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Investigating the Impact of All-In-One Learning Suites on English Language Learning: A Study of Iraqi EFL Male and Female Learners with Emphasis on Vocabulary and Grammar

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Abstract

This study investigated the effects of Mobile-Assisted Language Learning (MALL) through an all-in-one learning suite on the vocabulary and grammar acquisition of intermediate Iraqi EFL learners. A total of 80 university students, both male and female, were randomly assigned to experimental and control groups. The experimental group engaged with an educational mobile application incorporating digital games and interactive tasks targeting L2 grammar and vocabulary, while the control group received traditional teacher-centered instruction. Pre- and post-tests measured vocabulary and grammar proficiency, and a survey assessed learners' attitudes toward the technology. Results revealed that the experimental group showed statistically significant improvements in both vocabulary and grammar compared to the control group. Additionally, learners expressed positive attitudes toward the mobile learning platform, highlighting its role in enhancing motivation and engagement. The findings suggest that integrating multimedia and mobile technologies into language instruction can effectively support L2 acquisition in Iraqi EFL contexts. Pedagogical implications include the promotion of technology-enhanced learning environments to foster learner autonomy, interaction, and language proficiency development.

Introduction

Multimedia English teaching, incorporating contemporary educational technology, is transforming traditional classroom instruction (Ahmadi, 2018). The effective integration of multimedia and teaching methodology plays a crucial role in engaging learners in English language learning (Ahmadi, 2018). By creating simulated and virtual language environments, teachers can optimize students' English learning experience (Ahmadi, 2018).

In today's interconnected world, learners need to be technologically literate and capable of independent action (Ahmadi, 2018). The use of multimedia applications in teaching provides authentic contexts through incorporating sound, images, text, and animation (Ahmadi, 2018). Additionally, the integration of technology and widespread internet access can enhance learners' second language (L2) acquisition (Ahmadi, 2018).

Mobile-Assisted Language Learning (MALL) represents a significant advancement in educational technology, as it combines mobile technology and e-learning to meet the demands of a dynamic and personalized educational landscape (Romero et al., 2010). Educational technology empowers learners to utilize their free time effectively, such as during commutes or breaks, for language learning (Romero et al., 2010).

MALL, which encompasses learning with mobile technology and handheld devices, including smartphones, is a rapidly evolving field (Stockwell, 2012; Balance, 2012). However, the implementation of mobile phones for language learning is complex and goes beyond mere design and usage considerations (Stockwell, 2012). The field of computer-assisted language learning has evolved alongside technological advancements, developing frameworks that guide pedagogy (Bax, 2003).

Digital games, in particular, present unique challenges due to the perception that gaming is not traditionally associated with formal learning (Thorne, Fischer, & Lux, 2012). However, the popularity of remote learning has led to the recognition that mobile phones can provide valuable resources for instruction (Miangah Mosavi & Nezarat, 2012). Integrating technology into pedagogy has the potential to revolutionize L2 instructional methods (Pourhosein Gilakjani & Rahimy, 2019). Technology not only impacts the time learners dedicate to tasks but also influences their attitudes towards mobile language learning (Pourhosein et al., 2013). Furthermore, mobile-based applications facilitate easy interaction among learners anytime and anywhere (Pourhosein et al., 2013).

The utilization of MALL has created opportunities for interaction between learners and teachers, necessitating technological literacy to remain competitive in the social world (Huang et al., 2010). Proficiency in English is particularly important in the current international labor force, given its status as a major commercial language (Abdullah & Shah, 2015; Hsiao et al., 2016; Jin, 2015).

In today's industrialized societies, digital information and communication technologies, social media platforms, and virtual gaming environments have become integrated into various aspects of daily life, including education, work, and leisure (Huang & Lin, 2012). Mobile technologies offer advantages such as flexibility, cost-effectiveness, portability, and user-friendliness (Huang & Lin, 2012). Hubbard (2009) highlights the increasing popularity of digital games and urges educators to consider the nature of the game and the quality of linguistic collaboration surrounding it to achieve optimal outcomes.

A digital online game relies on an internet connection for operation. Generally, it refers to a video game that requires an internet connection to function (Darihastining et al., 2019). The game itself encompasses a set of systems that are accessed online, necessitating an internet connection for student usage (Darihastining et al., 2019).

One effective instructional approach to encourage language practice in the classroom is the use of games (Nguyen & Pham, 2018). Games provide motivation for students to compete and naturally practice their language skills. They can be used as warm-up activities to introduce new learning points or review previously taught content (Nguyen & Pham, 2018). Games offer an enjoyable method for students to engage in English language practice and promote interaction and communication among students, allowing them to express themselves effectively (Nguyen & Pham, 2018).

Furthermore, incorporating gaming in the classroom has a significant impact on training students in language usage, as it encourages interaction, collaboration, and creativity in expressing ideas (Pham et al., 2020). Nguyen and Pham (2019) provided several reasons supporting the use of games in classrooms to enhance students' language skills. Firstly, when games are employed as a teaching tool, students may not even realize they are practicing the language, allowing for more natural language acquisition. Secondly, incorporating games in classrooms engages students in communication, providing opportunities for even quiet students to actively participate and improve their English skills. Consequently, teachers frequently utilize games to enable students to practice language and express their ideas during competitive activities. It is crucial for teachers to not only make learning enjoyable through games but also find ways to actively involve students in language learning.

