International Journal of TESOL Studies (2025)
250805, 1-19 https://doi.org/10.58304/ijts.250805

Article

Integrating Technology into EFL Contexts to Enhance Vocabulary Learning

Morteza Mellati*
Shahab Danesh University, Qom, Iran

Is'haaq Akbarian
University of Qom, Qom, Iran

Received: 25 April, 2025 / Received in revised form: 11 June, 2025 / Accepted: 17 August, 2025 / Available online: 28 August, 2025

Abstract
Technological advancements have prompted researchers to examine the integration of technology in learning environments. This study aimed to assess the effects of incorporating technology into vocabulary learning environments. Two intact classes from a large state university were divided into an experimental and a control group, each consisting of 34 participants. The experimental group used Telegram and Xmind applications to learn new vocabulary, creating concept maps with Xmind and sharing them via Telegram. The control group, on the other hand, used traditional concept-mapping techniques. Furthermore, semi-structured interviews were held with 15 participants from the experimental group to examine their perspectives on technology-enhanced learning. The results of the ANCOVA analysis showed that integrating technology significantly improved vocabulary acquisition. The qualitative results revealed that although technology alleviated learning difficulties, enhanced motivation, and improved vocabulary knowledge, it also introduced certain challenges. The study concludes with implications for both learners and educators.

Keywords
Incorporation of technology, EFL contexts, technology-supported education, vocabulary acquisition, Xmind

1 Introduction

In an increasingly interconnected world, the role of English as a global lingua franca has underscored the importance of effective language education, particularly for learners of English as a Foreign Language (EFL) (Akbarian, 2018). The acquisition of vocabulary is a fundamental component of

*Corresponding author. Email: mellati.morteza@shdu.ac.ir

language learning, as it directly influences communicative competence and overall language proficiency (Dodigovic, 2023). Traditional methods of vocabulary instruction often struggle to engage learners or provide the necessary contextual practice that vocabulary mastery demands (Akbarian, 2010a, 2010b). In this context, the integration of technology into EFL teaching emerges as a transformative approach, promising to enrich vocabulary learning experiences (Chacón-Beltrán, 2018; Hsu et al., 2023). The digital age has ushered in a plethora of tools and resources that can enhance language learning, making it more interactive, personalized, and accessible. From mobile applications and online games to virtual reality and adaptive learning platforms, technology offers innovative avenues for engaging students and catering to diverse learning styles (Mellati & Khademi, 2019). Moreover, the integration of multimedia resources, such as videos and audio clip, allows for contextualized learning, wherein vocabulary is encountered in authentic and meaningful situations (Chun et al., 2016; Jurkovič, 2019). This integration not only helps in memorizing words but also fosters a deeper understanding of their usage, nuances, and cultural connotations. Furthermore, technology facilitates opportunities for collaboration among learners through online forums and social media, enabling them to use new vocabulary in creative and relevant contexts (cf., Chun et al., 2016; Friðriksdóttir, 2018).

All aspects of and approaches to vocabulary acquisition (e.g., intentional and incidental vocabulary learning) might benefit from tech-enhanced instruction. For instance, incidental vocabulary acquisition, a key component in foreign or second language learning, is further amplified by technology-enhanced environments. More particularly, digital tools provide repeated exposure, contextual richness, and interactive engagement—factors in line with the cognitive mechanisms, discussed in details in Teng and Reynolds (2025).

As educators increasingly embrace these digital tools, they can create dynamic and conducive learning environments that motivate students and promote active participation (Friðriksdóttir, 2018; Ko, 2019). By understanding how technology can complement traditional teaching methods, educators can better prepare their students for successful communication in English, empowering them to navigate the complexities of the language landscape in today's global society (Jurkovič, 2019).

The rapid advancement of technology has significantly transformed educational practices across the globe. In the realm of EFL, the integration of technological tools has emerged as an effective strategy to engage learners, diversify instruction, and enhance learning outcomes (Chacón-Beltrán, 2018; Chun et al., 2016). Vocabulary acquisition, a critical aspect of language proficiency, often poses challenges for EFL learners as it requires not only rote memorization but also contextual understanding and practical application (Kurt & Bensen, 2017). There is ongoing debate about the effectiveness of technology in enhancing vocabulary learning outcomes. While some studies point to positive achievements when integrating tools like social media and mind mapping software, others report inconsistent results. The success of these tools can be influenced by factors such as the learners' age, proficiency level, and the specific context in which they are used (e.g., Ada et al., 2017; Ko, 2019; Shi et al., 2024). Critics argue that simply integrating technology does not guarantee improved learning outcomes without careful implementation and alignment with pedagogical goals (Stockwell & Liu, 2015).

Some educators and researchers advocate traditional vocabulary learning methods, such as direct instruction and rote memorization, as being more effective in certain contexts. The concern arises that reliance on social media and mind mapping may detract from traditional teaching practices that have historically proven effective. This raises questions about the optimal balance between innovative practices and established methods in EFL contexts (Wang, 2016). Although social media has the potential to engage learners, it can also serve as a distraction. Critics argue that the noise of social networking platforms can detract from focused vocabulary learning, leading to superficial engagement rather than meaningful interaction. This raises questions about the context in which social media should be integrated and how to ensure it enhances rather than hinders learning (Xu et al., 2017). Not all learners possess the same level of digital literacy, which can affect their ability to leverage social media and mind mapping tools effectively for vocabulary learning. This discrepancy can create inequitable learning

experiences, leading to frustration for some students and disengagement from the learning process. There is a need to address how differing levels of digital competence might impact the overall effectiveness of these tools (Shi & Tsai, 2024).

The use of social media and Xmind for receiving feedback raises questions about the quality and accuracy of that feedback. Peer feedback in social media contexts may lack the depth and detail provided by traditional assessments or instructor comments, potentially leading to misunderstandings or misuse of vocabulary. Ensuring that learners can effectively use feedback from peers while maintaining high standards can be contentious (Kim et al., 2013). The effectiveness of integrating technology into language learning varies across educational contexts. Factors such as institutional support, infrastructure, and access to technology can greatly influence the success of technology integration. In environments where access to technology is limited, the feasibility and appropriateness of using these tools for vocabulary learning can be questioned (Kusyk, 2017). The integration of technology into EFL contexts, particularly through the use of social media and Xmind, presents a range of controversial issues that merit thorough exploration. It is crucial to tackle these issues in order to grasp the wider implications of technological integration on vocabulary acquisition and learner experiences. By critically examining these issues, educators and researchers can make informed decisions that prioritize effective and equitable language learning practices. This examination will ultimately encourage the thoughtful and judicious use of technology in EFL contexts, ensuring that it serves to enhance, rather than complicate, vocabulary learning outcomes (Hung, 2015).

