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The Effect of Teaching Vocabulary through Ilingo Application on EFL Learners' Vocabulary Learning and Vocabulary Learning Strategy Use

Nima Yazdi Zamani¹
Farrokhlagha Heidari^{2*}

¹M.A. in Applied Linguistics, Department of English Language and Literature, University of Sistan and Baluchestan, Zahedan, Iran

^{2*}Associate Professor of Applied Linguistics, Department of English Language and Literature, University of Sistan and Baluchestan, Zahedan, Iran

ABSTRACT

This study investigated the effect of teaching vocabulary through Ilingo application on English as a Foreign Language (EFL) learners' vocabulary learning and Vocabulary Learning Strategy (VLS) use. A total of 83 male intermediate EFL learners participated in this study. Quantitative data were collected through Oxford Quick Placement Test (OQPT), pre- and post-tests to measure vocabulary learning, and Vocabulary Learning Strategy Questionnaire (VLSQ). The participants were randomly assigned to an experimental group receiving vocabulary instruction through Ilingo application and a control group receiving conventional vocabulary instruction. The statistical analysis of the data revealed significant differences between the two groups in terms of vocabulary learning, with the application-based instruction group outperforming the conventional instruction group. Additionally, higher levels of vocabulary learning strategy utilization were observed for learners who learned vocabulary with Ilingo application. More specifically, statistically significant differences were observed for the deployment of *determination* and *memory* VLSs indicating a higher frequency of use in the experimental group. These findings contribute to a deeper understanding of the advantages of incorporating technology-driven language learning tools into the EFL classroom. The implications of this study are valuable for EFL educators and curriculum designers, providing evidence-based insights into effective pedagogical approaches in EFL contexts.

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CORRESPONDING AUTHOR

E-mail: heidari.f@english.usb.ac.ir

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1. Introduction

The advent of Mobile-Assisted Language Learning (MALL) applications has not only expanded the horizons of Computer-Assisted Language Learning (CALL) but also has offered learners an unprecedented level of flexibility, particularly in terms of accessibility and portability of learning materials. Unlike CALL methods, which lacked this level of convenience, MALL empowers learners to engage with language learning resources on the go, adapting to their dynamic lifestyles and learning preferences.

The landscape of learning and teaching English has undergone a significant transformation in terms of methodologies, approaches, and techniques (Martin & Bolliger, 2018). Thanks to technological advancements, the traditional reliance on blackboards and textbooks for lesson delivery has become obsolete. The rapid integration of online education presents both opportunities and challenges for both students and educators. The constantly evolving and swiftly progressing realm of technology necessitates the incorporation of emerging technologies, such as mobile learning technologies, into the field of education. According to Jee (2011), as mobile technology advances, it provides second/foreign language learners and educators with increasingly expansive chances to engage in target language practice, irrespective of the place and time. The widespread availability of mobile applications has additionally presented the potential for tailoring learning experiences, enabling a learner to engage with the material at his/her preferred time and place (Khojah & Thoas, 2021). Furthermore, MALL software has the potential to be created, embraced, and customized according to the needs, skills, expertise, and learning preferences of the users.

Considering the contemporary demand for foreign language learning in our technology-driven world, scholars and teachers are actively exploring methods to incorporate the utilization of language applications into foreign language education. This integration applies to various contexts, including both classroom-based and independent learning. In line with this changing emphasis on language teaching methods, there has been a growing recognition of the significance of learning vocabulary during the process of learning another language. Ellis (1995) highlighted the significance of Language Learning Strategies (LLSs), particularly in the context of vocabulary development. Among these strategies, one distinct category is known as Vocabulary Learning Strategies (VLSs). As a result, there has been a growing interest in recent decades in examining VLSs, which are specific techniques employed when undertaking the specific task of acquiring vocabulary in the target language (Fan, 2020).

The problem of inadequate vocabulary proficiency among EFL learners is emphasized by the observation that despite years of formal English instruction, many learners exhibit limited vocabulary knowledge and struggle to employ a diverse range of words in context (Lei et al., 2022). This problem raises questions about the effectiveness of the current vocabulary teaching techniques employed in EFL classrooms. While traditional approaches to vocabulary instruction, such as rote memorization and isolated word lists, have been the norm for decades, recent developments in language education suggest the potential benefits of more innovative and interactive approaches. One such approach gaining traction is the integration of vocabulary learning through mobile applications, which combine technology, contextualization, and learner autonomy to enhance vocabulary learning (Rafiq et al., 2022).

Nonetheless, the extent to which EFL learners benefit from vocabulary learning opportunities through technology remains uncertain. Consequently, learners may fail to engage with vocabulary learning in a meaningful and effective manner. According to Karami (2019), further investigation is required to explore the utilization of technology in educational settings. Although numerous studies exist in the current body of literature regarding vocabulary learning, persistent challenges still exist among EFL learners, particularly at the intermediate level. Many intermediate-level EFL learners struggle to attain the desired levels of vocabulary proficiency, which ultimately hampers their overall language competence. Therefore, there is a pressing need to investigate and address the challenges surrounding vocabulary development among intermediate-level EFL learners (Hasan et al., 2022). Hence, this study aims to assess the effect of teaching vocabulary through Iingo application on intermediate EFL learners' vocabulary learning and utilization of VLSs.