Vocabulary acquisition is vital in English language teaching, as it enables EFL learners to comprehend others' viewpoints and express their own opinions effectively. Vocabulary encompasses single words, phrases, and word chunks that convey specific meanings (Lessard-Clouston, 2013). Among the language skills, vocabulary and reading have received significant attention from researchers. Learning vocabulary is an essential component of acquiring a new language (Aghajanzadeh Kiasi & Pourhosein Gilakjani, 2023; Nation, 2001). Mobile phones can facilitate enhanced vocabulary learning and motivation by providing ubiquitous access to various skills activities (Fageeh, 2013). The use of digital texts, films, and multimedia applications in classes familiarizes learners with language vocabulary and structures, enhancing their linguistic knowledge and providing necessary information for language learning (Arifah, 2014). With the widespread availability of mobile devices and internet connectivity, smartphones have become indispensable tools in language education, offering pedagogical potential and omnipresent learning opportunities (Hsu et al., 2013).

The growth of wireless technologies has made MALL accessible through various devices, ranging from brief tutorials to comprehensive courses. These devices support the retention and application of newly acquired language skills, addressing the time constraints faced by learners (Chen & Hsu, 2020). Additionally, scholars and researchers (e.g., Alemi & Lari, 2012; Taki & Khazaei, 2011; Zhang et al., 2011) argue that digital devices like mobile phones can facilitate the acquisition of language skills, particularly vocabulary. Moreover, smartphones equipped with advanced digital features create new avenues for language learning, acting as miniature classrooms that enable "anytime, anywhere" learning (Ryu & Parsons, 2009). Mobile technology effectively bridges the gap between learning outside and inside the classroom, seamlessly transferring knowledge (Redd, 2011).

Statement of Problem

Recent research highlights the challenges faced by teachers in effectively teaching vocabulary, as they may lack confidence in the best practices and struggle to establish a clear instructional focus on word learning (Berne & Blachowicz, 2008). Teaching vocabulary is a widely discussed aspect of English language instruction, and teachers often encounter difficulties in achieving satisfactory results for their students.

Furthermore, recent research on vocabulary and grammar has made significant progress in determining the levels of proficiency required for reading both simplified and non-simplified materials, as well as understanding various types of oral and written texts. It has also explored the strategies employed by learners in comprehending, using, and retaining words (Alqahtani, 2015). Additionally, the integration of technology, such as computers and internet access, can assist learners in enhancing their L2 skills (Pourhosein Gilakjani & Rahimy, 2020).

While there is a considerable body of research on the integration of digital games in the English as a foreign language (EFL) classroom, the impact of digital gaming as an extramural activity in English has received limited attention in previous studies. Svensson (2018) noted the scarcity of studies on extramural English and games. Most of the existing studies primarily focused on the effect of engaging in extramural English activities on EFL language learning. Only Olsson and Sylvén (2011) explored additional factors such as game genres, general academic success, studying other languages, and other extramural English activities.

Furthermore, despite the extensive research on MALL, there is a lack of studies examining its contribution to grammar acquisition. Few studies have investigated the impact of MALL on learning grammar tenses and aspects compared to speaking, listening, and writing skills among language learners (Jin, 2015). Grammar mastery is a crucial component of language proficiency, and there is a need for effective integration of technology in grammar instruction to enhance learners' L2 proficiency (Abdullah & Shah, 2015; Larsen-Freeman, 2015; Matsumoto & Dobs, 2017; Suwantarathip & Orawiwatnakul, 2015).

Some games offer learning aids but lack enthusiasm (Jantke & Hume, 2015). Certain games may not align well with the learning process and may not serve educational objectives effectively. Such games are more suitable for after-class activities without clear learning objectives (Ongoro & Mwangoka, 2014). Therefore, it is crucial to integrate learning theories effectively into instructional games that strike a balance between learning and entertainment, ultimately fostering students' enthusiasm for learning their L2.

Objectives of the Study

In the current study, the researchers chose to focus on enhancing Iraqi students' interest in using mobile devices for language practice and exploring the practicality of these devices in the present context. Based on the reviewed literature, the study aimed to investigate the impact of a digital game on Iraqi EFL learners' grammar and vocabulary skills. Specifically, it aimed to investigate

the impact of a digital game on grammar and vocabulary skills, comparing its effectiveness against traditional teacher-fronted instruction. The study posed three research questions:

1. Can the utilization of MALL-based learning suites lead to a statistically significant improvement in English vocabulary retention and grammar for intermediate male and female Iraqi EFL learners?
2. Does teacher-centered instruction result in a statistically significant improvement in English vocabulary retention and grammar for intermediate male and female Iraqi EFL learners?
3. Is there a statistically significant difference in the effects between MALL-based learning suites and teacher-centered instruction regarding the improvement of English vocabulary retention and grammar among intermediate male and female Iraqi EFL learners?

Literature Review

According to Mayer's (2001) Cognitive Load Theory, individuals can learn more effectively when they receive information through multiple channels, such as a combination of auditory and visual input, which helps reduce cognitive load. Sweller (2010) suggests that cognitive load refers to the mental effort required to process information, including its design and organization within schemas. Specifically, germane cognitive load represents the necessary mental load for effective information processing.

The Modality Principle states that when pictures and words are presented together visually, they enhance cognitive load by providing context and utilizing visual working memory resources (Mayer, 2009; Tindall-Ford et al., 2003). In a study conducted by Mayer and Moreno (2003), students who learned with simultaneous narrations and animations outperformed those who learned with concurrent on-screen text and animations. These findings can be attributed to two effects: the spatial-contiguity effect and the modality effect. Similarly, drawing from the Generative/Cognitive Theory of Multimedia Learning, Chang et al. (2011) provided learners with Personal Digital Assistants (PDA) that could interact with their surroundings and proposed that the interactive nature of the materials reduced cognitive load. The presence of dual channels of visual and textual cues allowed for increased opportunities to acquire the content. In today's industrialized world, digital information and communication technologies, social media sites, and virtual and gaming environments are extensively integrated into educational, professional, and recreational activities of everyday life (Huang & Lin, 2012).

