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Recent developments in mobile-assisted vocabulary learning: a mini review of published studies focusing on digital flashcards

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This mini review provides a concise overview of recent developments in mobile-assisted vocabulary learning (MAVL) and compares its effectiveness to traditional methods in English as a Foreign Language (EFL) settings. The review synthesizes findings from recent empirical studies, highlighting how MAVL, particularly digital flashcards, promotes learner autonomy, engagement, and long-term vocabulary retention through features like spaced repetition and gamification. Traditional methods such as paper flashcards, while effective in structured classroom settings, lack the interactive and personalized benefits of MAVL. The review also discusses existing research gaps, including the need for further investigation into productive vocabulary use and long-term retention. Future developments in the field may include hybrid approaches that combine the strengths of both traditional and digital methods. This review aims to provide language teachers and researchers with an up-to-date understanding of MAVL and its potential to enhance EFL vocabulary acquisition.

KEYWORDS

mobile-assisted vocabulary learning, EFL, digital flashcards, spaced repetition, learner autonomy, retrieval practice, vocabulary retention

1 Introduction

The purpose of this literature review is to investigate the impact of mobile-assisted vocabulary learning (MAVL) and compare its effectiveness to traditional methods of vocabulary acquisition in English as a Foreign Language (EFL) contexts. With the advent of digital tools and mobile devices, the landscape of language education has shifted significantly, making learning more accessible and engaging for students both inside and outside the classroom (Golonka et al., 2014; Goodwin, 2020, 2021; Vyatkina, 2016; Xodabande, 2017, 2018). The integration of mobile devices into language learning has generated increasing interest among educators and researchers alike (Stockwell, 2022). In recent years, there has been a notable rise in the use of mobile applications, digital flashcards, and mobile-assisted learning platforms, all of which offer various tools for vocabulary acquisition (Burston, 2013, 2014; Burston and Giannakou, 2021; Chwo et al., 2018; Yang et al., 2021). These digital innovations have not only changed how learners access vocabulary but also enhanced their ability to engage in self-directed learning outside the traditional classroom setting (Demouy and Kukulska-Hulme, 2010; Xodabande and Atai, 2022). Digital flashcards, such as Quizlet and Anki, are prime examples of

how technology supports spaced repetition, a well-researched method for improving long-term retention (Mohammadi et al., 2024; Nakata, 2011, 2019). Additionally, mobile-assisted platforms offer interactive features such as gamification, progress tracking, and customizable learning paths, which can further motivate learners and sustain their interest in vocabulary learning (Lin and Lin, 2019; Loewen et al., 2019, 2020; Mahdi, 2017). Given these advances, this review seeks to explore the effectiveness of MAVL compared to traditional methods in fostering vocabulary growth. Furthermore, this study aims to synthesize key theoretical insights and empirical studies that examine how mobile-assisted learning with digital flashcards can influence vocabulary retention, acquisition, and learner autonomy, in contrast to conventional methods such as paper flashcards and word lists.

2 Empirical research findings

2.1 Effectiveness of MAVL

Mobile-assisted vocabulary learning (MAVL) has demonstrated significant effectiveness in improving vocabulary acquisition, as evidenced by a growing body of empirical research (Lin and Lin, 2019). More specifically, MAVL has consistently shown that learners who use mobile-assisted tools—such as digital flashcards and mobile applications—exhibit higher vocabulary gains compared to those who rely on traditional methods (Koleini et al., 2024; Mohammadi et al., 2024; Xodabande et al., 2022b; Xodabande and Atai, 2022; Zakian et al., 2022; Zarrati et al., 2024). One of the key advantages of MAVL is its ability to provide learners with consistent, varied exposure to vocabulary items through interactive and flexible platforms (Mahdi, 2017; Xodabande and Hashemi, 2022). This aligns with established cognitive theories that emphasize the importance of retrieval practice, repetition, and meaningful engagement in the process of vocabulary acquisition (Nakata, 2011).