2. Literature review

The inception of CALL marked a paradigm shift in language education. Early studies (Levy, 1997; Warschauer & Healey, 1998) explored the integration of software and computer programs to enhance language instruction. These investigations delved into the effectiveness of CALL in providing interactive exercises, multimedia resources, and self-paced learning opportunities. The findings contributed to understanding the potential benefits and challenges of incorporating technology into language classrooms. With the rise of the internet, online language platforms became prominent in language learning research. Platforms like Duolingo and Rosetta Stone attracted attention from researchers (Fan, 2023; Zhang et al., 2021), who sought to evaluate the impact of web-based language learning on proficiency levels, user engagement, and adaptability to individual learning needs. These studies provided valuable insights into the evolving landscape of technology in language education.

With the advent of technology, researchers have explored the integration of digital tools in vocabulary instruction. Studies (Chun & Plass, 1996; Stockwell, 2007) have examined the benefits of multimedia elements, interactive exercises, and adaptive feedback in enhancing vocabulary learning experiences. The efficacy of mobile applications in vocabulary development has been a focal point in recent literature (Stockwell & Liu, 2015). Since the advent of mobile devices like tablets and smartphones, various commercial applications have emerged to support vocabulary learning in different languages. These applications cover general language development (e.g., Duolingo), vocabulary storage (e.g., MyWordBook), and vocabulary retrieval (e.g., Quizlet). Teachers and researchers have also tried creating English vocabulary applications tailored to their specific contexts. For instance, Wu (2015) developed a Basic4Android application to help Chinese college students improve their English vocabulary, reporting that the app users performed significantly better than those in the control group. Similarly,

Wang et al. (2023) designed an Android app presenting 720 common English words to university students in Taiwan which provided more learning opportunities and encouraged daily learning for most students.

Mobile-assisted language learning applications, including *Memrise*, *Quizlet*, *Anki*, *WordUp*, *Stemup*, *Busuu*, *English Place*, *Bright*, *Babbel*, *Lela*, and *ELSA* have gained significant attention in recent years, offering learners innovative and flexible tools to enhance their vocabulary knowledge. *Memrise* employs a gamified approach to vocabulary learning, incorporating mnemonic techniques, multimedia elements, and spaced repetition. Research indicates that its engaging interface positively influences learners' motivation and retention (Wu, 2015). According to Wu (2015), studies suggest the need for further investigation into the long-term impact and transferability of vocabulary learned through *Memrise*. *Quizlet* offers a versatile platform for vocabulary learning through flashcards, games, and quizzes. Research highlights its adaptability to various learning styles and preferences (Waluyo & Bucol, 2021). However, concerns have been raised regarding the potential overreliance on rote memorization and the limited depth of understanding acquired through *Quizlet* (Waluyo & Bucol, 2021). *Anki* utilizes spaced repetition algorithms to optimize vocabulary retention. Studies indicate its effectiveness in promoting long-term memory retention (Nguyen, 2021). Nevertheless, challenges related to the learning curve and user interface have been identified, emphasizing the importance of user-friendly designs in optimizing learning experiences (Khoshshima & Khosravi, 2021). *WordUp* incorporates interactive video content to facilitate vocabulary acquisition in context. Preliminary research suggests that the contextualization of words in videos enhances comprehension and application (Maenza & Gajić, 2020). However, more comprehensive investigations are needed to assess the impact of *WordUp* on diverse learner populations and language proficiency levels.

The effect of mobile applications on vocabulary learning has been explored in various contexts (Başal et al., 2016; Rachels & Rockinson-Szapkiw, 2018; Sato et al., 2020). The results of these investigations consistently indicate that the use of MALL programs can markedly enhance learners' vocabulary proficiency and improve their oral communication skills. For instance, Başal et al. (2016) conducted a four-week experiment utilizing *MICASE* to assess the efficacy of a specific mobile application in teaching idioms to EFL learners. The outcomes demonstrated a significant positive impact on learners' vocabulary knowledge, particularly in the application of targeted idioms during foreign language speaking activities.

Rachels and Rockinson-Szapkiw (2018) investigated the impact of MALL software on the vocabulary attainment of elementary Spanish learners. The *Duolingo* Software was employed to teach the experimental group, while the control group received vocabulary instruction through conventional methods. The treatment period lasted for 12 weeks, during which a teacher-made vocabulary achievement test was administered as both a pre- and post-test. The inferential statistics revealed statistically significant differences between the two groups, indicating greater progress and improvement in the experimental group.