According to recent research by So and Seo (2018), categorizing game genres is challenging due to their overlapping nature. Digital games can be classified based on factors such as the game platform, game genre, or game mode (Apperley, 2021). Parental influence and peer pressure only encourage the initiation of behavior, including problematic behavior related to online activities (Linayaningsih & Virgonita, 2019). Playing online games can interfere with psychological aspects, social interactions, and academic work. Online games are seen as an enjoyable activity for children and adolescents, offering various strategies, adventures, and social networking opportunities (Fauzi, 2019). The influence of games like PUBG on student learning achievement is attributed to their ability to provide pleasure, reduce stress, facilitate social connections, enhance cooperation, improve language skills, and discourage risky behaviors (Fauzi, 2019).

As described by Gee (2012), digital games are well-designed experiences that involve problem-solving tasks, fostering motivation, engagement, and creativity. The use of digital games allows students to actively participate in the technological community of the 21st century. Through gaming, children can explore and experience complex virtual worlds, which may positively impact their learning (Takeuchi & Vaala, 2014). Mobile phones, with their user-friendly interfaces, ubiquitous access, and information storage capabilities, offer a suitable platform for learning (Gabarre et al., 2015; Godwin-Jones, 2014; Miangah Mosavi & Nezarat, 2012). Kolb (2012) suggests that mobile devices can enhance learning outcomes and make the learning process enjoyable. Additionally, mobile devices provide easy access to information, as stated by Hajim (2012).

Integrating digital games into classrooms can bring joy and creativity to the learning environment, which is particularly important for language learning classes where students may easily become bored (Pomerantz & Bell, 2007). Digital games create an appealing atmosphere and promote engagement, offering educational potential in language learning, as highlighted by Reinders and Wattana (2014). Language learning games or simulations that incorporate specific linguistic or cultural elements can be effective, especially when learners are motivated by external factors and use these games in diverse contexts (Godwin-Jones, 2014). However, it’s important to note that addiction to online games can influence gamers’ behavior (Ulfa, 2017). Online games often involve interaction among players, requiring them to complete missions, achieve high scores, and compete within specific groups (Ulfa, 2017).

Digital games foster a competitive learning environment that encourages collaboration among learners (Derakhshan & Davoodi Khatir, 2015). These games provide a context for learners to practice speaking and utilize vocabulary in the target language (Gee, 2012). Vocabulary games offer opportunities for flexible and collaborative use of the target language, bridging the gap between the language classroom and real-world contexts (Huyen & Nga, 2003). Multimedia games, by providing multimedia contexts with vocabulary, sentences, and conversations, promote collaboration and enhance vocabulary learning (Segal-Drori et al., 2010).

Kukulska-Hulme and Viberg (2018) conducted a comprehensive literature review on the use of mobile technologies in collaborative language learning. Their findings emphasized the importance of social interactions and collaboration in informal language learning through mobile technologies. Berns et al. (2016) developed a game-based mobile learning application called VocabTrainerA1 app to support language learners. The study aimed to explore learners' motivation, perceived usefulness, attitudes toward the application, and development of linguistic proficiency. The mobile application included both individual and collaborative tasks, requiring learners to cooperate and solve an assassination secret game. Kurniawan (2017) found that the intensity of playing online games influenced academic procrastination among Guidance and Counseling students, suggesting the need to reduce game-playing intensity to avoid academic procrastination. Suplig's (2017) study described different forms of online game addiction, the negative impact on social intelligence, and efforts to prevent online game addiction among adolescents.

In the context of EFL and language learning, several studies have examined the relationship between EFL learners' time spent playing digital games and their EFL learning outcomes. These studies investigated whether the frequency of game playing, including hours per day, days per week, and years of play, had an impact on EFL achievement. Understanding this relationship is crucial for understanding EFL students' game-playing patterns (Alamr, 2019). Yılmaz et al. (2018) conducted a study to examine the impact of heavy digital gaming (more than 2.5 hours per day) on students' social and educational status. They interviewed teachers and peers of three heavy gaming students and found that the teachers highlighted the positive aspect of heavy gaming, particularly in relation to English language learning. One teacher mentioned that playing video games appeared to help students learn English words and contributed positively to their motivation in learning the language (Yılmaz et al., 2018).

Since the majority of digital games are designed in English and played globally, online social interactions within games often occur in English. Several studies have explored the effects or discussed the potential benefits of online gaming for EFL learners, in general or for specific English skills. Dixon and Christison (2018) conducted an exploratory study to investigate the usefulness of Massive Multiplayer Online Role-Playing Games (MMORPGs) as a tool for L2 acquisition. Their findings indicated that playing online digital games, such as MMORPGs, facilitated L2 acquisition by providing opportunities for social interaction and collaborative problem-solving tasks in the target language (Dixon & Christison, 2018).

Methodology

Participants

The study involved a group of 30 students enrolled in English courses at a private language institute in Iraq. In order to ensure a homogeneous sample in terms of language proficiency, the students were administered the Solutions Placement Test (SPT). Based on the test results, 30 intermediate EFL learners were selected as the potential participants for the study. These participants were then randomly divided into two groups: an experimental group and a control group, with each group consisting of 15 language learners.