This study explores the effectiveness of social media and the mind mapping software Xmind in enhancing EFL learners' vocabulary achievements and their attitudes toward these tools in feedback contexts. Firstly, it examines whether integrating social media, which promotes interaction and peer collaboration, and Xmind, which helps organize and visualize vocabulary, can improve learners' vocabulary retention and usage. The study assesses if this blended approach of using social media for dynamic learning and Xmind for meaningful word connections can enhance vocabulary acquisition in EFL contexts. Secondly, the study examines EFL learners' attitudes toward using social media and Xmind for feedback in vocabulary learning. Learner attitudes are crucial as they impact engagement, motivation, and learning outcomes. Positive attitudes encourage the use of these tools, while negative perceptions may limit their effectiveness. By exploring these attitudes, the study aims to identify barriers and facilitators to technology integration in vocabulary learning. The findings offer practical insights for educators, helping to design technology-enhanced strategies that align with learners' preferences, and bridging the gap between technological tools and effective pedagogy in language education.

2 Review of the Related Literature

Integrating technology into EFL contexts to enhance vocabulary learning is supported by various educational theories (Şahin Kızıl & Savran, 2018). Grounded in Self-Determination Theory (Deci & Ryan, 1985), integrating technology in vocabulary learning might contribute to higher learner autonomy, competence, and relatedness, via individualized, interactive, and socially connected learning experiences, which would lead to motivation and retention. Moreover, in alignment with Cognitive Load Theory (Sweller, 1988), technology use might be purposefully integrated into vocabulary acquisition to lower extraneous cognitive load and adjust how to present new lexical items, hence increasing learners' capacity to process and retain vocabulary more successfully. Constructivism emphasizes active learner engagement, aligning with the collaborative and interactive features of social media and Xmind (Stockwell & Liu, 2015). Bandura's Social Learning Theory highlights learning through observation and interaction, suggesting that social media enhances vocabulary learning by exposing learners to authentic language use. The Technology Acceptance Model (TAM) explains that learners' acceptance of tools like social media and Xmind depends on perceived usefulness and ease of use (Yanguas, 2009). These frameworks

collectively illustrate how technology can facilitate vocabulary acquisition and how learner attitudes influence its effectiveness (Glassman & Kang, 2016; Wakefield & Frawley, 2020; Wang, 2016).

The integration of technology into EFL contexts has sparked considerable interest in educational research, particularly regarding its impact on vocabulary acquisition (). Several empirical studies have highlighted the potential of social media platforms to enrich vocabulary learning through increased interaction and engagement. For example, Chun et al. (2016) investigated the impact of using Instagram on vocabulary acquisition among EFL learners. The research found that incorporating social media led to significant improvements in learners' vocabulary retention and engagement, as students expressed enjoyment and motivation in using the platform to interact with peers and engage in vocabulary-related activities. Participants reported more frequent exposure to new words in context, thereby facilitating deeper learning. Ada et al. (2017) explored the use of Facebook groups for vocabulary learning. They found that students who participated in discussion forums and group activities frequently reported higher vocabulary gains. The immediate and informal nature of the feedback provided by peers was instrumental in reinforcing vocabulary knowledge, thus supporting the notion that social media can be an effective tool for enhancing vocabulary achievements.

The use of mind mapping tools, such as Xmind, has also been shown to positively affect vocabulary learning. Xin and Affrunti (2019) conducted an experimental study that examined the effects of using mind mapping on the vocabulary achievements of EFL students. The findings indicated that students who utilized mind maps to organize vocabulary and illustrate relationships between words performed significantly better in tests compared with those who received conventional instruction. Mind mapping's visual nature aided in memory retention and recall, suggesting that this tool can effectively enhance vocabulary learning. Additionally, Shi and Tsai (2024) investigated the impact of Xmind on collaborative vocabulary learning in EFL classrooms. Their results demonstrated that mind mapping promoted teamwork and facilitated discussion among students, which contributed to higher levels of engagement and vocabulary mastery. Participants appreciated having a structured visual representation of vocabulary, which helped them understand the connections between words and concepts.

Understanding learner attitudes towards technology is crucial for successful implementation. Rezai et al. (2025) examined EFL learners' attitudes toward using social media as a feedback mechanism for vocabulary learning. The study revealed that the majority of participants viewed social media positively, citing its ability to facilitate communication and foster a supportive learning environment. Learners expressed that receiving feedback from peers in a social media context felt less intimidating than traditional classroom settings, thereby encouraging their vocabulary practice. Conversely, Karimi and Nasouri (2024) noted some resistance among students who were unfamiliar with using social media for educational purposes. Their research highlighted a divide in attitudes based on prior experience, suggesting that students with limited digital literacy were less likely to view these platforms positively. This finding indicates the need for tailored training to enhance digital competency, helping more learners engage with these technologies effectively. The attitudes of learners towards using mind mapping tools for receiving feedback are generally favorable as well. In a study by Ko (2019), students reported that using Xmind not only aided in understanding vocabulary but also encouraged peer collaboration. Participants appreciated receiving visual feedback on their mind maps, which clarified misunderstandings and deepened their grasp of vocabulary. The structured format of mind mapping provided a clear framework for learners to visualize their feedback, making the learning process more transparent and manageable. However, some students expressed concerns about the time required to create and utilize mind maps effectively. For example, Rezai et al. (2025) found that while many learners acknowledged the benefits of mind mapping, they also felt overwhelmed by the task of creating detailed maps, which they believed could detract from their overall vocabulary learning experience.

While numerous studies indicate positive outcomes associated with technology in vocabulary learning (e.g., Ko, 2019), there is often an overemphasis on the benefits without a corresponding focus

on potential drawbacks. Critics argue that the effectiveness of technology is not universally applicable and can vary greatly depending on individual learner attributes and context. This raises questions about the validity of generalizing findings across different settings. As noted by Chun et al. (2016), the effectiveness of technology as a 'panacea' for vocabulary learning is largely contingent on various contextual factors. However, the literature often fails to fully account for how these factors might hinder technology's effectiveness. For example, learners' varying technological skills, educational background, and access to reliable devices and connectivity can significantly impact outcomes, highlighting a need for a more nuanced understanding of how technology is experienced differently across diverse populations (Hsu et al., 2023; Shi & Tsai, 2024; Zhang et al., 2025).

The literature suggests that social media facilitates interaction and feedback; however, the quality of peer feedback provided through these platforms can be questionable (Zhang et al., 2025). There may be inconsistencies in the accuracy and depth of feedback given by peers, which could lead to misunderstandings or improper language use. This poses challenges as to whether such interactions genuinely contribute to vocabulary mastery or if they sometimes mislead learners (Wakefield & Frawley, 2020; Xu et al., 2017; Zhang et al., 2025). The assumption that all learners are equally capable of utilizing technological tools can be controversial. Not all students possess the same level of digital literacy, which can create inequalities in their ability to benefit from technology integration. This issue complicates the narrative that technology enhances learning for all, as some students may struggle with the user interfaces or lack familiarity with online learning environments (Şahin Kızıl & Savran, 2018; Sushma, 2012; Tsai & Tsai, 2018; Zhang et al., 2023). These controversial issues underscore the need for further research and critical discourse regarding technology integration in EFL contexts. Addressing these concerns will help create a more balanced understanding of how technologies, like social media and Xmind, can be effectively utilized to support vocabulary learning while considering various barriers and challenges. Such insights are essential for developing informed pedagogical approaches that maximize technology's benefits while minimizing its potential drawbacks.