Sato et al. (2020) explored the impact of *Quizlet* on the vocabulary development of Japanese undergraduate students. The study involved 94 intermediate undergraduate students, divided into experimental and control groups. The control group was tasked with memorizing expressions along with their corresponding Japanese translations from a paper-based list, to be done outside the classroom. Meanwhile, the experimental group received three weeks of vocabulary instruction through MALL software. Both groups took a teacher-made fill-in-the-blank vocabulary pre- and post-test. The results revealed statistically significant differences in favor of the experimental group on the post-test, leading the researchers to recommend the use of MALL applications for enhancing vocabulary instruction among EFL undergraduate students.

Ahmad et al. (2017) conducted a case study focusing on six migrant women learners who utilized the *ThinkEnglish!* application to enhance their vocabulary knowledge. The participants were required to attend a minimum of five non-MALL sessions, and three participants continued to attend a minimum of five MALL sessions. Pre- and post-session interviews were conducted, and thematic analysis was applied to the data. The findings led the researchers to conclude that MALL programs are potent and resilient tools, highly recommended for teaching and learning vocabulary. However, it's important to note that the study's limitations, specifically the small sample size, may have influenced the results.

On the contrary, Bowles (2017) investigated the impact of generic vocabulary software on enhancing the vocabulary knowledge of undergraduate university students. Data analysis, performed through ANOVA, aimed to compare the participants' language backgrounds and the number of quarters in the English program with their individual score differences on the post-tests. The results did not reveal any statistically significant differences between the scores of the experimental and control groups. These findings suggest that generic vocabulary applications may not have a significantly greater effect than conventional vocabulary teaching methods. However, the researchers propose that the absence of score differences could be attributed to various factors, including the need for longer vocabulary practice time, variations in practice time among participants, and potential limitations in the measurement tools used to assess vocabulary achievement.

Although the integration of MALL and VLS use has not received enough attention among researchers, MALL applications seem to possess the potential to harness the capability of technology in optimizing vocabulary learning by nurturing strategic learners. Among the few studies in this regard, Rahimi and Allahyari (2019) investigated the effect of multimedia-assisted vocabulary learning on EFL learners' vocabulary learning and VLS use. Data analysis confirmed that multimedia incorporation had a significant effect on learners' use of VLSs with a significantly higher frequency of cognitive and memory

strategies. However, the intervention did not lead to a significant difference in the deployment of determination and metacognitive strategies. Kim and Bae (2020) investigated how a digital English learning environment could affect students' learning strategy use. A significant use of compensation strategies followed by memory and metacognitive strategies was reported. Gao and Shen (2020) conducted a study to explore learning strategies deployed by a group of EFL learners in a mobile-assisted learning environment. They reported significant differences in learners' deployment of a particular set of learning strategies indicating variations both in frequency and type from those employed in conventional teacher-led classrooms. The most frequent strategies were found to be metacognitive and commitment control strategies with metacognitive strategies being ahead of commitment control strategies. More recently, Yusoff and Mohd Said (2024) aimed to study the frequency and type of learning strategies used by learners in computer-assisted online classes. Memory strategies were reported to have the highest frequency and affective strategies showed the lowest frequency. Furthermore, a significant relationship between language learning strategy deployment and success in learning English was reported.

The current body of literature exhibits several notable gaps that warrant further investigation in the context of the proposed research. Firstly, a distinct dearth exists in comprehensive studies specifically scrutinizing the efficacy of the *Ilingo* application as a tool for teaching vocabulary within the Iranian EFL milieu. Moreover, a significant lacuna is identified in the literature regarding the focus on intermediate EFL learners. The existing studies predominantly lean towards either novice or advanced proficiency levels, leaving an evident gap in understanding how intermediate learners, a critical demographic, navigate and derive benefits from vocabulary instruction through applications such as *Ilingo*. The literature has yet to provide a comprehensive understanding of how the integration of *Ilingo* may influence learners' vocabulary development and their strategic approaches to vocabulary learning. This study aims to explore the effect of teaching vocabulary through *Ilingo* application on vocabulary development and VLS use of EFL learners. In so doing, the following research questions have been proposed.

1. Does teaching vocabulary through *Ilingo* application have any significant effect on intermediate EFL learners' vocabulary learning?
2. Does teaching vocabulary through *Ilingo* application make any significant difference in the frequency and type of vocabulary learning strategy use?

3. Methodology

3.1. Participants

The participants of this study were selected from a pool of 100 intermediate-level EFL learners in Safir Language Institute in Isfahan, Iran. The participants were recruited through a purposive sampling method to ensure that they met the specific criteria necessary for this research. Those participants who have had any prior experience with vocabulary learning using MALL software were excluded. For this reason, 17 students were excluded from the original sample, and the number of participants decreased to 83. The participants were between the ages of 16 and 21, with an average age of 18. All participants were required to have access to smartphones or tablets compatible with the *Ilingo* application, as this was the primary tool for vocabulary instruction in the study. It should be mentioned that the participants were students majoring in various fields, including Civil Engineering, Mechanical Engineering, Computer Engineering, Electrical Engineering, Nursing, Psychology, Education, Veterinary Medicine, and Sports Sciences, which represented a diverse academic background. All participants were at the intermediate level of English proficiency, as determined by the Oxford Quick Placement Test (OQPT) and had a minimum of 5 years of formal English language learning experience.