Interview

Interviews provide a flexible and open-ended approach for data collection, making them a commonly used method in qualitative research (Song, 2015). Flick (2009) explains that one reason for the increasing popularity of qualitative interviews is their ability to allow participants to express their views more openly compared to standardized questionnaires. In this study, after the quantitative phase, participants were asked if they would be interested in participating in follow-up interviews. These interviews aimed to gather more detailed and precise information on MALL, covering aspects not addressed in the questionnaire. Six teachers who consented to participate were selected for semi-structured interviews.

To enhance the depth and detail of the quantitative findings, a semi-structured interview consisting of eight questions was conducted with willing participants. These interviews aimed to gain insight into participants' thoughts and opinions on various aspects of mobile-language learning. The questions focused on the useful features of MALL, participants' preferences in using the applications, their control over the learning environment, their overall experience with M-learning, their perceptions of the application, and the affective impact of M-learning. The

questions were derived from relevant literature and validated by experts in Teaching English as a Foreign Language (TEFL). The final set of questions was as follows:

1. What features have proven to be the most beneficial to you?
2. What aspects of the applications did you enjoy the most?
3. Have you ever had a positive experience working with the application?
4. How much control do you think you had over the learning environment?
5. What are your thoughts on language learning through MALL?
6. What is your opinion of the application?
7. Have you ever had a positive experience learning through a virtual platform?
8. What is the emotional impact of mobile learning?

Materials and Instruments

A total of 20 random grammar items (refer to Appendix A) and 20 random vocabulary items (refer to Appendix B) were selected from the mobile game app Elevate. These items served as the foundational material to be taught to both groups of participants prior to the start of the intervention program. The purpose was to assess the participants' proficiency in L2 vocabulary and grammar and to ensure their initial homogeneity at the beginning of the experiment.

Procedure

To ensure that the learners exhibited similar performance levels in both vocabulary and grammar, the researchers initiated the treatment phase by introducing the intervention program to the experimental group. The participants in the experimental group were assigned to receive instruction on vocabulary and grammar using a mobile game app called "Elevate."

During each session, the learners were presented with a maximum of five games that focused on engaging their grammar and vocabulary skills. They were given a specific amount of time to complete each game, and the application provided feedback at the end of each training session. The initial section of the app outlined the study plan for the day, while subsequent sections consisted of different levels that the learners had to achieve a certain grade in vocabulary and/or grammar in order to progress to the next skill.

In the Activities section of the app, the learners had two in-game components: the game itself and a study component. The in-game section offered various types of training for grammar and vocabulary. For instance, as depicted in Figure 1, the application provided the learners with an "Error Avoidance" exercise for vocabulary, which helped them select appropriate words or

phrases to enhance their vocabulary skills and prevent the mixing of commonly confused words. At the conclusion of the exercise, the app provided the necessary feedback to the learners.

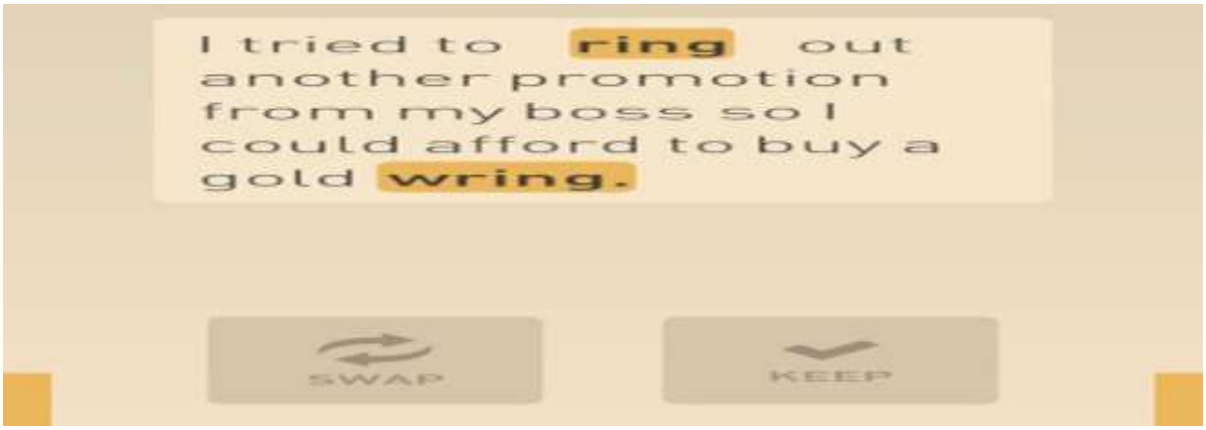

Figure 1. The game includes a section for activities that involve both playing and studying

At the conclusion of each training session, learners received prompt feedback that helped them identify their areas of difficulty. Figure 2 illustrates an example of the feedback provided by the application, which was found to be beneficial. The feedback sample is as follows:

Figure 2. Elevate Feedback Decks

The experimental group received training on grammar and vocabulary through the use of the Elevate app, while the control group did not receive any special treatment and instead received conventional grammar and vocabulary instruction from the teacher in a traditional teacher-centered manner. In the control group, the teacher would read out the words and provide their meanings in either English or the students' native language. Grammar instruction in the control group involved the teacher teaching grammar concepts from the learners' book using a whiteboard in the classroom. The learners attended eight sessions, with two sessions per week, each lasting 45 minutes. In each session, they were taught one set of five vocabulary items and one grammar point using the app. After the treatment period, posttests were administered to both groups to assess the participants' vocabulary and grammar knowledge at the end of the treatment. This was done to measure their progress compared to their performance in the pretest. The interviews conducted with the participants were recorded, transcribed, and analyzed by the researchers. The analysis process involved using a commercial qualitative data analysis software called MAXQDA. The analysis approach followed an inductive coding model proposed by Strauss and Corbin (1998), which involves coding data fragments in three distinct phases: 'open', 'axial', and 'selective' coding (p. 101-103). To ensure the reliability of the coding, a second rater, a colleague, was involved for an inter-coder reliability check, using Cohen's Kappa statistics. According to Viera and Garrett (2005), a kappa value of 1 indicates perfect agreement, while a kappa of 0 indicates agreement equivalent to chance. For this study, the inter-rater agreement calculated using Kappa statistics was 0.89, indicating almost perfect agreement within the range of 0.82-0.99.

