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Elevate: On the Effects of All-In-One Learning Suites on the Learning of L2 Vocabulary and Grammar Among Iranian Male and Female Intermediate EFL Learners

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Abstract

This study was carried out to explore the effects of a mobile application on the learning of L2 grammar and vocabulary among Iranian intermediate EFL learners. In this research study, the target population comprised 30 male and female EFL learners who were identified at the intermediate level of language proficiency based on their performance scores on a sample copy of the Oxford Solutions Placement Test (OSPT). The participants were selected from among 40 learners who were studying EFL at Talk English Institute in Rasht, Iran. Using a digital randomizer called Super Cool Random Number Generator, the final pool of qualified participants was randomly assigned into two groups of experimental and control, each consisting of 15 learners. Next, the experimental group received treatment on their English vocabulary and grammar during a four-week period where they were assigned to learn 20 grammar and 20 vocabulary items by playing games through a mobile educational game called Elevate. The control group, on the other hand, received treatment on the same L2 grammar and vocabulary items through a conventional method (i.e., teacher-fronted instruction). Analysis of the scores obtained on a post-intervention measure of L2 grammar and vocabulary knowledge revealed that both groups made significant progress over the course of the experiment; however, the experimental group performed significantly better than those who were trained using the conventional method. The results carry the implications that mobile applications provide a more felicitous condition for expanding learners' L2 grammar and vocabulary repertoire.

Keywords: all-in-one learning suites, EFL learners, L2 grammar, L2 vocabulary, MALL

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1. Introduction

Multimedia English teaching based on contemporary education technology is changing the traditional mode of classroom teaching, and as Ahmadi (2018) argues, the true combination of multimedia and teaching methodology is very important to attract learners' attention toward English language learning. In the classroom, teachers spend most of their time and space promoting simulated and virtual language surroundings so that students will achieve the efficiency of English learning.

Generally, learners should be technologically informed to be able to act autonomously in the universal world. The use of multimedia applications in the process of teaching can impart the real context of teaching resources with simulation, such as integrating sound, images, text, and animation. Moreover, incorporating technology into the learning process as well as wide internet access might assist learners to promote their L2.

Mobile-Assisted Language Learning (MALL) is undoubtedly the big phase in the development of educational technology, depicting the merging of mobile technology and e-learning responding to a highly dynamic world that pursues a very personalized, lifelong, and global training education (Romero et al., 2010). Thus, educational technology can allow learners to control and take advantage of the free time that most people have during a typical day: while traveling to and from work, having a lunch break, or waiting to see somebody.

MALL, referring to learning with mobile technology and handheld devices (Stockwell, 2012), includes rapidly evolving smartphone technology (Balance, 2012). Employing mobile phones for language learning is astonishingly complicated and goes beyond just the design or the way it is used. As new technologies have occurred over the past few decades, the field of CALL has responded by improving frameworks that lead pedagogy (Bax, 2003).

Thus, digital games have proven specifically challenging in this sense, in part because for many educators (e.g., the general public), online gaming has yet to be considered an apt context for learning in the conventional sense (Thorne, Fischer, & Lux, 2012). Yet, the appeal of remote learning resulted in the recognition that mobile phones offer real resources for instruction (Miangah, Mosavi, & Nezarat, 2012). The employment of technology in pedagogy offers great potential to make a big change in the prevailing L2 instructional methods (Pourhosein Gilakjani & Rahimy, 2019). Pourhosein et al. (2013) contend that technology has had a great impact not only on the amount of time that learners spend on the tasks but also on their attitudes toward mobile language learning. Moreover, mobile-based applications can make learners' interaction with each other easy every time and everywhere.

Hence, the employment of MALL as an educational approach has pedagogically paved the way for learners and teachers to interact (Huang et al., 2010). Nevertheless, they have to be technologically well-informed to stay competitive with others in the social world. Aside from being technology informed, the current call of the international labor force necessitates that the students also be proficient in using English, as it is the major commercial language (Abdullah & Shah, 2015; Hsiao et al., 2016; Jin, 2015).

Throughout the majority of the industrial world, digital information and communication technologies, social media sites, and virtual and gaming environments are now broadly merged into educational, professional, and recreational realms of everyday life activity. Huang and Lin (2012) mentioned some advantages of mobile technologies such as flexibility, cost-effectiveness, smallness of size, and user-friendliness. Hubbard (2009) emphasizes the growing popularity of digital games and entreats teachers to consider whether a game is truly a game and whether the quality of collaboration with and around the game is linguistically rich enough to lead to ideal outcomes.