It is worth mentioning that prior to the intervention, the participants were provided with informed consent forms outlining the purpose of the study, the data collection procedures, and their rights as participants. They were given the opportunity to ask questions and were required to provide written consent to participate voluntarily in the research.

3.2. Instrument

The research instruments utilized in this investigation encompass the OQPT version 2, the Vocabulary Levels Test (VLT), the Vocabulary Learning Strategies Questionnaire (VLSQ), and the *Ilingo* mobile application.

3.2.1. Oxford quick placement test

The OQPT version 2 comprises two sections, each with increasing difficulty. The initial segment encompasses 40 items, requiring test-takers to select the best-fitting word to fill in the blanks. Only if participants complete the initial segment without problems, they proceed to the second segment. The first segment typically takes around 15 to 20 minutes. The subsequent segment comprises 20 items, encompassing both cloze tests and multiple-choice grammar exercises. This segment usually takes around 15 to 25 minutes to finish.

3.2.2. Vocabulary levels test

The VLT (Schmitt et al., 2001) assesses the extent of learners' vocabulary across four word-frequency categories. Each category comprises 30 items, totaling 120 items. The test-takers are required to select the best-fitting word to match the words with their definitions. This test employs a multiple matching format, where test takers are tasked with matching a set of definitions with specific target words. Given the study's context within a Persian setting, the Cronbach's Alpha coefficient for the VLT was determined prior to the actual study to be .91, indicating a high level of internal consistency reliability.

3.2.3. Vocabulary learning strategy questionnaire

The evaluation of learners' application of VLSs was conducted through the utilization of the VLSQ. The VLSQ originally developed and validated by Schmitt (1997), has also undergone additional validation within the Iranian context by Boroushaki and Lee-Luan (2016). The questionnaire items were designed in accordance with the taxonomy of LLSs, introduced by Oxford (1990). The VLSQ delves into a range of strategies commonly employed by EFL learners for vocabulary learning. It comprises a total of 41 items categorized into five sections. The VLSQ employs a 5-point Likert scale ranging from 1 to 5, with participants providing single answers to each item, with options including 'always (5 points),' 'often (4 points),' 'sometimes (3 points),' 'seldom (2 points),' and 'never (1 point).'

The first section of the questionnaire, comprising 7 items, assesses the extent to which learners employ determination strategies. The second section, consisting of 5 items, evaluates the degree to which learners utilize social strategies. These first two sections collectively constitute the discovery subgroup of VLSs. The third section encompasses 17 items, focusing on strategies within the memory category. The fourth section encompasses 7 items that pertain to cognitive strategies, while the fifth section incorporates 5 items that pertain to metacognitive strategies. These subsequent five sections constitute the consolidation subgroup of VLSs.

Given the study's context within a Persian setting, the Cronbach's Alpha coefficient for the VLSQ was determined prior to the actual study to be .83, indicating a high level of internal consistency reliability.

3.3. Materials

3.3.1. Ilingo Application

Ilingo is a popular language-learning app and platform that offers a gamified and interactive approach to learning English. Founded in 2018, *Ilingo* has gained significant recognition and a large user base due to its accessibility and effectiveness. Some key features and characteristics of *Ilingo* app include gamified learning, free to use, structured learning path, audio pronunciation, and adaptive learning. Furthermore, it covers various language skills, including speaking, listening, reading, and writing.

Lessons are broken down into bite-sized exercises that cover specific language topics and skills. These exercises include translation, multiple-choice questions, and speaking exercises to help learners build a well-rounded language proficiency. *Ilingo* uses an adaptive algorithm to personalize the learning experience. The difficulty of exercises and lessons can adjust based on the user's performance and progress. Users can practice and review what they've learned through daily challenges, progress quizzes, and the "Strengthen Skills" feature, which revisits previously learned materials to reinforce retention. *Ilingo* features audio recordings by native speakers to help learners with pronunciation and listening comprehension.

3.3.2. English vocabulary in use: intermediate

The *English Vocabulary in Use* series edited by Redman (2017) and published by Cambridge University Press, stands as a highly acclaimed collection of books. These resources are designed to facilitate vocabulary learning, proficiency, and accuracy for English learners at all proficiency levels. They are user-friendly and contain explanations, examples, study tips, follow-up tasks and an easy-to-use answer key that allow learners to practice and reinforce their vocabulary skills independently.