Research Questions

RQ1. Does integrating social media and Xmind into EFL contexts enhance the learners' vocabulary achievements?

RQ2. What are the attitudes of EFL learners toward using social media and Xmind as the means of receiving feedback in vocabulary learning contexts?

3 Method

3.1 Participants

Two intact classes (N = 68, 18 to 24 years old) at the tertiary level from a large state university in Iran were invited to participate in this quasi-experimental study. The participants represented a diverse range of academic disciplines, including Architecture, Management, Engineering, Mathematics, and Chemistry, reflecting the multidisciplinary nature of the student body. To ensure balanced group composition and minimize selection bias, the two intact classes were randomly assigned to either an experimental group (n = 34) or a control group (n = 34) to enhance the study's internal validity, ensuring that any observed differences between the groups could be attributed to the intervention rather than to pre-existing differences. All participants were instructed by the same instructor—the first researcher—who ensured consistent delivery of the course content across both groups. The students attended the course regularly, a crucial factor for maintaining the study's reliability and ensuring that the intervention was applied consistently over time.

3.2 The context

The learners in this study were frequent users of modern technologies, particularly social media platforms, which played a significant role in their daily lives. This familiarity with digital tools made them well-suited for participating in a technology-enhanced learning environment. All participants were based in Iran and had consistent access to the Internet, both at home and at university, ensuring that they could fully engage with the course materials and activities outside of the traditional classroom setting. The availability of reliable internet access was critical for the smooth execution of the blended learning model, which relied heavily on digital platforms for instruction and interaction. To cater to students wishing to expand their English vocabulary knowledge in a more flexible and modern context, a blended reading course was specifically designed. The course aimed to integrate traditional learning methods with innovative technological tools—Telegram and Xmind—to create an engaging and interactive learning experience. The course spanned one academic term, comprising 14 sessions in total. Throughout these sessions, Telegram and Xmind served as the primary platforms for delivering course content, facilitating communication, and organizing collaborative activities. The course was structured in two main stages to ease students into the new mode of learning. In Stage 1, the learners were familiarized with the course objectives, structure, and instructional approach, focusing on how to effectively navigate and use Telegram and Xmind as part of their learning. In Stage 2, the learners actively engaged with these tools to enhance their vocabulary acquisition. Telegram was utilized for discussions, sharing resources, and providing immediate feedback, while Xmind, a mind-mapping tool, allowed students to visually organize and connect new vocabulary in meaningful ways. By blending these technological tools with traditional reading exercises, the course sought to create a dynamic and learner-centered environment that encouraged active participation, collaboration, and autonomous learning.

3.3 Instruments

3.3.1 Telegram Application

The Telegram application offers online users a wide range of capabilities, enabling them to send and receive various forms of media, such as images, videos, audio files, and voice messages through their social network, group, or individual contacts (Olson, 2013). This versatility has made Telegram a popular platform for communication and interaction in many contexts, including language learning. With over 700 million photos and 10 billion messages shared daily, Telegram facilitates real-time, media-rich communication, which is particularly beneficial for language learners who can engage with authentic language input in diverse formats (Olanof, 2012; Parmy, 2013). As Telegram operates on multiple devices such as smartphones, tablets, and desktops, it offers learners a high degree of accessibility and flexibility, ensuring that they can engage in learning activities anytime and anywhere. Moreover, Telegram allows teachers and learners to create and manage groups, which can serve as virtual classrooms or discussion forums where learners can collaborate, share resources, and engage in meaningful social interactions. These group discussions can facilitate language practice in a communicative setting, as students are encouraged to use the target language for practical interactions. Consequently, Telegram becomes a valuable tool in both formal and informal language learning environments, boosting learner engagement and enhancing communicative competence.

3.3.2 Xmind

The Xmind application, developed by XMind Ltd, combines the effectiveness of the concept mapping strategy with the advanced capabilities of modern technology, making it a powerful tool for learners and educators alike (Shi & Tsai, 2024). This software allows users of all ages and skill levels to easily create, modify, and organize concept maps, offering an intuitive interface that simplifies the process of

structuring information. Whether the goal is to outline a complex subject, brainstorm ideas, or synthesize knowledge, Xmind enables users to visually represent their thoughts in a structured and accessible manner. One of its key advantages is its collaborative feature, which allows users to work together remotely, constructing and publishing their concept maps in real time. This online accessibility means that anyone can view or interact with the maps, enhancing collaboration and collective learning. This tool allows learners to navigate through intricate language concepts with ease, using the map as a visual and interactive guide.

3.3.3 Vocabulary pretest and posttest

The researchers designed a vocabulary pretest based on the textbook *Read This! 2* (Mackey et al., 2010), which is primarily used for teaching general English to all incoming students at the University of Qom, Iran. The pretest was designed to evaluate the learners' initial vocabulary knowledge at the start of the study. Comprising 30 items, the test was specifically aligned with the vocabulary found in the textbook's reading passages to ensure relevance to the learners' coursework. The vocabulary tests used in this study were designed to assess receptive vocabulary knowledge through multiple-choice and matching formats. The tests underwent a pilot study with a comparable group of learners (n = 20) who were not part of the main study. Reliability analysis using Cronbach's alpha yielded a coefficient of .714 for the pretest and .818 for the posttest, indicating acceptable internal consistency. To establish content validity, three experienced EFL professionals reviewed the test items and confirmed their alignment with the study's learning objectives. Additionally, to ensure comparability between the pre-test and post-test, the vocabulary items were matched based on corpus frequency using the British National Corpus (BNC) and assigned CEFR levels from the English Vocabulary Profile (EVP). Words were also matched for length and part of speech distribution. Item facility and discrimination indices were computed during the pilot phase to further confirm that the two test versions were equivalent in difficulty. These procedures were undertaken to ensure that both the validity of the vocabulary assessment and the comparability of the pre-test and post-test were adequately addressed (see Appendix for sample items).

3.3.4 Semi-structured interview

To gain a deeper understanding of the participants' perspectives on a technology-enhanced learning environment, the researchers carried out semi-structured interviews with 15 learners from the experimental group. The participants for the interviews were purposefully selected from the experimental group using a maximum variation sampling strategy. This approach was chosen to capture a broad range of perspectives and experiences related to the intervention. Selection criteria included gender, language proficiency levels, and observed classroom participation, allowing for diverse representation within the sample. The interview language was English, consistent with the instructional language of the intervention and the proficiency level of the participants, who were all upper-intermediate EFL learners. However, participants were informed that they could switch to their first language (Persian) if needed to express complex ideas or emotions. In such cases, follow-up translations were verified through member checking and expert review to ensure accuracy. Each face-to-face interview lasted about 30 minutes, offering a flexible platform for learners to share their views not only on the specific questions posed by the researchers but also on any other related topics they wished to explore. The semi-structured format allowed the conversation to flow freely, giving learners the opportunity to elaborate on their experiences and perceptions in a more natural and comprehensive manner. The interview questions were designed to explore key areas of interest, such as the learners' overall attitudes toward technology-enhanced environments, the perceived benefits of integrating technology in reading and vocabulary courses, the challenges they encountered in such settings, and their general feelings and feedback about participating in a blended learning model. The researchers carefully crafted the questions to prompt reflection on both

the positive and negative aspects of the learning environment, encouraging learners to provide a balanced perspective.