A digital online game is a game that should be operated by using an internet connection. In general, a digital game is a video game that could only be operated when there is an internet connection. According to Darihastining et al. (2019), a digital game can cover a wide range of online games. The game itself comprises a set of systems that are commonly used for playing and being online means that the systems should be connected to the internet for the students to be able to use them.

One of the best ways to encourage students to practice language skills in the classrooms was using games as a means of instruction (Nguyen & Pham, 2018). Games motivated students to compete with one another in the competition so they could practice their language skills naturally. Games could be used as warm-up activities used either to introduce a new learning point or to review the previously taught learning content. Games can be used as a useful method to provide students with opportunities to practice the English language with fun. Using games encouraged students to interact and communicate; students could learn how to express themselves to other people (Nguyen & Pham, 2018).

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Also, gaming in the classroom had a great effect on training students on how to use the language because it was able to encourage students to interact with each other, work together, and become more creative in expressing their ideas (Pham, Nguyen, Nguyen, & Nguyen, 2020).

Nguyen and Pham (2019) stated several reasons why games could be used in classrooms to improve students' language skills. First, when employing games to teach the students how to play the games, the students might not be aware that they are practicing the language so they could do it naturally. Secondly, employing games in classrooms is one of the ways to get students involved in communication. Furthermore, quiet students would have chances to participate in the learning activities actively to improve their English. Hence, games are frequently employed by teachers to provide students with chances to practice the language and to express their ideas and thoughts naturally during the competition. To this issue, the teachers should not only take advantage of using games for fun but also try to find ways to engage students in language learning.

Vocabulary is fundamental to English language teaching. Without acceptable terminology, EFL learners are not able to gain others' points or state their own opinions. According to Lessard-Clouston (2013), vocabulary is the words of a language, ranging from a single item and phrase to chunks of many words that transport a specific meaning. Among the language skills, vocabulary and reading have highly gained researchers' attention. Learning vocabulary is an indispensable part of learning a new language (Aghajanzadeh Kiasi & Pourhosein Gilakjani, 2023; Nation 2001). Mobile phones can persuade augmented learning of vocabulary and improve motivation for acquiring vocabulary by providing omnipresent learning through the learners' easy access to numerous skills activities (Fageeh, 2013).

The use of digital texts in classes helps learners to be familiar with language vocabulary and structures. Texts, film, and online multimedia applications enhance learners' linguistic knowledge. These facilities provide learners with the opportunities to gather necessary information for language learning (Arifah, 2014). Given the omnipresence of mobile devices and Internet connectivity, smartphones, and their innate pedagogical potential, are becoming pervasive, indispensable, and most likely inevitable digital tools that are currently commonly adopted (Hsu et al., 2013).

Nowadays, due to the growth of wireless technologies, MALL is available through numerous devices. They offer very short tutorials as well as full courses. Such devices support the retention and utilization of newly acquired language skills. The pre-edited growth of MALL is reinforced by the overwhelming lack of time (Chen & Hsu, 2020). Additionally, regarding this flourishing technology, scholars and researchers (e.g., Alemi & Lari, 2012; Taki & Khazaei, 2011; Zhang et al., 2011) argue that some skills of language learning, like vocabulary, can be intermediated through digital devices such as mobile phones. Furthermore,

Smartphone software with the latest digital features can open up new panoramas of language acquisition (Ryu & Parsons, 2009). Thus, smartphones can play the role of miniature classrooms where students can participate in an "anytime, anywhere" learning movement (Schachter cited in Fageeh, 2013). Mobile technology, then, is useful in flawlessly encouraging the transfer of learning from outside of the classroom to the classroom (Redd, 2011).

1.1 Statement of Problem

Recent research indicates that teaching vocabulary may be problematic because many teachers are not confident about the best practice in vocabulary teaching and at times do not know where to begin to form an instructional emphasis on word learning (Berne & Blachowicz, 2008). Teaching vocabulary is one of the most discussed parts of teaching English as a foreign language. When the teaching and learning process takes place, problems would appear to the teachers. They have problems with how to teach students to gain satisfying results.