Empirical studies have shown that MAVL enhances both receptive and productive vocabulary knowledge. For example, Rahmani et al. (2022) found that learners who used digital flashcards on mobile devices demonstrated significantly greater improvements in receptive vocabulary knowledge than those using paper-based word lists. The flexibility of mobile tools, which can be accessed anytime and anywhere, allows learners to engage in consistent retrieval practice, a factor that is critical for retention. This aligns with findings by Fathi et al. (2018), who also demonstrated the superior efficacy of MAVL in promoting long-term vocabulary retention. Their study revealed that learners using mobile-assisted tools not only acquired vocabulary faster but were also more likely to retain the newly learned words over a longer period. Another major strength of MAVL is its capacity to support spaced repetition, a technique that has been widely researched for its positive effects on long-term retention. Digital flashcard applications like Quizlet and Anki use algorithms to schedule reviews of vocabulary items at optimal intervals, ensuring that learners are exposed to words just before they are likely to forget them. This method is highly effective in reinforcing long-term memory, as demonstrated in studies by Lei and Reynolds (2022). Their research indicated that learners using spaced repetition

via mobile platforms showed significant improvements in both immediate recall and delayed retention tests, surpassing those who used traditional methods such as word lists or paper flashcards.

MAVL also offers learners personalized learning experiences that adapt to individual progress and needs. Unlike traditional paper-based methods, which are static and provide the same level of difficulty regardless of learner performance, digital tools can adjust the frequency of vocabulary reviews based on how well the learner has mastered specific words. This personalized approach not only ensures that learners focus on words they find challenging but also prevents cognitive overload by reducing unnecessary repetition of words they have already mastered. Studies by Xodabande and Boroughani (2023) confirm that this adaptive learning environment, enabled by MAVL, is crucial in promoting effective vocabulary acquisition, particularly in EFL contexts where students vary widely in proficiency. Beyond the cognitive benefits, MAVL has been shown to enhance *learner motivation and engagement*, factors that are critical for successful language learning. The use of mobile devices introduces an element of interactivity and gamification that traditional methods lack. Learners using digital flashcards, for example, often report higher levels of motivation due to the immediate feedback, progress tracking, and customizable features provided by mobile platforms (Zakian et al., 2022). Fathi et al. (2018) found that learners using MAVL tools exhibited greater engagement with vocabulary learning tasks and were more likely to continue studying vocabulary outside of class hours, compared to their counterparts who used paper-based methods.

2.2 Long-term gains and retention

The empirical evidence on long-term gains from MAVL is particularly robust. Numerous studies highlight the superior retention rates of vocabulary learned through mobile-assisted tools when compared to traditional paper-based methods. For instance, a study by Xodabande and Atai (2022) examined the long-term retention of academic vocabulary among university students using digital flashcards with spaced repetition. The results showed that learners who engaged with MAVL tools retained significantly more words over a 3-month period compared to those who relied on traditional word lists. This aligns with findings from Fathi et al. (2018), where learners using mobile devices exhibited better retention of both high-frequency and academic vocabulary. One of the key factors contributing to the success of MAVL in promoting long-term retention is the use of spaced repetition algorithms, which schedule reviews of vocabulary items at optimal intervals. This method has been shown to significantly reduce forgetting, a phenomenon that traditional methods like word lists or massed practice (i.e., cramming) fail to address effectively. Studies suggest that spaced repetition not only improves retention but also enhances learners' ability to use vocabulary productively in speaking and writing tasks (Lei and Reynolds, 2022). Another study by Boroughani et al. (2023) explored the long-term impacts of MAVL on learners' vocabulary retention over 6 months. The results confirmed that learners using digital flashcards with spaced repetition retained a larger proportion of vocabulary, even after extended periods of time without review. This finding is crucial in EFL contexts, where sustained vocabulary retention is necessary for academic success and fluency development.