To initiate the discussion, learners were first asked to define what they understood by the term 'technology-enhanced environment.' This warm-up question helped ease the participants into the conversation while setting a clear context for the subsequent topics. Following this, the learners were asked to share their opinions on the effectiveness of conducting such technology-supported learning environments, particularly in the context of vocabulary acquisition. Specific questions addressed their attitudes toward learning new vocabulary in a blended classroom, the use of applications such as Telegram and Xmind, and their views on how these tools impacted their learning process. To ensure confidentiality and anonymity, each participant was assigned a number during the interview process, a practice recommended by Creswell and Creswell (2017), to create a safe space where learners could openly share their thoughts and concerns without fear of being personally identified.

3.3.5 Reading material

The two groups in the study were exposed to *Read This! 2*, an English reading textbook from a series designed specifically for secondary and university students (Mackey et al., 2010). *Read This! 2* stands out with several key features that align well with the objectives of the current study. The passages in the textbook serve as springboards for various learning activities, including reading comprehension tasks, vocabulary building exercises, grammatical analysis, and opportunities for both oral and written discussion. The textbook offers explicit instruction in critical reading skills, such as skimming and scanning. These skills help learners extract meaning more efficiently from texts and prepare them to encounter new vocabulary with greater confidence. The textbook introduces key strategies for learning new words, such as using contextual clues and understanding word forms (e.g., prefixes, suffixes, and root words). Each chapter includes a Vocabulary Review section that highlights 12 key words before students begin reading the passages. This pre-reading vocabulary instruction is designed to prepare students for the text and ensure that they have a foundational understanding of the new words they will encounter. Throughout the intervention, the learners in both the experimental and control groups were guided through the textbook's chapters, with the experimental group utilizing Telegram and Xmind to supplement their learning. These platforms allowed learners to collaborate, share concept maps, and receive immediate feedback on their vocabulary exercises. This technology-enhanced learning environment not only provided learners with diverse methods of engaging with the material but also aligned with the textbook's objective of fostering deeper language acquisition through interactive and visual means.

3.4 Procedures

The study took place over a 14-week period, with one 90-minute session conducted each week during a regular academic term. In the first two sessions, participants in the experimental group were trained on how to use the applications essential for the study. They were introduced to the Xmind application for creating concept maps and the Telegram platform for communication and file sharing. The researchers conducted practical tests to ensure that all learners had an equivalent level of technology literacy, ensuring a uniform starting point for the intervention. In the pre-reading phase, the teacher introduced new vocabulary words that were central to the texts. This phase also involved providing relevant background knowledge and activating the learners' existing schemata, which helped them engage meaningfully with the reading materials. Warm-up activities, such as brainstorming and vocabulary review, stimulated the learners' interest in the topic, thereby aiding in their comprehension of new words. Learners were encouraged to explore word meanings and usage through a combination of context clues, word formation analysis, and prior knowledge.

During the while-reading phase, the teacher introduced a variety of effective learning strategies to enhance vocabulary acquisition and comprehension. These strategies included guessing word meanings from context, using word formation clues, recognizing cognates, paying attention to sentence structure and syntax, analyzing reference words, and predicting text content. Learners were also taught to use dictionaries effectively to support their understanding. These strategies helped students create concept maps, which were visual representations of their understanding. The experimental group used Xmind to construct these maps, incorporating information from various sources such as textbooks, peer discussions, and online resources. They then shared their maps via Telegram, enabling collaborative learning outside the classroom. The use of Telegram allowed for real-time collaboration, with participants linking photos, images, videos, charts, tables, and texts to their concept maps by dragging and dropping resources from the internet or personal files.

In the post-reading phase, the teacher assessed the students' reading comprehension and the quality of their concept maps. Group discussions were held to address any misunderstandings or gaps in comprehension. The teacher then provided feedback on the concept maps, offering suggestions for improvement and sharing an updated version of the Xmind maps with the group. Towards the end of the intervention, the researchers carried out semi-structured interviews with 15 learners from the experimental group. Each interview, lasting around 30 minutes, aimed to delve into the learners' experiences and attitudes regarding the technology-enhanced learning environment. After a series of warm-up questions, participants were asked about the perceived advantages and disadvantages of using tools, like Telegram and Xmind, in their learning. The interviews were transcribed and analyzed for deeper insights into the learners' perspectives on the technology-enhanced approach.

The control group adhered to a similar instructional approach, including the same pre-reading, while-reading, and post-reading phases. However, the key difference was that this group did not use Telegram or Xmind. Instead, learners created concept maps using traditional paper-and-pencil methods. These maps were completed individually and submitted to the teacher without any opportunities for collaboration or resource sharing. The control group's concept mapping process was less interactive, as they lacked the collaborative features available to the experimental group. However, they received instruction on how to construct concept maps using handouts and practiced drawing them manually.

4 Results

4.1 Integrating technology into EFL classes

The first research question explored whether incorporating Telegram and Xmind into EFL settings would improve learners' vocabulary outcomes. Table 1 offers a comparative overview of the vocabulary test scores for both the experimental and control groups, showing their performance before and after the intervention. Prior to performing ANCOVA, the researchers carefully checked its assumptions, including homogeneity of regression slopes, to validate the analysis.

Table 1
Descriptive Statistics

	Pretest scores		**Posttest scores**	
Group (*n*)	Experimental (34)	Control (34)	Experimental (34)	Control (34)
M (*SD*)	22.15 (4.61)	22.56 (4.53)	29.59 (5.11)	24.91 (4.32)

Table 1 presents the descriptive statistics for the pretest and posttest vocabulary scores of both the experimental and control groups. The mean pretest scores were 22.15 (*SD* = 4.61) for the experimental

group and 22.56 (*SD* = 4.53) for the control group. Following the intervention, the experimental group showed a substantial increase in their vocabulary performance with a mean posttest score of 29.59 (*SD* = 5.11), while the control group exhibited a more modest improvement, with a mean posttest score of 24.91 (*SD* = 4.32). These results suggest that incorporating Telegram and Xmind in the experimental group led to a more significant enhancement in vocabulary achievement than what was observed in the control group.