Learners have the flexibility to choose between American English and British English, making it an excellent resource for both self-study and classroom instruction. *English Vocabulary in Use* books include a variety of exercises, including gap-filling, matching, and multiple-choice questions. These exercises allow learners to practice what they have learned and check their understanding.

3.4. Data collection procedure

To ensure the homogeneity of the participants, the OQPT version 2 was administered to all participants at the outset of the study. Therefore, 83 participants who scored within the specified intermediate range (i.e., 25 to 35) were eligible to participate in the study. Then the participants were randomly assigned to an experimental group (N=41), who utilized the *Ilingo* mobile application for vocabulary instruction, and a control group (N=42), who relied on the *English Vocabulary in Use: Intermediate* textbook for vocabulary learning.

Prior to the intervention, all participants took the VLT to assess their initial vocabulary proficiency levels. In addition, they completed the VLSQ to measure their vocabulary learning strategy use.

The experimental group received vocabulary instruction using the *Ilingo* mobile application. The intervention encompassed 25 sessions and each session was meticulously planned. During regular class sessions, the researchers utilized the application to introduce new vocabulary, reinforce concepts, and engage learners in interactive exercises. Each session began with a brief overview of the targeted vocabulary, followed by interactive exercises on *Ilingo*. The application facilitated personalized learning experiences, allowing learners to progress at their own pace. The researchers provided guidance and support, ensuring that learners navigated the application effectively.

To reinforce vocabulary learning beyond the confines of the classroom, learners in the experimental group were assigned homework tasks utilizing *Ilingo*. These assignments varied in nature, encompassing activities such as vocabulary quizzes, interactive games, and multimedia exercises. The intention was to extend the learning experience, encouraging learners to independently explore the application's features and consolidate their understanding of the introduced vocabulary.

Conversely, the control group relied on the conventional medium of the *English Vocabulary in Use: Intermediate* textbook for their vocabulary learning. Their instruction, delivered through regular 90-minute sessions twice a week over the course of the semester, represented a conventional classroom approach. The researchers adhered to the predetermined lesson plans, introducing new vocabulary through structured exercises and contextual examples. Each session was meticulously designed to cover specific thematic units. Learners were asked to complete the exercises, activities, and comprehension tasks of the textbook at home.

This design allowed for a comparative analysis of the effectiveness of technology-assisted instruction against conventional classroom methods. Like the experimental group, they also met twice a week for 90-minute sessions over the course of the semester. At the end of the 13-week intervention, both groups were administered the VLT and VLSQ again. This comprehensive post-intervention assessment facilitated a thorough evaluation of the effect of the instructional methods on participants' vocabulary learning development and VLS use.

4. Results and discussion

Before conducting the statistical tests, the data collected from both the pre- and post-test on vocabulary were examined to ensure that the distribution followed a normal pattern. The results of this examination can be found in Table 1.

Table 1. Test of Normality for the Pre- and Post-Test on VLT

Group		Kolmogorov-Smirnov		
		t	df	Sig.
Pre-test	Experimental	.105	41	.200*
	Control	.108	42	.200*
Post-test	Experimental	.099	41	.200*
	Control	.100	42	.200*

P>.05*

According to the data in Table 1, the p values for the Kolmogorov-Smirnov test for pre- and post-test scores of both groups were higher than .01, affirming the normal distribution of pre- and post-test scores on vocabulary knowledge. With the normality assumption established, an independent-samples t-test was conducted on the pre-test scores on VLT to assess whether participants exhibited homogeneity in their knowledge of vocabulary before the treatment. Table 2 presents the results.

Table 2. Independent-Samples T-test on Pre-Test Scores on VLT

Group	Mean	Std. Deviation	Mean Difference	t	Sig.
Experimental	54.31	10.612	-2.130	-.849	.398
Control	56.44	12.201			

P>.01*

According to the results reported in table 2 and using a significance level of $\alpha = .01$, the p value ($t = -.849$, $p = .398$) indicates that there is no significant difference concerning vocabulary knowledge at the beginning of the study. Consequently, it can be inferred that the two groups exhibited homogeneity in this regard.

To examine the effect of the treatment on EFL learners' vocabulary knowledge, another independent-samples t-test was conducted on the post-test scores on the VLT. Table 3 depicts the results.

Table 3. Independent-Samples T-test on Post-Test Scores on VLT

Group	Mean	Std. Deviation	Mean Difference	t	Sig.
Experimental	72.68	10.48	-11.111	-5.029	.001*
Control	61.57	9.63			

P>.01*

As indicated in Table 3, with a significance level set at $\alpha = .01$, statistically significant differences were observed ($t = -5.029$, $p = .001 < .01$) in the post-test performance on the VLT indicating the outperformance of the experimental group in their vocabulary learning after formal instruction and practice with *Ilingo* application.

This study also aimed to analyze and compare the frequency distribution of VLS sub-categories between the two groups. Before conducting the statistical analyses, a Kolmogorov-Smirnov test was run to check the normality of the distribution for the collected data from the pre- and post-test on the VLSQ. The outcomes of the Kolmogorov-Smirnov test are presented in Table 4.