Data Analysis

Once the necessary data was gathered, the researchers utilized SPSS version 25, a statistical software package, for data analysis. They conducted paired t-tests to assess the within-subjects effects and independent samples t-tests to evaluate the between-subjects effects. These tests aimed to estimate the magnitude of the effects observed. The statistical analysis involved comparing the pretest and posttest scores of both study groups. The summarized statistics of these scores for each group are presented in the tables below.

Results

After gathering the necessary data, the researchers employed the Statistical Package for Social Sciences (SPSS) version 25 as their statistical tool for data analysis. To assess the magnitude of both within-subjects and between-subjects effects, paired t-tests and independent samples t-tests were conducted, respectively. These tests aimed to provide an estimation of the effect sizes observed. The data collected included pretest and posttest scores for both study groups. The summarized statistics of these scores for each group are presented in the tables below.

Table 1. The grammar pretest scores of study groups

Study groups	N	Mean	Std. Deviation	Std. Error Mean
Experimental group	15	13.8668	1.59764	.41252
Control group	15	14.5334	1.88479	.48666

Table 2. The performance scores of study groups on the vocabulary pretest

Study groups	N	Mean	Std. Deviation	Std. Error Mean
Experimental group	15	14.1334	1.59764	.41252
Control group	15	14.4001	1.35226	.34916

The tables indicate that the mean scores are nearly identical, indicating that the two groups had similar levels of grammar and vocabulary knowledge before the treatment. Furthermore, the participants' scores were below average, indicating a need for improvement in their grammar and vocabulary skills. Upon analyzing the posttest results shown in Tables 3 and 4, it becomes evident that the mean scores in the posttest were significantly higher than those in the pretest. This suggests that the participants made substantial progress as a result of the treatment. However, a closer examination reveals a significant difference in the mean scores, indicating that the two treatment conditions might have had varying effects on the participants' vocabulary and grammar knowledge.

Table 3. The scores achieved by study groups on the grammar posttest

	N	Mean	Std. deviation	Std. error mean
Experimental Group	15	17.6000	1.24213	.32072
Control Group	15	15.6668	1.83875	.47477

Table 4. The scores achieved by study groups on the vocabulary posttest

	N	Mean	Std. deviation	Std. error mean
Experimental group	15	17.0000	1.30932	.33807
Control group	15	15.8668	1.50556	.38874

The data demonstrates that the experimental group achieved a significantly higher mean score, indicating that utilizing a mobile application and incorporating online gaming was more successful in enhancing the participants' grammar and vocabulary knowledge. By comparing the test performance scores of the participants before and after receiving treatment for grammar knowledge, it was also possible to assess the magnitude of within-subjects effects. This analysis provided insight into the extent of progress made by the participants in both groups throughout the duration of the experiment.

Table 5. The study groups differences in the means of the grammar pretest and posttest.

Pairwise Comparison of the Means		Mean	N	Std. deviation	Std. error mean
Pair 1	Experimental group posttest scores	17.6000	15	1.24213	.32072
	Experimental group pretest scores	13.8668	15	1.59764	.41252
Pair 2	Control group posttest Scores	15.6668	15	1.83875	.47477
	Control group pretest Scores	14.5334	15	1.88479	.48666

Table 5 reveals a substantial difference between the means of the two groups in both the pretest and posttest, indicating that the groups demonstrated noticeable improvement primarily as a result of the treatment. However, it cannot be concluded solely based on the scores whether this significant mean difference is statistically significant. Additionally, by comparing the participants' test performance scores before and after receiving treatment for vocabulary knowledge, it was possible to determine the magnitude of within-subjects effects, indicating the extent to which the participants in both groups progressed throughout the experiment.

Table 6. The study groups discrepancies in the vocabulary pretest and posttest means.

Pairwise comparison of the means		Mean	N	Std. deviation	Std. error mean
Pair 1	Experimental group posttest scores	17.0000	15	1.30932	.33807
	Experimental group pretest scores	14.1334	15	1.59764	.41252
Pair 2	Control group posttest scores	15.8668	15	1.50556	.38874
	Control group pretest scores	14.4001	15	1.35226	.34916

The comparison between the two groups indicates a significant improvement in vocabulary skills for the experimental group as opposed to the control group. This suggests that engaging students through mobile applications is more effective and advantageous compared to traditional teacher-fronted instruction. In other words, MALL proves to be superior in terms of student engagement and overall performance when compared to conventional methods. The results obtained from inferential analysis, specifically the paired and independent samples t-tests, provided the researchers with an estimation of the magnitude of both within-subjects and between-subjects effects. This estimation helped determine the extent to which the findings of this study could be generalized to a diverse range of similar research situations.

Table 7. The Independent Samples T-Test results indicative of significant differences based on the grammar pretest statistics.