2.3 Comparison with traditional methods

When comparing MAVL to traditional methods, such as paper flashcards and word lists, the evidence points to several clear advantages of mobile-assisted tools. Studies consistently show that while traditional methods can be effective in the short term, they fall short in promoting long-term retention and learner engagement. For example, paper flashcards are often used in massed practice sessions, which may result in temporary gains but do not support the long-term retention needed for successful language acquisition. In contrast, MAVL tools utilize spaced repetition and adaptive learning algorithms, which are proven to enhance retention over time (Nakata, 2011). Additionally, traditional methods often lack the interactivity and feedback that MAVL tools provide. Learners using paper flashcards or word lists are required to assess their own progress, which can lead to ineffective study habits and missed opportunities for review. In contrast, mobile applications offer immediate feedback on learner performance, allowing for more accurate self-assessment and targeted practice. A study by Xodabande et al. (2022a) demonstrated that learners using mobile-assisted tools were able to track their progress more effectively, which in turn motivated them to continue engaging with vocabulary learning tasks. This contrasts with traditional methods, which, while effective for initial learning, may not offer the same level of motivation or self-regulation. However, it is important to note that some studies have found value in traditional methods, particularly for learners who prefer a more tangible, hands-on approach to studying. Paper flashcards, for example, allow for manual manipulation, which some learners find beneficial for memorization. Additionally, the simplicity of traditional methods may appeal to learners who find digital tools overwhelming due to the abundance of features (Fathi et al., 2018). Nonetheless, the majority of research indicates that MAVL provides a more efficient, engaging, and sustainable approach to vocabulary learning, particularly in terms of long-term retention and learner autonomy.

2.4 Autonomy and engagement

Mobile-assisted vocabulary learning (MAVL) has garnered attention for its ability to promote learner autonomy and increase engagement, largely due to its interactive features. By providing learners with access to personalized, on-demand resources, MAVL empowers students to take control of their own learning processes. Autonomy in language learning refers to the learners' capacity to set their own goals, monitor progress, and regulate study habits without the constant presence of a teacher. MAVL promotes these qualities through tools such as digital flashcards and mobile applications, which offer flexibility, accessibility, and adaptability to individual learning needs (Rahmani et al., 2022). In contrast to traditional paper-based methods, which are limited by static content and lack of interactivity, MAVL tools are dynamic, continuously adapting to the learner's performance and needs.

A key factor in enhancing learner autonomy through MAVL is the integration of spaced repetition. Spaced repetition systems, used in applications like Anki and Quizlet, automatically schedule reviews of vocabulary items at optimal intervals, ensuring that

learners revisit words just before they are likely to forget them. This feature not only strengthens long-term retention but also allows learners to manage their study time more effectively. By relying on the app's algorithm to prompt reviews, learners are able to focus on content that needs reinforcement, rather than manually deciding what to study next. This targeted approach is more efficient than traditional methods, where learners may either over-study known words or neglect those they have yet to master. As a result, learners become more independent, relying less on instructor-led reviews and more on self-regulated, technology-facilitated study routines.

In addition to spaced repetition, gamification is another feature of MAVL that has been shown to enhance learner engagement. Gamification refers to the use of game-like elements, such as rewards, points, and levels, to motivate learners and sustain their interest in a given task. Digital flashcard platforms often incorporate these elements, turning vocabulary acquisition into a more engaging and rewarding experience. Learners earn points or badges for completing quizzes or achieving streaks of consecutive days of study, which in turn motivates them to continue using the app. This is especially valuable in EFL contexts, where learners might otherwise find vocabulary learning monotonous or daunting. Boroughani et al. (2023) found that learners who used MAVL tools with gamified elements reported higher levels of motivation and were more likely to continue studying vocabulary outside of class time, compared to those who relied on paper-based flashcards.