Table 4. Test of Normality for the Pre-Test and Post-Test on VLSs

	Group	Kolmogorov-Smirnov		
		t	df	Sig.
Pre-test	Experimental	.180	41	.001
	Control	.183	42	.002
Post-test	Experimental	.188	16	<.001
	Control	.206	16	<.001

P>.05*

As indicated in Table 4, the results suggest that the pre- and post-test scores on VLSs did not follow a normal distribution, as the significance levels of the Kolmogorov-Smirnov test were below .01. Consequently, non-parametric measures were adopted after the normality assumption could not be established. To assess the homogeneity of the participants in terms of VLS use before the treatment, a Chi-squared test was conducted on the pre-test scores of the VLSQ. The outcomes of this test are detailed in Table 5.

Table 5. The Results of Chi-Square Test on Pre-Test Scores on VLSs

Strategies	Group	Mean	Std. Deviation	X ²	df	Sig.
Determination	Experimental	3.54	.413	10.220	13	.676
	Control	3.64	.591			
Social	Experimental	2.98	.677	13.825	15	.539
	Control	3.05	.736			
Memory	Experimental	3.67	.208	22.663	15	.092
	Control	3.68	.162			
Cognitive	Experimental	3.63	.333	12.213	9	.271
	Control	3.45	.298			
Metacognitive	Experimental	3.45	.294	6.989	9	.638
	Control	3.42	.408			

P>.01*

As presented in Table 5, using a significance level of $\alpha=.01$, the statistical outcomes reveal that there is no statistically significant difference in the use of determination, social, memory, cognitive, and metacognitive VLSs between the two groups. To assess the effect of teaching vocabulary through *Ilingo* application on EFL learners' VLS use, another Chi-square test was conducted on participants' post-test scores on the VLSQ. The detailed outcomes of this analysis are presented in Table 6.

Table 6. The Results of Chi-Square Test on Post-Test Scores on VLSs

Strategies	Group	Mean	Std. Deviation	X ²	df	Sig.
Determination	Experimental	4.38	.435	51.067	17	<.001*
	Control	3.62	.358			
Social	Experimental	2.95	.359	10.761	8	.216
	Control	2.90	.356			
Memory	Experimental	4.06	.219	52.800	19	<.001*
	Control	3.65	.189			
Cognitive	Experimental	3.53	.283	16.578	12	.166
	Control	3.57	.418			
Metacognitive	Experimental	4.13	.375	8.001	9	.534
	Control	4.01	.417			

P>.01*

As depicted in Table 6, utilizing a significance level of $\alpha=.01$, the outcomes of the Pearson's Chi-square test on post-test scores revealed noteworthy findings. Specifically, statistically significant differences were observed for the utilization of *determination* and *memory* VLSs indicating a higher frequency of use of these strategies in the experimental group. However, the results of the Pearson's Chi-square test on post-test scores did not indicate statistically significant differences for the use of *social*, *cognitive*, and *metacognitive* VLSs between the two groups.

5. Discussion

The purpose of this study was to investigate the effectiveness of teaching vocabulary through *Ilingo* application on Iranian intermediate EFL learners' vocabulary learning and vocabulary learning strategy use. According to the results, *Ilingo* application significantly developed learners' vocabulary knowledge. The significant difference in post-test performance between the two groups highlights the potential of *Ilingo* application as an effective tool for vocabulary learning. The substantial improvement observed in the experimental group can be attributed to the interactive and engaging nature of *Ilingo* application. This application allows learners to access a variety of multimedia resources, practice vocabulary in real-world contexts, and receive immediate feedback, which is known to enhance learning outcomes. The flexibility and accessibility of MALL may also have contributed to the experimental group's success, as it allows learners to engage with the material at their own pace and convenience.

The obtained results align with previous research suggesting that technology-assisted learning can be a powerful complement to conventional teaching methods. For instance, Lei et al. (2022) asserted that students who received MALL instruction using *Duolingo* demonstrated significantly improved post-test scores in vocabulary retention. The results of the current study also align with Ellis (1995), Burston (2014), and Liu (2016), all of whom substantiating the favorable effect of mobile-integrated language learning on cultivating positive learning outcomes. The findings of this study are well-supported because mobile devices likely facilitate the collaborative activities among the participants, both inside and outside the classroom. This suggests that mobile applications offer numerous advantages for engaging learners in autonomous activities, making vocabulary tasks more self-paced and enjoyable. Consistent with these findings, Lu (2008) asserts that MALL encourages interaction among learners, promotes the integration of natural communication needs with language learning, and enhances the retention of language learning skills.

