocabulary learning depends on learner motivation and engagement (Setiawan & Wiedarti, 2020; Alghameeti, 2022; Poláková and Klímová, 2019), ease of use and access (AlDakhil & AlFadda, 2021), frequency of use (Polakova & Klimova, 2022; Azi, 2023; AlDakhil & AlFadda, 2021; Alghameeti, 2022), personalisation and adaptive learning (Elaish et al., 2019), cultural relevance and content authenticity (Naftchi et al., 2023), and combining verbal with visual modalities (Rezaei et al., 2013).

Polakova and Klimova (2022), Azi (2023), AlDakhil and AlFadda (2021) and Alghameeti (2022) highlighted that frequent interaction with apps helps to reinforce vocabulary consistently. These findings are consistent with the findings of Azabdaftari and Mozaheb (2012), who compared mobile learning strategies and found that habituation is effective in vocabulary retention. The results also align with the advantages of spaced repetition, as highlighted by Lin and Lin (2019), who emphasise monitoring vocabulary at intervals that gradually increase to eliminate the forgetting curve. Moreover, while game elements such as dashes, rewards, and reminders can encourage continued use, over-delivering content can overwhelm students and hinder progress (Hamari et al., 2014; Cruaud, 2018). The integration of these elements is consistent with the broader pedagogical principles of MALL, as discussed by Burston (2014), emphasising a balance between engagement and cognitive load.

Based on the TAM model (cf. AlDakhil & AlFadda, 2021), acceptance increases when mobile learning applications introduce multimedia elements. Visual aids and auditory support lower cognitive load, making vocabulary acquisition easier and thus increasing perceived ease of use and perceived usefulness. Motivational features (such as badges and leaderboards) are most effective when combined with tailored learning routes. For example, learners are more likely to engage with and move through content that corresponds to their competence level, ensuring that the motivation given by the app's design is appropriate for their unique needs. High levels of engagement with dynamic app elements (such as game-based activities) are heavily dependent on app usability. An engaging program that is also simple to use ensures continued use, while complex or crowded interfaces may detract from the immersive experience. The effectiveness of mobile applications for English vocabulary learning hinges on both individual and interactive contributions from motivational design, usability, adaptability, and cultural relevance. Understanding these interactions can guide future app development tailored to ESL learners' diverse needs and preferences.

When combined, these factors create engaging learning environments. Poláková (2022) states that learners derive benefit when vocabulary is contextualised into culturally relevant settings. Many effective apps balance gamification elements with content depth, ensuring learners remain engaged without compromising learning outcomes (Hamari et al., 2014; Huang & Hew, 2021). Personalised learning paths and adaptive algorithms further increase engagement by tailoring learning experiences to individual needs (Dabbagh & Kitsantas, 2012; Mayer, 2021). Personalised and adaptive learning opportunities, such as tailored practice based on learners' proficiency levels, further improve learning experiences, keeping content challenging yet attainable (Hwang & Wu, 2014; Chen & Hsu, 2020). User-friendly interfaces are essential, especially for younger learners, as they reduce cognitive load and improve ease of use (Nouri, 2019). Developers should iteratively refine these tools based on user feedback and data analytics, optimising engagement and learning outcomes (Kukulska-Hulme & Viberg, 2018).

All the studies reviewed found that mobile apps create more engaging and effective learning experiences, increasing retention and motivation. In contrast, traditional methods often lack engagement and adaptability while offering modest improvements (AlDakhil & AlFadda, 2021; Özcan & Kert, 2020; Poláková & Klímová, 2019). The lack of interactive elements and repetition in traditional teaching methods hinders student motivation and long-term retention. These findings highlight the growing importance of mobile apps in modern educational settings, where technology offers a personalised and engaging learning experience.

Educators also play a crucial role in ensuring students maximise the potential of language learning mobile apps. Teachers are encouraged to adopt applications that can be modified to accommodate different learning styles and needs (Burston, 2014; Godwin-Jones, 2011). The flexibility of mobile apps allows learners to progress at their own pace, creating an interactive and memorable learning experience. Additionally, collaborative learning features should be prioritised in app design to counter the predominantly individual nature of mobile learning (Warschauer, 2012). Teacher training in effectively integrating mobile applications into classroom instruction is critical to ensure successful implementation (Kukulska-Hulme, 2012; Tai et al., 2021).

Policymakers and learning institutions can support this effort by advocating for and developing infrastructure to ensure equal access to mobile technologies for language vocabulary learning. For instance, policymakers might prioritise improving internet access and facilitating the distribution of mobile devices dedicated to educational use (UNESCO, 2019). Policies supporting the integration of mobile apps in formal education systems can encourage teachers and institutions to explore innovative teaching methods (Traxler, 2010). Formalising mobile learning within language programs can also help students build digital literacy alongside language proficiency, preparing them for a technology-driven world (Pachler et al., 2010).

5.1. Limitations of the Review

This review is a broad survey of current research but has limitations. The studies in this review were heterogeneous in terms of sample characteristics, application type, and settings, which might affect generalizability. Studies were also limited in using self-report measures to assess learner engagement and satisfaction, although these can provide useful information for evaluation. In addition, the diversity of research designs used across studies on mobile vocabulary learning limits any meaningful comparisons. Additional research with standardised methodologies, especially longitudinal studies, would enhance our understanding of the long-term effects of mobile vocabulary learning.

5.2. Further Research Direction

Mobile-assisted vocabulary learning has shown promising results, and there are several directions for future research. For example, future studies should investigate the long-term retention effects of mobile applications and whether these foster sustained vocabulary knowledge beyond short-term gains. Comparative evaluations that investigate varying types of mobile applications—apps which are solely for vocabulary or include more language skills in general—may provide more information on apps' effectiveness. Further, studying the effects of adaptive learning algorithms and individualised feedback systems on learner performance could optimise these tools. The reviewed articles did not explicitly mention AI-enabled features or their effects. However, this is a dynamically evolving area on which future research should focus. One should also take a closer look at the cultural factors. Understanding how learners from different linguistic and socio-economic backgrounds engage with and respond to mobile applications could provide important clues for designing such tools for other educational contexts.

This review highlights the benefits of mobile-assisted vocabulary learning as an additional and complementary tool to traditional language instruction, which learners can utilise for self-study at their convenience. While mobile applications have challenges, their flexibility, personalisation, and motivational features currently make them a resourceful tool for learning the English language. With mobile learning harnessing its potential and limitations, educators and policymakers can refine these technologies and enhance language learning outcomes for a variety of populations.

AI Declaration

I declare that this work and its text are my original work, and no artificial intelligence was used in its creation. I take full responsibility for the content of this thesis.

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