Table 2
The Results of ANCOVA

Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	1083.346a	2	541.673	46.121	.000	.587
Intercept	330.936	1	330.936	28.178	.000	.302
Pretest	711.567	1	711.567	60.586	.000	.482
Group	419.461	1	419.461	35.715	.000	.355
Error	763.404	65	11.745			
Total	52341.000	68				
Corrected Total	1846.750	67				

Dependent Variable: Posttest

a. R Squared = .587 (Adjusted R Squared = .574)

Table 2 details the results of the ANCOVA used to assess the effect of group assignment (experimental vs. control) on posttest scores, with pretest scores as a covariate. The overall model is statistically significant, as evidenced by an F-ratio of 46.121 and a partial eta squared value of .587. This indicates that the model explains a substantial amount of the variance in the posttest scores, demonstrating the effectiveness of the overall analysis in capturing the impact of the intervention. The pretest scores, which were used to control for initial differences in vocabulary knowledge, are a strong predictor of posttest performance. This is highlighted by the F-ratio of 60.586 and a partial eta squared of .482, showing that pretest scores account for nearly 48.2% of the variance in the posttest scores. This emphasizes the importance of accounting for baseline knowledge when evaluating the effectiveness of educational interventions. The group assignment variable also has a significant effect on posttest scores, with an F-ratio of 35.715 and a partial eta squared of .355. This finding implies that about 35.5% of the variation in posttest scores can be explained by the differences between the experimental and control groups. The considerable effect size highlights that the use of Telegram and Xmind had a significant impact on vocabulary learning outcomes. The ANCOVA results indicate that integrating Telegram and Xmind in the experimental group led to a notable improvement in vocabulary learning compared with the traditional methods used by the control group. This improvement was observed after accounting for initial differences in vocabulary knowledge between the groups, emphasizing the effectiveness of the technology-enhanced learning environment in advancing vocabulary acquisition.

Table 3
Estimated Marginal Means

Group	Mean	Std. Error	95% Confidence Interval	
			Lower Bound	Upper Bound
Experimental	29.736a	.588	28.562	30.911
Control	24.764a	.588	23.589	25.938

Dependent Variable: Posttest

a. Covariates appearing in the model are evaluated at the following values: Pretest = 22.35.

Table 3 presents the estimated marginal means for posttest scores of the experimental and control groups, adjusted for pretest scores. The estimated marginal means indicate that the experimental group, with Telegram and Xmind, achieved a higher mean posttest score (M = 29.736) compared with the control group (M = 24.764). The significant difference between these means reflects the positive impact of the technology-enhanced learning tools on vocabulary acquisition. The confidence intervals further support this interpretation, as the intervals do not overlap. For the experimental group, the confidence interval (28.562 to 30.911) is significantly higher than that of the control group (23.589 to 25.938), reinforcing the conclusion that the intervention had a meaningful effect on improving vocabulary learning outcomes. These results suggest that integrating Telegram and Xmind into the learning process provided a significant benefit over traditional methods, as evidenced by the higher estimated marginal means and the clear separation between the confidence intervals of the two groups.

4.2 Attitudes towards technology use

The second research question explored the attitudes of EFL learners toward the use of Telegram and Xmind to obtain feedback in vocabulary learning contexts. Intended for the sake of data triangulation, the researchers conducted a semi-structured interview with 15 learners from the experimental group. The results showed that there were some differences between these learners' attitudes towards technology-enhanced environment. The main themes, obtained in the semi-structured interview, are organized in terms of advantages and disadvantages below:

4.2.1 Advantages of technology-enhanced learning environment

Interactive activities: 'Using Internet to find the meaning of new words and find the relationship among them in Xmind provide interactive activities that help us learn new vocabulary' (Student # 1; in addition, students # 3, 6, 8, & 11 mentioned the same concept but in different words). Most of them argued that blended setting provides adequate opportunities for learning new vocabulary.

Collaborative learning: One student stated that 'before this course we did not know how to work with a dictionary. In Telegram, we learn a lot from other learners about how to use a dictionary, especially online dictionaries' (Student # 5). 'It is so interesting that I can ask my classmates any questions, at any time. They help me clarify the meaning of new words in the Telergam. Even they share with me their Xmind maps to understand the words better. This feature motivates me to use this application more than before for language learning, especially for vocabulary learning' (Students # 3; in addition, students # 6 & 8 stated the same concepts but in different words). These statements indicate that collaborative learning is a significant feature of any blended learning environment that provides extraordinary ubiquitous learning opportunities for diverse language learners.

Feedback: 'Making XMind, sharing it in Telegram, and receiving immediate feedback are significant factors that motivate learners to participate in classroom activities and consequently learn new vocabularies more effectively' (Students # 3, 5, 8, 11, 14, & 15).

Good learning source: 'Internet is a learning source in which we can find numerous examples of new words of the text in different contexts. It helps us make more adequate XMind. Without Internet, making XMind would be a complicated issue' (Students # 6; in addition, student # 8 stated the same concepts but in different words).

Encouraging self-learning and self-assessment: 'We learn practically what our strengths and weaknesses are in every session, while in conventional learning contexts we found it at the end of the course' (Student # 5). When there is technology in the classroom, then teachers have an opportunity to let learners operate in the classroom at their own pace which suits them without disturbing others. In other words, various educational tasks are available and the learners can choose them based on their specific learning styles. They can play educational games that reinforce the lesson; they can work on learning material in different level (Students # 1, 3, 8, & 11).

Solving educational problems: Technology-enhanced environment enables us to solve our educational problems among themselves even without help from our parents and teachers. This extraordinary feature motivates every learner to participate in such a beneficial learning environment (Students # 1, 5, 8, & 11). Individualized instruction allows students to learn at their own specific pace and check their progress individually.

Recent information: Approximately all the learners stated that web-based content is up-to-date. They have access to the most current information helping them become better informed even outside the classroom environment.

Reduced learning expenses: Financial matters are magnificently important for language learners. Learning expenses can be reduced in technology-enhanced learning environments. In addition, students can share different textbooks in Telegram group. They may no longer need to buy learning materials.

Fun learning: Vocabulary learning can be fun when you use applications, such as Xmind and Telegram. Learners are highly motivated to participate in classroom activities. This factor provides a situation in which learners can retain the new vocabulary more effectively in comparison to conventional classrooms (Students # 1, 5, 8, & 14).

The interview findings revealed that learners with technological proficiency highlighted the considerable effect of a technology-enhanced environment on EFL vocabulary learning. Additionally, their participation in classroom activities could shape their attitudes toward the importance of implementing such programs in various learning settings.

4.2.2 Perceived benefits and challenges of feedback through social media platforms

Limited access to Internet: 'The main obstacle in conducting technology-enhanced learning environment is learners' limited access. I can say that my major problem is that Internet is not always accessible in and out of class' (Student # 2). Approximately, all of the students agreed that limited access to Internet was their main concern in the learning environment.

Although all participants had general access to the Internet at home and at university, several reported issues with unstable connections, limited bandwidth, and occasional outages during online activities. Thus, the disadvantage of 'limited access to Internet' refers to the quality and reliability of the connection rather than complete lack of access.