Similar results were also reported in the studies conducted by Xodabande and Boroughani (2023), Xodabande et al. (2022). Xodabande and Boroughani (2023) undertook a comprehensive 24-session experimental study involving 37 Iranian EFL learners. The research centered on the utilization of the *WordUp* application, with the aim of enhancing vocabulary retention. The outcomes of the study revealed noteworthy positive effects of *WordUp* instruction on learners' overall vocabulary knowledge. Furthermore, in their prior work (Xodabande et al., 2022), the researchers observed a notable shift in the learning outcomes when moving from conventional classrooms to MALL instruction. This transition was reported to increase learners' vocabulary knowledge. Moreover, Xodabande et al. (2022) emphasized that the contribution of MALL applications could provide authentic vocabulary practice.

Consistent findings have also been reported in studies conducted by Wu (2015), Berns et al. (2016), Ashiyan and Salehi (2016), and Başal et al. (2016). For instance, Wu's (2015) study revealed that the experimental group, which underwent

MALL instruction using the *Word Learning CET6* program outperformed the control group. In Berns et al.'s (2016) research, learners in the treatment group utilized the self-study English learning application *Guess It! Language Trainer* for vocabulary practice. The results indicated that the participants of the treatment group exhibited significantly better performance on the vocabulary post-test. Additionally, Ashiyan and Salehi's (2016) study demonstrated notable improvements in vocabulary knowledge within the treatment group from pre-test to post-test, with their scores significantly surpassing those in the control group. Furthermore, Basal et al. (2016) incorporated *WhatsApp* for vocabulary practice, and their findings revealed that individuals who engaged with the software achieved significantly higher post-test scores compared to those who received conventional vocabulary instruction.

In the same line, Ahmad et al. (2017) emphasized the effectiveness of the *ThinkEnglish* App as a superior method for vocabulary learning compared to conventional classroom instruction. Bowles (2017) confirmed the superiority of apps like the *Academic Vocabulary App* over commercially available generic apps such as *Vocabulary and Spelling City* in addressing the specific academic English vocabulary learning needs of graduate students.

Guaqueta and Garcés (2018) argued for the synergistic use of apps like *Duolingo* and *Kahoot* in combination with conventional classroom practices to enhance vocabulary development. These contemporary studies collectively underline the efficacy of mobile applications in advancing vocabulary knowledge of learners.

Concerning the second research question of the study, the findings of the present study revealed a statistically significant difference in the utilization of determination VLSs between the experimental and control groups. This underscores the potential efficacy of targeted interventions aimed at enhancing determination-related VLSs in educational contexts. The observed increase in post-test scores suggests that employing *Ilingo* application can positively influence the use of determination VLSs.

Determination VLSs encompass the techniques learners employ to set goals and plan their learning endeavors. In the context of vocabulary development, learners establish specific learning goals, often targeting a predefined number of words within a given timeframe. They meticulously devise systematic plans for vocabulary learning, efficiently allocating their time and resources (Fan, 2020). Moreover, the higher frequency of the determination VLSs deployed in the experimental group using *Ilingo* software illuminates the role of technology in fostering goal-setting and strategic planning in language learning. These strategies involve various tactics such as checking the part of speech of newly learned words, guessing meaning, forming visual or auditory associations, and utilizing dictionaries. The noteworthy outcome regarding the higher frequency of determination strategies might be attributed to the visual aids integrated into the application. These visual aids assist learners in associating meanings with shapes and forms, a feature not commonly emphasized in conventional vocabulary courses. The incorporation of visual aids in the application represents a departure from conventional methods and underscores the potential benefits of multimedia resources in vocabulary instruction.

Another noteworthy result emerged in the domain of memory VLSs, where a significant difference was identified. This implies that interventions targeting memory-related VLSs yielded substantial improvements in post-test scores. Memory strategies encompass practices like repetition, mnemonics, and imagery. One potential explanation could be the manner in which these memory strategies were implemented and emphasized in the instructional interventions. The effectiveness of memory-related VLSs might be influenced by the frequency, variety, and context in which these strategies were introduced and practiced. For example, the MALL intervention might have incorporated multimedia elements that enhanced the visual and auditory aspects of mnemonics and imagery, making these strategies more memorable and impactful for learners. Moreover, individual learner preferences and cognitive styles could have influenced the effectiveness of memory-related VLSs. Some learners may naturally gravitate towards mnemonic devices, finding them particularly effective, while others might favor repetition or imagery (Fan, 2020). The results may reflect the diverse ways in which learners engage with and benefit from these memory strategies.

The obtained results with regard to the significant higher frequency of memory strategies are in line with Rahimi and Allahyari (2020), Kim and Bae (2020), and Yusoff and Mohd Said (2024) who reported a higher deployment of memory strategies as the result of computer-assisted vocabulary learning. However, the findings contrast with Gao and Shan (2020) who reported metacognitive and commitment control strategies as the most frequent ones in a mobile-assisted learning environment. In addition, the higher frequency of determination strategies reported in this research contrasts with the findings of Rahimi and Allahyari (2020) reporting that the multimedia-supported vocabulary instruction did not have any significant effect on the use of determination strategies.