Smartphones play a crucial role in facilitating both autonomy and engagement, as they offer learners anytime, anywhere access to learning materials. Unlike traditional paper-based methods, which require the learner to carry physical materials, smartphones provide a portable and readily accessible platform for vocabulary learning. This constant accessibility means that learners can integrate vocabulary practice into their daily routines, reviewing words during short breaks, commutes, or whenever convenient. The ability to study in small, manageable chunks not only reduces cognitive overload but also makes language learning a more seamless part of the learner's life. Furthermore, smartphones enable interactive features such as push notifications, which remind learners to review vocabulary, thus encouraging regular study habits and promoting continuous engagement (Lei and Reynolds, 2022).

2.5 Challenges and limitations

While MAVL offers several advantages in promoting autonomy and engagement, it is not without its challenges. Some studies have highlighted technical issues as a barrier to effective mobile-assisted learning. For instance, learners may encounter connectivity problems, software glitches, or device incompatibilities, all of which can interrupt the learning process. Additionally, certain mobile applications may require internet access, limiting their use in areas with poor connectivity or for learners who do not have consistent access to mobile data. Zakian et al. (2022) note that such technical difficulties can diminish learner motivation, particularly if they encounter frequent disruptions in their study sessions. Another challenge associated with MAVL is learner resistance to adopting new technologies. Although younger learners are generally more comfortable using smartphones and mobile applications, older or

less tech-savvy learners may find it difficult to adjust to digital tools. Some learners may prefer traditional methods, such as paper flashcards, because they are more familiar and offer a tactile learning experience. Additionally, certain studies have found that some learners may feel overwhelmed by the abundance of features offered by mobile applications, particularly when they are presented with multiple options for customization, tracking, and gamification. This can lead to cognitive overload, reducing the effectiveness of MAVL for learners who are less comfortable with technology (Fathi et al., 2018). Finally, it is important to acknowledge the need for long-term interventions when using MAVL. While mobile-assisted tools are effective in promoting vocabulary acquisition, they require consistent use over time to be truly impactful. Learners who only engage with the app sporadically may not see the same long-term retention benefits as those who use it regularly. Additionally, without proper guidance or scaffolding from instructors, some learners may struggle to develop the self-regulation skills needed to use MAVL tools effectively. Xodabande et al. (2022a) highlight the importance of integrating MAVL into a broader instructional framework, where teachers provide support and encourage consistent use of mobile tools alongside other learning activities.

3 Conclusion

This review highlights the growing evidence supporting mobile-assisted vocabulary learning (MAVL) as an effective tool for enhancing vocabulary acquisition in EFL contexts. Key insights from both theoretical frameworks and empirical studies suggest that MAVL, particularly through digital flashcards, improves long-term retention, promotes learner autonomy, and engages students with interactive features like spaced repetition and gamification. Compared to traditional methods such as paper flashcards and word lists, MAVL offers significant advantages in terms of flexibility, personalized learning, and sustained motivation, particularly in self-directed learning environments. However, traditional methods still have value in structured classroom settings where teacher-led guidance can ensure consistent practice. The practical implications for teachers and learners are clear. Educators should consider incorporating MAVL tools, especially those that utilize spaced repetition, into their curriculum to enhance vocabulary retention. For self-study, learners can benefit

from using digital flashcards to structure their learning and review vocabulary items at optimal intervals. Teachers can also guide students in combining traditional methods with digital tools, ensuring that learners are equipped with multiple strategies to improve both receptive and productive vocabulary knowledge. Future research should focus on the long-term effects of MAVL on vocabulary retention and explore hybrid approaches that integrate both traditional and digital methods. Additionally, more studies are needed to examine how MAVL impacts productive vocabulary use in real-world language contexts. Investigating how different learning strategies, such as retrieval practice, can be optimized in mobile-assisted platforms will also contribute to enhancing vocabulary acquisition for diverse learners.