Learner absence: I do not know whether it is a positive or negative feature; however, when I have access to everything in Telegram, I think there is no need to attend the class' (Student # 4). It can be said that lazy students' attitudes toward online learning might be a major problem in blended learning contexts in which learners' presence in the class is required.

Social network media as an entertainment: Many learners had negative attitudes toward technologies, such as social networks, they usually use for entertainment in the class (Students # 7, 10, & 12). Many believed that textbooks are materials designed for learning while social networks are designed for fun or anything except learning.

Taking much time: Controlling a technology-enhanced learning context requires a great deal of time. Ever-changing applications with different settings can bother both teachers and learners in every learning context. Some learners believe that a conventional class with paper and pencil concept-maps and face-to-face classroom would be more preferable as you need a lot of time to handle the technical problems of modern technologies (Students # 2, 7, 10, 12, & 13).

Confusion for beginners: Access to a huge amount of information in a technology-enhanced learning environment probably misguides low-proficient learners. In other words, access to unclassified input can be dangerous for beginners and can be eventuated in a state of confusion (Students # 9, 10, 12, & 13).

Unlike the results of quantitative analysis that show the superiority of the experimental group who had better scores in their vocabulary tests, the results of semi-structured interview indicate that the learners have mixed attitudes toward technology-enhanced learning context for language learning, especially for vocabulary learning. Some discussed the challenges they had in learning in a technology-enhanced language classroom. Several participants stated that this new environment needs a large amount of time. Some stated that internet interruption can cause many unanticipated problems. Some of them, in contrast, talked about positive features of technology-enhanced classrooms. They mentioned that self-motivated assessment through classroom activities, setting specific goals based on learners' interest, and giving feedback are major features of this new mode of instruction. Using educational tools, Internet, and chat in social networks may help learners realize the mental process that they engage in as they make their maps about new vocabulary. They believe that flexible course content allows them to focus on the part in which they are more interested.

5 Discussion

The findings from the current study investigating the impact of employing Xmind and Telegram on learners' vocabulary learning in EFL contexts highlight both the benefits and challenges associated with using technology-enhanced methods in language education. The results revealing that learners in a technology-enhanced classroom outperformed those in a conventional classroom align with existing literature on technology's positive influence on vocabulary acquisition. However, the themes that emerged from the semi-structured interviews provide a more nuanced understanding of the implications of integrating such technologies in EFL contexts.

The use of the internet to find meanings and relationships among words through Xmind provides interactive activities that significantly enhance vocabulary acquisition. This finding confirms the role of interactive technology in fostering engagement and deeper learning. By allowing learners to visualize connections between new vocabulary, Xmind promotes a more profound understanding of the words and their contexts. The emphasis on collaborative learning as a beneficial aspect of blended learning environments reflects an essential characteristic of effective language learning. The ability for students to work together, share ideas, and support one another in vocabulary acquisition aligns with Vygotsky's social constructivist theory, which underlines the importance of social interaction in learning. The opportunities for ubiquitous learning through platforms like Telegram allow diverse language learners to benefit from peer collaboration outside traditional classroom settings. The feedback mechanism provided by Telegram, where learners can share and receive immediate feedback on their XMind, significantly

motivates participation and enhances learning outcomes. This responsiveness is critical in educational settings as it allows learners to correct misunderstandings and reinforce their learning promptly, which is in line with effective feedback strategies discussed in educational literature. The ability to access web-based content and examples of new words in various contexts aligns well with principles of authentic learning. The immediacy and relevance of using up-to-date content can significantly enrich vocabulary instruction, making it more relevant to real-world applications, which supports learner engagement and connection to the material.

Limited access to technology is a significant barrier in a diverse educational landscape, particularly when students lack reliable internet connectivity or access to devices, which exacerbates existing inequalities (Xin & Affrunti, 2019). This challenge underscores the necessity of ensuring equitable access to educational technologies for all learners. The study identified that some students had negative attitudes toward using social media technologies for educational purposes, often associating these platforms with entertainment rather than learning. This resistance to educational applications of social media reflects a disconnect between learners' personal use and its educational potential, a perception also noted by Friðriksdóttir (2018), who emphasized the need for educators to help students redefine the context in which such tools are viewed. Furthermore, the requirement of significant time to manage and integrate technology-enhanced learning environments was highlighted as a concern, which aligns with findings by Hsu et al. (2023), who discussed the challenges educators face in maintaining quality instruction while managing technology. The study's findings corroborate prior research, particularly regarding the effectiveness of tools like Xmind and Telegram in enhancing vocabulary learning, but also reinforce existing concerns around access, student attitudes, and the need for robust strategies in technology integration (Wakefield & Frawley, 2020).

These findings align with those of Kim et al. (2013), who suggested that interactive digital tools allow students to engage actively with vocabulary, thus improving retention. Similarly, Stockwell and Liu (2015) noted that internet resources provide contextual examples that enhance vocabulary understanding. The findings also resonate with Jurkovič (2019), who found that social media facilitated collaborative vocabulary learning. Moreover, Karimi and Nasouri (2024) emphasized that collaborative activities on platforms, such as Facebook, could lead to meaningful vocabulary acquisition. The study indicated that sharing XMind and receiving immediate feedback through Telegram were motivational factors for learners. Teng (2025) highlights that learners' motivation and perceived progress in tech-enhanced contexts mutually reinforce, hence contributing to appropriate conditions that improve vocabulary acquisition. This aligns with Ada et al. (2017), who highlighted the importance of timely feedback in enhancing learner outcomes. Findings from the study noted that learners could choose various educational tasks based on their learning styles. Prior research, including Zhang et al. (2025), supports the notion that personalized learning experiences catered to individual styles can improve engagement and outcomes in vocabulary learning.

6 Conclusion

Learners exposed to the technology-enhanced environment significantly outperformed those in traditional classrooms, underscoring the efficacy of digital tools in promoting vocabulary learning. Insights from semi-structured interviews revealed several pedagogical advantages, including increased learner interaction, enhanced collaboration, and heightened motivation. The use of concept maps, access to internet resources, and real-time feedback created a learning environment that supported diverse learning styles and fostered independent problem-solving.

Our findings correspond with technology acceptance model as learners positively perceive the usefulness and ease of use, which significantly affected their engagement with these applications. Interview data further revealed that their willingness to adopt persistently increased with vocabulary

tasks because of the intuitive design and practical functionality of the digital platforms (Wang, 2016). Moreover, these outcomes align with self-determination theory (Deci & Ryan, 1985), as the technology-mediated setting nurtured learners' autonomy, competence, and relatedness—key components for intrinsic motivation and sustained engagement. Moreover, the use of digital tools also catered to varied cognitive processes, consistent with cognitive load theory (Sweller, 1988), by helping learners organize and integrate information through visual aids and structured platforms, thereby reducing extraneous cognitive load and enhancing germane processing. Interestingly, Wu et al.'s (2025) qualitative study of an L2 English learner in Hong Kong has showed that gaming habits leads to unexpected lexical development despite initial resistance to recognizing these benefits. That is, technology and digital gaming leads to language learning, which in turn provides unique opportunities for vocabulary acquisition, particularly incidental vocabulary acquisition, through sustained engagement.