		Levene's Test for Equality of variances		T-test for Equality of Means						
		F	Sig.	t	df	Sig. (2-tailed)	Mean difference	Std. Error difference	95% confidence interval of the difference	
									Lower	Upper
Grammar pretest scores	Equal variances assumed	.507	.482	-1.045	28	.305	-.66667	.63795	-1.97345	.64012
	Equal variances not assumed			-1.045	27.26	.305	-.66667	.63795	-1.97504	.64170

Table 6 reveals that the probability value obtained from Levene's test is greater than the significance level of 0.05. This suggests that the assumption of homogeneity of variances is valid, allowing for the use of parametric tests such as the t-test. Upon closer examination of the table, it can be observed that the significance value for the t-test is higher than the alpha value of 0.05. This indicates that the mean difference in the pretest scores for grammar is not statistically significant. Furthermore, it is evident from the table that the confidence interval includes zero, implying that the two groups were part of the same population at the beginning of the experiment.

Table 8. The vocabulary pretest statistics indicative of the results of the Independent

		levene's test for equality of variances		t-test for equality of means						
		F	Sig.	t	df	Sig. (2-tailed)	Mean difference	Std. Error difference	95% confidence interval of the difference	
									Lower	Upper
Vocabulary pretest scores	Equal variances assumed	.258	.615	-.493	28	.626	-.26667	.54043	-1.37369	.84035
	Equal variances not assumed			-.493	27.25	.626	-.26667	.54043	-1.37505	.84171

Table 8 indicates that the probability value obtained from Levene's test is greater than the significance level of 0.05. This suggests that the assumption of homogeneity of variances is valid, allowing for the utilization of parametric tests such as the t-test. Furthermore, upon closer examination of the table, it can be observed that the significance value for the t-test is higher than the alpha value of 0.05. This indicates that the mean difference in the pretest scores for vocabulary is not statistically significant. Additionally, supporting evidence can be derived from the fact that the confidence interval encompasses zero, signifying that the two groups were part of the same population at the outset of the experiment.

Table 9. The grammar posttest statistics indicative of the results of the Independent Samples T-Test

		Levene's Test for Equality of Variances		T-test for Equality of Means						
		F	Sig.	t	df	Sig. (2-tailed)	mean difference	std. error difference	95% confidence interval of the difference	
									Lower	Upper
Grammar posttest scores	Equal variances assumed	1.372	.251	3.374	28	.002	1.93333	.57293	.75973	3.10694
	Equal variances not assumed			3.374	24.57	.002	1.93333	.57293	.75232	3.11435

According to Table 9, the assumption of homogeneity of variance holds true ($p > 0.05$), allowing for the utilization of parametric tests to assess statistical significance. The probability value obtained from the t-test, as indicated in the table, is lower than the 5% significance level. However, it is important to note that the confidence interval does not include zero, indicating that the between-subjects effects are statistically significant. This suggests that the two instructional modalities had different impacts on the students' learning of L2 grammar. Given that the mean difference favors the experimental group, one can argue that the experimental group benefitted more from the mobile-assisted instruction compared to the control group.

Table 10. The vocabulary posttest statistics indicative of the results of the Independent SamplesT_est

		F	Sig.	t	df	Sig. (2-tailed)	Mean difference	Std. Error difference	95% confidence interval of the difference	
									Lower	Upper
Vocabulary posttest scores	Equal variances assumed	.899	.351	2.200	28	.036	1.13333	.51517	.07806	2.18860
	Equal variances not assumed			2.200	27.471	.036	1.13333	.51517	.07715	2.18952

According to Table 10, the assumption of Homoscedasticity of variance is supported ($p > 0.05$), allowing for the application of parametric tests to evaluate statistical significance. The probability value obtained from the t-test, as displayed in the table, is lower than the 5% significance level. However, it is important to note that the confidence interval does not contain zero, indicating that the between-subjects effects are statistically significant. This suggests that the two instructional modalities had differing impacts on the students' learning of L2 vocabulary. Since the mean difference favors the experimental group, it can be argued that the experimental group had an advantage over the control group in terms of the participants deriving greater benefits from the mobile-assisted instruction.

Table 11. The study groups' performance scores on the grammar test using Paired Samples T-Test results.

		Paired differences					T	Df	
		Mean	Std. deviation	Std. error mean	95% Confidence Interval of the difference				Sig. (2-tailed)
					Lower	Upper			
Pair 1	Experimental group posttest scores - experimental group pretest scores	3.73333	1.22280	.31573	3.05617	4.41050	11.825	14	.000
Pair 2	Control group posttest scores - control group pretest scores	1.13333	1.18723	.30654	.47587	1.79080	3.697	14	.002

As depicted in the preceding Table 11, the disparity between the means of the two groups in both the pretest and posttest is statistically significant at the predetermined alpha level ($p < 0.05$), indicating that the groups exhibited substantial improvement throughout the study. However, the magnitude of progress achieved by the two groups is not comparable, suggesting that the two treatment conditions had varying effects on enhancing the participants' L2 grammar knowledge.

Table 12. The study groups' performance scores on the vocabulary test using Paired Samples T-Test results

		Paired differences					T	Df	Sig. (2-tailed)
		Mean	Std. deviation	Std. Error mean	95% Confidence Interval of the Difference				
					Lower	Upper			
Pair 1	Experimental group posttest scores - experimental group pretest scores	2.86667	.63994	.16523	2.51228	3.22105	17.349	14	.000
Pair 2	Control group posttest scores - control group pretest scores	1.46667	.83381	.21529	1.00492	1.92841	6.813	14	.000

In order to assess the progress made by the participants in their writing ability throughout the study, a comparison of their test performance scores before and after receiving treatment was conducted. The results, as shown in Table 12, indicate a statistically significant difference between the means of the two groups in the pretest and posttest ($p < 0.05$). This suggests that both groups showed notable development after the study, primarily due to the experiment. However, the mean difference between the posttest means, favoring the experimental group, indicates that the achievements made by the two groups are not of the same magnitude. This implies that the two treatment conditions had varying effects on improving the participants' L2 vocabulary skills.