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References

- Boroughani, T., Behshad, N., and Xodabande, I. (2023). Mobile-assisted academic vocabulary learning with digital flashcards: Exploring the impacts on university students' self-regulatory capacity. *Front. Psychol.* 14, 1–8. doi: 10.3389/fpsyg.2023.1112429
- Burston, J. (2013). Mobile-assisted language learning: A selected annotated bibliography of implementation studies 1994–2012. *Lang. Learn. Technol.* 17, 157–225.
- Burston, J. (2014). MALL: The pedagogical challenges. *Comp. Assisted Lang. Learn.* 27, 344–357. doi: 10.1080/09588221.2014.914539
- Burston, J., and Giannakou, K. (2021). MALL language learning outcomes: A comprehensive meta-analysis 1994–2019. *ReCALL* 34, 147–168. doi: 10.1017/S0958344021000240
- Chwo, G. S. M., Marek, M. W., and Wu, W.-C. V. (2018). Meta-analysis of MALL research and design. *System* 74, 62–72. doi: 10.1016/j.system.2018.02.009
- Demouy, V., and Kukulska-Hulme, A. (2010). On the spot: Using mobile devices for listening and speaking practice on a French language programme. *Open Learn. J. Open Distance e-Learn.* 25, 217–232. doi: 10.1080/02680513.2010.511955
- Fathi, J., Alipour, F., and Saedian, A. (2018). Enhancing vocabulary learning and self-regulation via a mobile application: An investigation of the memrise app. *J. Modern Res. English Lang. Stud.* 5, 27–46. doi: 10.30479/jmrels.2019.10311.1282
- Golonka, E. M., Bowles, A. R., Frank, V. M., Richardson, D. L., and Freynik, S. (2014). Technologies for foreign language learning: A review of technology types and