It is worth mentioning that the duration and intensity of exposure to memory-related VLSs in each instructional setting could be a contributing factor. The experimental group using the MALL intervention may have had more opportunities for consistent and varied practice with memory strategies due to the interactive and adaptive nature of the digital platform. On the other hand, the conventional classroom setting may have offered a more structured but potentially less flexible approach to memory strategy practice.

Moreover, while the significant difference in memory VLSs is a valuable finding, exploring the nuances of how these strategies were implemented, individual learner factors, and the motivational aspects of the interventions can provide a more comprehensive understanding. Future research might delve deeper into the specific elements that enhance the effectiveness of memory-related VLSs in different instructional contexts, guiding educators towards more tailored and impactful vocabulary instruction methods.

There is ample evidence suggesting that MALL applications serve as effective tools for enhancing learners' vocabulary learning and nurturing strategic learners. However, further research is needed to explore the long-term effects of MALL and to investigate the specific mechanisms through which it enhances vocabulary knowledge. Additionally, future studies could examine the transferability of these findings to other language learning contexts and different language skills. However, it is important to acknowledge that this study has certain limitations. The sample size, for instance, could be expanded to improve the generalizability of the findings. Additionally, future research may explore the long-term effects of MALL software on language learning autonomy and investigate the specific aspects of the software that contribute most to learners' autonomy development.

6. Conclusion

In conclusion, this study has shed light on the significant effect of integrating MALL, specifically *Ilingo* application, on the vocabulary development and strategy use of Iranian intermediate EFL learners. The interactive and engaging nature of MALL, coupled with its flexibility and accessibility, provides learners with opportunities to engage with multimedia resources, practice vocabulary in real-world contexts, and receive immediate feedback, contributing to more effective language acquisition.

The practical implications of this study are significant for language educators and institutions. Integrating MALL software into language learning programs can provide a valuable tool for fostering more self-directed and motivated language learners. However, acknowledging the limitations of the study, including the sample size and the need for further exploration of long-term effects of MALL, a comprehensive understanding of the potential benefits and challenges associated with technology-assisted autonomy development seems crucial.

It is recommended that future research expands the sample size to enhance generalizability, explores the sustained impact of MALL software on language learning autonomy over an extended period, and delves into the specific features of the software that contribute most to autonomy development. This will contribute to a more nuanced understanding of how technology can be optimally integrated into language education to empower strategic learners and promote autonomy in their language learning journey.

This study has also provided valuable insights into the impact of *Ilingo* application on the frequency and type of VLS use among Iranian intermediate EFL learners. The results indicated significant distinctions in the frequency and distribution of VLSs between the two groups. The findings of this study highlight the potential efficacy of *Ilingo* in influencing the utilization of determination-related VLSs. The observed increase in the post-test scores for determination strategies suggests that technology-assisted interventions can positively impact learners' goal-setting and strategic planning in the context of vocabulary learning. Notably, the incorporation of visual aids in *Ilingo*, including pictorial descriptions and linguistic information, presents a departure from conventional methods and emphasizes the potential benefits of multimedia resources in vocabulary instruction. The study also highlights the need for a better understanding of the interplay between MALL interventions and the use of social and cognitive VLSs. While no statistically significant differences were identified for these strategies, the exploration prompts a reflection on the design and implementation of language courses, suggesting that a combination of conventional and technological resources may offer a more comprehensive and effective approach to vocabulary instruction.

The observed higher use of metacognitive VLSs in both the conventional classroom and MALL intervention groups raises intriguing questions about the nature of instructional methods and learner autonomy. The autonomy afforded to participants in the MALL intervention may have contributed to a heightened sense of responsibility for their academic achievements, influencing their engagement with metacognitive strategies. The conventional classroom, with its explicit guidance and structured activities, might have fostered an environment that naturally promoted metacognitive engagement. Furthermore, the significant difference identified in memory-related VLSs suggests the potential impact of instructional design and support on the effectiveness of these strategies. The manner in which memory strategies are implemented, the variety of approaches offered, and the individual learner factors could all play a role in the observed distinctions.

While this study adds valuable insights to the existing body of knowledge on VLSs in vocabulary learning, it is essential to recognize its limitations. Future research could explore the specific elements and dynamics of MALL interventions and conventional classrooms that contribute to the use of VLSs. Additionally, investigating individual learner preferences and cognitive styles, as well as the motivational aspects of these interventions, can provide a more comprehensive understanding of how to optimize instructional approaches for enhanced vocabulary learning outcomes.

In summary, the findings of this study contribute to the ongoing discourse on effective vocabulary instruction by highlighting the potential of MALL software in influencing the frequency and types of VLSs employed by language learners. The refined exploration of determination, social, cognitive, metacognitive, and memory-related strategies offer educators with valuable insights into how technology-assisted language learning can be harnessed to promote a diverse and effective array of vocabulary learning strategies among EFL learners.

7. References

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