Nevertheless, several challenges emerged. Limited access to technology, resistance to the educational use of social media, and the time-consuming nature of managing digital tools were noted. Additionally, learners with lower proficiency levels risked experiencing cognitive overload due to the volume and complexity of available online information. These drawbacks emphasize the need for scaffolded implementation and careful instructional design to mitigate cognitive strain.

Despite these limitations, the findings suggest that when pedagogically grounded and purposefully integrated, technology can significantly enrich vocabulary learning in EFL contexts. By promoting interaction, learner autonomy, and motivational engagement, such tools offer a dynamic and responsive learning environment that aligns with both cognitive and motivational learning frameworks. The theoretical implications of these findings suggest that integrating technology, such as Xmind and Telegram, into vocabulary learning in EFL contexts aligns with current theories of blended and technology-enhanced learning. These tools provide opportunities for interactive and collaborative learning, which are central to social constructivist theory, where learners build knowledge through social interaction and context.

Practically, these findings offer valuable insights for educators and policymakers. The benefits of using technology-enhanced environments, such as enabling ubiquitous learning, providing access to diverse tasks that cater to different learning styles, and keeping content up-to-date, highlight the potential of such tools in fostering more engaged and self-directed learners. The immediate feedback mechanisms in tools like Telegram further support active learning, which can significantly enhance vocabulary acquisition.

However, the disadvantages must also be carefully considered when designing technology-enhanced learning environments. Issues, such as limited access, students' attitudes, and time required for classroom management, indicate the need for careful planning and support structures. Educators must ensure equal access to technology, address students' misconceptions or resistance, and implement effective classroom management strategies to handle the vast amount of information available online. Moreover, scaffolding low-proficient learners to prevent information overload is critical to ensure that all students benefit from these innovations.

Despite its insights on tech-enhanced EFL vocabulary acquisition, this study has limitations. First, the sample size was relatively small and limited to a specific context, hence affecting the findings' generalizability. Future studies should attempt for a larger and more diverse sample across different institutions and proficiency levels to enhance external validity. Second, post-test scores (29.59/30) indicated a ceiling effect, thus limited variability, which would limit or insight into high-proficient learners. Future studies with more tiered assessment could better capture nuanced learning gains. Third, the self-reported qualitative data might be subject to social desirability bias. Despite ensuring anonymity and encouraging honest responses, some participants might have provided answers they believed were expected by the researcher.

Future research could further investigate the long-term effects of using Xmind and Telegram on learners' vocabulary retention. Moreover, future research could explore how Xmind and Telegram impact other language skills, such as reading, writing, listening, and speaking in EFL contexts and, thus, impact learners at different proficiency levels; do beginner, intermediate, and advanced learners benefit equally or differently from these tools. It might be interesting to integrate additional collaborative technologies (e.g., Google Docs, Padlet) to understand how a combination or comparison of different digital tools might further enhance language learning outcomes. Last but not least, relevant variables (e.g., learners' intrinsic motivation, self-regulation skills, and perceptions of autonomy in blended learning environments) could be explored.

Acknowledgements

The authors express their sincere thanks to the students who participated in this research with patience, generosity, and commitment. Moreover, the second author is grateful to the first author for involving him, upon invitation, in the current research endeavor. Therefore, Is'haaq Akbarian, the second author, only assisted in conference presentation, manuscript editing, paper submission to IJTS, and constructive feedback provision on the two rounds of revision for the respective journal; Morteza Mellati conceived the study, conducted the research, and wrote the original draft.

Appendix

Sample items for Vocabulary pre- and post-test

A. *Please read the following sentences and choose the correct answers.*

1. Exercise is important because it……. people's bodies and minds healthy.

a) takes b) makes c) keeps d) gets

2. Eyes, ears, and nose are called sense…….

a) material b) substances c) procedures d) organs

3. John Vane, a British researcher, found the reason aspirin helped to ……. heart attacks.

a) assist b) prevent c) develop d) produce

B. *Match each word or phrase on the left with its correct definition or synonym on the right. Write the letter of the correct answer next to the number.*

A. Save someone from danger
B. Guess or calculate roughly
C. Feel worried or nervous

Number	Word or Phrase	Match
4.	anxious	……
5.	rescue	……
6.	estimate	……

References

Ada, M., Stansfield, M., & Baxter, G. (2017). Using mobile learning and social media to enhance learner feedback: Some empirical evidence. *Journal of Applied Research in Higher Education, 9*(1), 70-90. https://doi.org/10.1108/JARHE-07-2015-0060

Akbarian, I. (2010a). The comparative development of vocabulary breadth and depth, and academic vocabulary for ESP/EAP learners. *Iranian Journal of Applied Linguistics, 13*(1), 1-22. http://ijal.khu.ac.ir/article-1-43-en.html

Akbarian, I. (2010b). The relationship between vocabulary size and depth for ESP/EAP learners. *System, 38*(3), 391-401. https://doi.org/10.1016/j.system.2010.06.013

Akbarian, I. (2018). Vocabulary development and teaching speaking. In J. Liontas, M. DelliCarpini, & Abrar-ul-Hassan, S. (Eds.), *TESOL Encyclopedia of English language teaching*. Wiley-Blackwell. https://doi.org/10.1002/9781118784235.eelt0704

Chacón-Beltrán, R. (2018). Vocabulary learning strategies outside the classroom context: What adults learn in a technology-based learner-centred environment. *The Language Learning Journal, 46*(5), 583-593. https://doi.org/10.1080/09571736.2018.1503135

Chun, D., Kern, R., & Smith, B. (2016). Technology in language use, language teaching, and language learning. *The Modern Language Journal, 100(S1), 64-80.* https://doi.org/10.1111/modl.12302

Creswell, J. W., & Creswell, J. D. (2017). *Research design: Qualitative, quantitative, and mixed methods approaches (3th ed.).* Sage publications.

Deci, E. L., & Ryan, R. M. (1985). Intrinsic motivation and self-determination in human behavior. Plenum.