To further support and elaborate on the quantitative findings of the study, the third research question was divided into several additional inquiries aimed at gathering the participants' opinions on different aspects of mobile-language learning. When asked about their experiences learning through a virtual platform, the majority of both the control group learners (91%) and the experimental group participants (83%) reported greatly enjoying working with the multimedia applications. They found MALL to be highly engaging and efficient in facilitating their learning of English grammar and vocabulary. One participant expressed their enthusiasm, noting the realistic and amusing virtual icons, the enjoyable challenges, and the introduction of new and interesting grammar and vocabulary items.

Another possible explanation for the findings is that learning through MALL-based learning suites can be more or less learner-centered, allowing learners to have some control over the pace of their learning. In response to questions about the control they had over the learning environment, a significant percentage of both the control group individuals (75%) and the experimental group respondents (80%) reported being able to partially control the pace of their learning. They found the experience to be learner-centered and individualized to some extent. Participants appreciated the ability to pause, rewind, and review content as needed.

When asked about their thoughts on language learning through MALL and their opinions of the application, the majority of participants in the experimental group (around 96%) reported being overwhelmingly impressed with the application over time. They found the information provided to be informative, and the feedback on their answers was timely and accurate. However, a smaller percentage of participants (around 33%) mentioned finding the application and data informative but struggled to keep up with the continuous flow of information. Some

participants mentioned the initial challenge of adapting to the pace of the application but eventually found themselves catching up and directing their focus on the presented data.

The interview probes also revealed that the experimental group participants found MALL slightly challenging, particularly in processing aural and visual texts and integrating fragmented information while using the application. One participant mentioned finding the amount of received data somewhat distracting. In contrast, a participant in the control group mentioned having no difficulty following the flow of information and visual texts provided by the application, perceiving them as a cohesive visual unit. Overall, the findings indicate that the experimental group had positive experiences with MALL, finding it engaging and efficient in their language learning. However, some participants faced challenges in processing the information presented through the application, particularly in the experimental group.

Discussion

The primary objective of this study was to examine the influence of MALL or mobile learning (M-learning) on the improvement of English vocabulary and grammar skills among intermediate male and female EFL learners in Iraq. The study also aimed to compare the effects of M-learning with teacher-fronted instruction on the same skills and population. The results of the paired samples t-tests revealed significant progress in terms of enhancing the learners' knowledge of L2 grammar and vocabulary during the study. The tests of between-subjects effects indicated no statistically significant difference between the means of the two study groups. This implies that the two instructional modalities had differential impacts on students' understanding of L2 grammar and vocabulary, with mobile-assisted instruction delivered through Elevate demonstrating comparatively greater effectiveness.

The findings of this study align with the Generative/Cognitive Theory of multimedia learning proposed by Chang et al. (2011). According to this theory, the interactive nature of multimedia materials reduces cognitive load, while the simultaneous presentation of visual and textual cues enhances the opportunities for content acquisition. The results also support the contiguity principle developed by Mayer (2001), which suggests that the effectiveness of multimedia teaching is enhanced when relevant terms and visuals are presented together in time or space.

Additionally, a study conducted by Berns et al. (2016) corroborates the findings of the present study, demonstrating the benefits of multimedia learning for learners engaged in autonomous language learning, both within and outside the classroom. With the ubiquitous presence of mobile phones, there is a high potential for students to benefit from effective language acquisition. Mobile devices, such as smartphones, are considered convenient mini-computers that students carry with them at all times. Utilizing mobile phones as one of the multiple modalities of learning is supported by Moreno (2006), who suggests that presenting information through multiple modalities leads to the modality effect, enabling seamless integration of information and efficient knowledge acquisition.

Similarly, Berns et al. (2016) conducted a study using a game-based mobile-learning application called VocabTrainerA1 app to assist language learners. Their findings align with the current study, indicating that the MALL application significantly enhanced learners' motivation and proficiency in the language. Consistent with the present study, Berns et al. identified several benefits of MALL, including opportunities for peer collaboration, personalized learning experiences, improved linguistic abilities, and increased motivation.

Furthermore, the results of the current study support the findings of Getkham's (2004) research, which compared the performance of two groups using traditional printed texts and multimedia computer programs. Getkham's study demonstrated that the multimedia group displayed a lower tendency to forget the taught vocabulary items compared to the other group. Both studies concluded that multimedia programs can help students retain vocabulary knowledge.

In a study examining the effects of digital games on foreign language vocabulary growth in the Iranian context, Aslanabadi and Rasouli (2013) yielded results consistent with the present study. Their experimental group, taught using an online language teaching game, exhibited more fun, motivation, and increased confidence compared to the control group receiving traditional instruction. The current study's findings are also incongruent with Wu's (2015) study, which highlighted that MALL is an adaptive process influenced by learners' proficiency level, perceptual learning style, and learning behavior. Wu's study emphasized how learners using vocabulary instruction applications could recognize the impact of learning style and behavior on vocabulary acquisition.