- their effectiveness. *Comp. Assisted Lang. Learn.* 27, 70–105. doi: 10.1080/09588221.2012.700315
- Goodwin, A. L. (2020). Globalization, global mindsets and teacher education. *Action Teacher Educ.* 42, 6–18. doi: 10.1080/01626620.2019.1700848
- Goodwin, A. L. (2021). Teaching standards, globalisation, and conceptions of teacher professionalism. *Eur. J. Teacher Educ.* 44, 5–19. doi: 10.1080/02619768.2020.1833855
- Koleini, N., Boroughani, T., Eslami, Z. R., and Xodabande, I. (2024). Exploring the impacts of mobile-assisted learning on university students' technical vocabulary knowledge. *Int. J. Educ. Res. Open* 7, 1–9. doi: 10.1016/j.ijedro.2024.100344
- Lei, Y., and Reynolds, B. L. (2022). Learning English vocabulary from word cards: A research synthesis. *Front. Psychol.* 13:984211. doi: 10.3389/fpsyg.2022.984211
- Lin, J.-J., and Lin, H. (2019). Mobile-assisted ESL/EFL vocabulary learning: A systematic review and meta-analysis. *Comp. Assisted Lang. Learn.* 32, 878–919. doi: 10.1080/09588221.2018.1541359
- Loewen, S., Crowther, D., Isbell, D. R., Kim, K. M., Maloney, J., Miller, Z. F., et al. (2019). Mobile-assisted language learning: A Duolingo case study. *ReCALL* 31, 293–311. doi: 10.1017/S0958344019000065
- Loewen, S., Isbell, D. R., and Sporn, Z. (2020). The effectiveness of app-based language instruction for developing receptive linguistic knowledge and oral communicative ability. *Foreign Lang. Ann.* 53, 209–233. doi: 10.1111/flan.12454
- Mahdi, H. S. (2017). Effectiveness of mobile devices on vocabulary learning: A meta-analysis. *J. Educ. Comp. Res.* 56, 134–154. doi: 10.1177/0735633117698826
- Mohammadi, M., Valizadeh, M., Zohdi Jalal, P., and Xodabande, I. (2024). University students' academic vocabulary development through mobile-assisted learning: Exploring the impacts on receptive and productive knowledge. *Heliyon* 10, 1–12. doi: 10.1016/j.heliyon.2024.e28103
- Nakata, T. (2011). Computer-assisted second language vocabulary learning in a paired-associate paradigm: A critical investigation of flashcard software. *Comp. Assisted Lang. Learn.* 24, 17–38. doi: 10.1080/09588221.2010.520675
- Nakata, T. (2019). "Learning words with flash cards and word cards," in *The Routledge handbook of vocabulary studies*, ed. S. Webb (London: Routledge), 304–319. doi: 10.4324/9780429291586-20
- Rahmani, A., Asadi, V., and Xodabande, I. (2022). Using mobile devices for vocabulary learning outside the classroom: Improving the english as foreign Language learners' knowledge of high-frequency words. *Front. Psychol.* 13. doi: 10.3389/fpsyg.2022.899885
- Stockwell, G. (2022). *Mobile assisted language learning: Concepts, contexts and challenges*. Cambridge: Cambridge University Press. doi: 10.1017/9781108652087
- Vyatkina, N. (2016). Data-driven learning of collocations: Learner performance, proficiency, and perceptions. *Lang. Learn. Technol.* 20, 159–179.
- Xodabande, I. (2017). The effectiveness of social media network telegram in teaching English language pronunciation to Iranian EFL learners. *Cogent Educ.* 4:1347081. doi: 10.1080/2331186X.2017.1347081
- Xodabande, I. (2018). Iranian EFL learners' preferences of different digital technologies for language learning beyond the classroom. *Int. J. Educ. Literacy Stud.* 6, 20–31. doi: 10.7575/aiac.ijels.v6n.3p.20
- Xodabande, I., and Atai, M. R. (2022). Using mobile applications for self-directed learning of academic vocabulary among university students. *Open Learn. J. Open Distance e-Learn.* 37, 330–347. doi: 10.1080/02680513.2020.1847061
- Xodabande, I., and Boroughani, T. (2023). Mobile-assisted focus on forms in English for academic purposes instruction: Investigating the impacts on learning academic words. *Front. Psychol.* 14:1071555. doi: 10.3389/fpsyg.2023.1071555
- Xodabande, I., and Hashemi, M. R. (2022). Learning English with electronic textbooks on mobile devices: Impacts on university students' vocabulary development. *Educ. Inform. Technol.* 28, 1587–1611. doi: 10.1007/s10639-022-11230-1
- Xodabande, I., Iravi, Y., Mansouri, B., and Matinparsa, H. (2022a). Teaching academic words with digital flashcards: Investigating the effectiveness of mobile-assisted vocabulary learning for university students. *Front. Psychol.* 13:893821. doi: 10.3389/fpsyg.2022.893821
- Xodabande, I., Pourhassan, A., and Valizadeh, M. (2022b). Self-directed learning of core vocabulary in English by EFL learners: Comparing the outcomes from paper and mobile application flashcards. *J. Comp. Educ.* 9, 93–111. doi: 10.1007/S40692-021-00197-6
- Yang, X., Kuo, L.-J., Eslami, Z. R., and Moody, S. M. (2021). Theoretical trends of research on technology and L2 vocabulary learning: A systematic review. *J. Comp. Educ.* 8, 465–483. doi: 10.1007/s40692-021-00187-8
- Zakian, M., Xodabande, I., Valizadeh, M., and Yousefvand, M. (2022). Out-of-the-classroom learning of English vocabulary by EFL learners: Investigating the effectiveness of mobile assisted learning with digital flashcards. *Asian-Pacific J. Second Foreign Lang. Educ.* 7, 1–16. doi: 10.1186/s40862-022-00143-8
- Zarrati, Z., Zohrabi, M., Abedini, H., and Xodabande, I. (2024). Learning academic vocabulary with digital flashcards: Comparing the outcomes from computers and smartphones. *Soc. Sci. Human. Open* 9, 1–15. doi: 10.1016/j.ssaho.2024.100900