Dodigovic, M. (2023). Vocabulary within a four strands curriculum: An interview with Paul Nation. *International Journal of TESOL Studies, 5*(2), 132-142. https://doi.org/10.58304/ijts.20230210

Friðriksdóttir, K. (2018). The impact of different modalities on student retention and overall engagement patterns in open online courses. *Computer Assisted Language Learning, 31*(1-2), 53-71. https://doi.org/10.1080/09588221.2017.1381129

Glassman, M., & Kang, M. J. (2016). Teaching and learning through open source educative processes. *Teaching and Teacher Education, 60, 281-290.* http://dx.doi.org/10.1016/j.tate.2016.09.002

Hsu, T.-C., Chang, C., & Jen, T.-H. (2023). Artificial Intelligence image recognition using self-regulation learning strategies: effects on vocabulary acquisition, learning anxiety, and learning behaviours of English language learners. *Interactive Learning Environments, 32* (6), 1-19. https://doi.org/10.1080/10494820.2023.2165508

Hung, H.-T. (2015). Flipping the classroom for English language learners to foster active learning. *Computer Assisted Language Learning, 28*(1), 81-96. https://doi.org/10.1080/09588221.2014.967701

Jurkovič, V. (2019). Online informal learning of English through smartphones in Slovenia. *System, 80,* 27-37. https://doi.org/10.1016/j.system.2018.10.007

Karimi, M. N., & Nasouri, A. (2024). EFL learners' flow experience and incidental vocabulary learning during text-based game tasks: The moderating role of working memory capacity. *System, 124,* 103398. https://doi.org/10.1016/j.system.2024.103398

Kim, D., Rueckert, D., Kim, D.-J., & Seo, D. (2013). Students' perceptions and experiences of mobile learning. *Language Learning and Technology, 17*(3), 52-73. *gy* http://llt.msu.edu/issues/october2013/kimetal.pdf

Ko, M.-H. (2019). Students' reactions to using smartphones and social media for vocabulary feedback. *Computer Assisted Language Learning, 32(8), 920-944.* https://doi.org/10.1080/09588221.2018.1541360

Kurt, M., & Bensen, H. (2017). Six seconds to visualize the word: Improving EFL learners' vocabulary through VVVs. *Journal of Computer Assisted Learning, 33*(4), 334-346. https://doi.org/10.1111/jcal.12182

Kusyk, M. (2017). The development of complexity, accuracy and fluency in L2 written production through informal participation in online activities. *CALICO Journal, 34*(1), 75-96. http://dx.doi.org/10.1558/cj.29513

Mackey, D. & Savage, A. (2010). *Read this! Level 2 student's book: Fascinating stories from the content areas*. Cambridge University Press.

Mellati, M., & Khademi, M. (2019). Technology-based education: Challenges of blended educational technology. In Habib, M. (Ed.), *Advanced online education and training technologies* (48–62). IGI Global.

Olanof, D. (2012). WhatsApp hits new record with 10 billion total messages in one day. *The Next Web.* https://thenextweb.com/news/whatsapp-hits-new-record-10-billion-total-messages-one-day

Olson, P. (2013). Teenagers say goodbye to Facebook and hello to messenger apps. *The Guardian, 10, 19.* https://www.theguardian.com/technology/2013/nov/10/teenagers-messenger-apps-facebook-exodus

Rezai, A., Soyoof, A., & Reynolds, B. L. (2025). Effectiveness of informal digital learning of English on EFL learners' vocabulary knowledge: A mixed-methods investigation. *Computer Assisted Language Learning, 1-26.* . Advance online publication. https://doi.org/10.1080/09588221.2024.2350419

Şahin Kızıl, A., & Savran, Z. (2018). Assessing self-regulated learning: The case of vocabulary learning through information and communication technologies. *Computer Assisted Language Learning, 31*(5-6), 599-616. https://doi.org/10.1080/09588221.2018.1428201

Shi, Y.-s., & Tsai, C.-y. (2024). Fostering vocabulary learning: Mind mapping app enhances performances of EFL learners. *Computer Assisted Language Learning, 37*(4), 634-686. https://doi.org/10.1080/09588221.2022.2052905

Stockwell, G., & Liu, Y. C. (2015). Engaging in mobile phone-based activities for learning vocabulary: An investigation in Japan and Taiwan. *CALICO Journal, 32*(2), 299-322. https://doi.org/10.1558/cj.v32i2.25000

Sushma, P. (2012). WhatsApp founder to operators: We're no SMS-killer, we get people hooked on data. *The next web.*

Sweller, J. (1988), Cognitive load during problem solving: Effects on learning. *Cognitive Science, 12,* 257-285. https://doi.org/10.1207/s15516709cog1202_4

Teng, M. F. (2025). Metacognition, self-efficacy belief, language learning motivation, and perceived progress in online English learning: A cross-lagged analysis. *International Journal of TESOL Studies*, *7*(1), 45–60. https://doi.org/10.58304/ijts.20250102

Teng, M. F. & Reynolds, B. L. (2025). *Researching incidental vocabulary learning in a second language. Routledge.*

Tsai, Y.-L., & Tsai, C.-C. (2018). Digital game-based second-language vocabulary learning and conditions of research designs: A meta-analysis study. *Computers & Education, 125,* 345-357. https://doi.org/10.1016/j.compedu.2018.06.020

Wakefield, J., & Frawley, J. K. (2020). How does students' general academic achievement moderate the implications of social networking on specific levels of learning performance? *Computers & Education, 144, 103694.* https://doi.org/10.1016/j.compedu.2019.103694

Wang, Y. H. (2016). Promoting contextual vocabulary learning through an adaptive computer-assisted EFL reading system. *Journal of Computer Assisted Learning, 32*(4), 291-303. https://doi.org/10.1111/jcal.12132

Wu, J. G., Miller, L., & Teng, M. F. (2025). Engagement and incidental L2 vocabulary acquisition in digital gaming: A qualitative perspective of an 'in-denial gaming addict' from Hong Kong. *International Journal of Applied Linguistics*. Advance online publication. https://doi.org/10.1111/ijal.12712

Xin, J. F., & Affrunti, R. (2019). Using iPads in vocabulary instruction for English language learners. *Computers in the Schools, 36*(1), 69-82. https://doi.org/10.1080/07380569.2019.1565888

Xu, Q., Dong, X., & Jiang, L. (2017). EFL learners' perceptions of mobile-assisted feedback on oral production. *TESOL Quarterly, 51*(2), 408-417. https://doi.org/10.1002/tesq.335

Yanguas, I. (2009). Multimedia glosses and their effect on L2 text comprehension and vocabulary learning. *Language Learning & Technology, 13*(2), 48-67. http://llt.msu.edu/vol13num2/yanguas.pdf

Zhang, R., Zou, D., & Cheng, G. (2023). Learner engagement in digital game-based vocabulary learning and its effects on EFL vocabulary development. *System, 119*, 103173. https://doi.org/10.1016/j.system.2023.103173

Zhang, R., Zou, D., & Cheng, G. (2025). Self-regulated digital game-based vocabulary learning: Motivation, application of self-regulated learning strategies, EFL vocabulary knowledge development, and their interplay. *Computer Assisted Language Learning,* 1-43. Advance online publication. https://doi.org/10.1080/09588221.2024.2344555

Morteza Mellati, Ph.D. in TEFL from the University of Tehran, serves as an assistant professor at Shahab Danesh University, Qom. His research interests revolve around empowering and developing teachers' professional competencies, integrating technology into teaching and learning process, evaluating learning in educational environments, and applying evidence-based practices.

Is'haaq Akbarian, Ph.D. from the University of Tehran, is Associate Professor in Applied linguistics (Department of English Language and Literature, University of Qom). Vocabulary studies and AI are included in his research agenda. He has presented in conferences and workshops in five countries. His most recent paper was published in *Language Teaching Research*.