To support the dual code theory and the use of multiple annotation types for listening, vocabulary, and grammar aspects, the current study's findings align with Huang et al.'s (2008) research on Taiwanese learners' access to video content and their interaction through text-based methods. Huang et al.'s study revealed that learners could construct representations of knowledge through visual and text channels, supporting learning that suits their individual learning styles. The reviewed studies, including the current one, confirm that the dual coding theory proposed by Paivio (1986) asserts that learning occurs through the combination of verbal/textual and nonverbal/visual codes, leading to separate mental representations of concepts.

Basal et al. (2016) advocate for the use of mobile applications in the learning and teaching process, highlighting the limitations of classroom-based vocabulary instruction due to time constraints and the learner's a heavy responsibility. They emphasize the advantage of using mobile phones and applications in vocabulary teaching, as they provide opportunities for learning beyond the classroom boundaries.

Conclusion and Implications

Multimedia learning offers numerous advantages for learners engaged in autonomous language learning, both inside and outside the classroom. Additionally, the widespread availability of mobile phones further increases the likelihood of students benefiting from effective language acquisition. As stated by Prensky (2003), mobile phones serve as highly useful mini-computers that can fit in students' pockets, are always accessible, and remain active.

Moreover, it is crucial for teachers to recognize the significance of delivering effective vocabulary and grammar instruction through MALL. As highlighted by Schmitt (2010), EFL teachers and learners still face uncertainty regarding the most effective vocabulary learning strategies in language classrooms. Materials developers should also acknowledge the importance of incorporating technology-enhanced language instruction within the Iraqi EFL context. They can integrate technology-based materials into the development process of educational resources for Iraqi English language learners. It is essential to reconsider and replace the conventional methods dominating pedagogical materials with technological and digital tools for language instruction.

Through technology-enhanced language learning (TELL), educators no longer have to rely solely on textbooks within educational institutions. The integration of technology and language learning yields significant benefits in language proficiency, particularly in the areas of vocabulary and grammar. Furthermore, with the ubiquity of technology, there is a growing inclination to utilize mobile-based programs for L2 acquisition. Multimedia learning can effectively support learners engaged in autonomous language learning, both within and outside the classroom. Additionally, with the omnipresence of mobile phones, students have increased opportunities for successful and comprehensive language acquisition.

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Appendix A: Grammar Test Sample

1. The storm _____ significant damage to the coastal area. (caused)
2. Yesterday, Sarah _____ her best friend at the mall. (met)
3. The concert tickets _____ sold out within minutes. (were)
4. Currently, birds _____ south for the winter season. (are migrating)
5. According to the law, individuals _____ entitled to legal representation. (are)
6. When the team won the championship, they _____ their hands in celebration. (raised)
7. I like to sing while I _____ in the shower. (am)
8. I was born in _____ beautiful city of Paris. (the)
9. The students were instructed to meet with _____ Johnson for career advice. (Professor)
10. When my brother tells a joke, everyone _____. (laughs)
11. Lisa _____ misses her morning coffee. (hardly ever)
12. John and Emily left _____ comfortable jobs to pursue their passion. (their)
13. If it were up to me, _____ would be no more war. (there)
14. Every citizen must _____ their taxes on time. (pay)
15. She _____ a marathon last month. (completed)
16. _____ and Mark are going on vacation next week. (He)
17. She and _____ are planning a surprise party. (you)
18. The cat lost its toy and _____ searching for it. (is)
19. The first _____ was invented in the late 19th century. (telephone)
20. We _____ our time at the beach last summer. (enjoyed)

Appendix B: Vocabulary Test Sample

1. The act of making something stronger or firmer: (strengthen)
   strength- strong or firm
   en- make or cause to be
2. Able to be understood: (comprehensible)
   com- together or with
   prehend- grasp or understand
   ible- able to
3. System for transmitting sound over long distances: (telephone)
   tele- distant
   phon- sound or voice
4. Related to the study of the Earth's physical features: (geographic)
   geo- Earth
   graph- writing or description
   ic- relating to
5. Located outside of a city: (rural)
   rur- countryside or rural area
   al- relating to
6. One who studies the origin and development of words: (etymologist)
   etym- origin or development of words
   ologist- one who studies
7. Word with the opposite meaning of another: (antonym)
   anti- against or opposite
   onym- name or word
8. To move or transfer data between computers: (transfer)
   trans- across or beyond
   fer- carry or transfer
9. A person who designs buildings: (architect)
   arch- chief or principal
   itect- one who does or makes

10. Relating to the study of the human society: (sociological)
    soci- society or social
    olog- study of
    ical- relating to
11. Able to withstand high temperatures: (heat-resistant)
    heat- high temperature
    resistant- able to withstand or resist
12. A device used to measure electric current: (ammeter)
    am- ampere (unit of electric current)
    meter- device for measuring
13. One who studies the behavior of living organisms: (biologist)
    bio- life
    logist- one who studies
14. Process of converting sunlight into electrical energy: (solar power)
    solar- related to the sun
    power- energy or ability to do work
15. Relating to the study of celestial bodies: (astronomical)
    astro- star or celestial body
    nom- law or study
    ical- relating to
16. To make something smaller or reduce in size: (shrink)
    shrink- make smaller or contract
17. One who studies the structure and properties of matter: (chemist)
    chem- chemical or matter
    ist- one who does or studies
18. Process of extracting useful substances from raw materials: (extraction)
    ex- out or from
    tract- pull or draw
    ion- act or process of
19. Relating to the study of living organisms: (biological)
    bio- life

log- study

ical- relating to

20. Able to be dissolved in a liquid: (soluble)

sol- dissolve

able- able to

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