Furthermore, research on vocabulary and grammar in recent years has done a great deal to eliminate the levels of these items learners need to achieve to read both simplified and non-simplified materials and to process various types of oral and written texts, as well as the kinds of strategies learners use in understanding, using, and remembering the words (Alqahtani, 2015). Moreover, incorporating technology, like computers, into the learning process as well as wide access to the internet might assist learners to promote their L2 (Pourhosein Gilakjani & Rahimy, 2020).

Although studies in EFL learning and digital games focus more on integrating digital games in the EFL classroom, the effect of digital gaming as an extramural activity in English has been briefly discussed in several studies. Svensson (2018), who conducted a systematic literature review on the effect of extramural English (EE) on EFL students' language proficiency, claimed that "the number of studies about extramural English and games is small" (p. 14). Finally, it is noted that the focus of most of the abovementioned studies was primarily concerning the effect of

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engaging frequently in extramural activities in English on EFL language learning. The study done by Olsson and Sylvén (2011) is the only found study that tested other factors concerning language achievement such as game genres, general academic success, studying other languages, and other EE activities.

Furthermore, despite the number of studies on MALL, there is still a dearth of research relating to the contribution of MALL to grammar acquisition. Very few studies have, so far, examined the contributions of MALL to learning grammar tenses and aspects as compared to that of speaking, listening, and writing skills among language learners (Jin, 2015). Language expertise involves mastering grammar, the vital constituent required to become an expert user of language (Abdullah & Shah, 2015; Larsen-Freeman, 2015; Matsumoto & Dobs, 2017; Suwantarathip & Orawiwatnakul, 2015). Accordingly, there is a robust need for the teaching of grammar via technology, which in turn could aid in the development of learners' L2 proficiency.

There are games with learning aids but with slight enthusiasm (Jantke & Hume, 2015). Some games may not apply to the process of learning and are not realistic for educational objectives. The lack of objectives will categorize these as more proper games for after-class activities only (Ongoro & Mwangoka, 2014). Therefore, it is necessary to efficiently merge learning theories into teaching games that can harmonize learning and entertainment, which will enhance students' enthusiasm toward learning L2.

1.2 Objectives of the Study

In the present study, the researchers chose to focus on increasing the interest that students reveal in using mobile devices to practice language and the applicability of these devices in today's context. Thus, concerning the literature reviewed, the current study aimed to investigate the impact of a digital game on Iranian EFL learners' grammar and vocabulary. In so doing, it aimed to compare the impacts of an educational game (Elevate) delivered on mobile phones and targets teaching of L2 grammar and vocabulary with a conventional method (i.e., teacher-fronted instruction) on the improvement of English vocabulary and grammar among Iranian intermediate EFL learners by proposing three questions:

1. Does the use of MALL-based learning suites produce any statistically significant effect on the improvement of English vocabulary and grammar of Iranian intermediate male and female EFL learners?
2. Does teacher-fronted instruction produce any statistically significant effect on the improvement of English vocabulary and grammar of Iranian intermediate male and female EFL learners?
3. Is there any statistically significant difference between the effects of MALL-based learning suites and those of teacher-fronted instruction on the improvement of English vocabulary and grammar among Iranian intermediate male and female EFL learners?

2. Literature Review

According to Mayer's (2001) Cognitive Load Theory, human beings can learn more efficiently if there are multiple channels of input, like a combination of auditory and visual input, and this can act to diminish the cognitive load. Sweller (2010) believes that cognitive load is the load allocated to the process of handling pieces of information, design, and mechanism of schemas. In other words, germane cognitive load is the amount of mental load which is necessary for effective information processing.

The Modality Principle reveals that pictures and words that are both presented visually enhance cognitive load through the context for resources in visual working memory (Mayer, 2009; Tindall-Ford et al., 2003). In the study carried out by Mayer and Moreno (2003), it was found that students who learned with simultaneous narrations and animation preceded those who learned with concurrent on-screen text and animation. The findings might be interpreted concerning two different types of effects: a spatial-contiguity effect and a modality effect.

Likewise, drawing on the Generative/Cognitive Theory of Multimedia Learning, Chang et al. (2011), who provided their learners with Personal Digital Assistants (PDA) that could interact with one another with their surroundings, proposed that the interactive feature of materials contributed to a lower cognitive load and that the stability of dual channels of visual and textual cues allowed for increased opportunities to acquire the content. Throughout the industrial world, digital information and communication technologies, social media sites, and virtual and gaming environments are now broadly merged into educational, professional, and recreational realms of everyday life activity (Huang & Lin, 2012).

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As So and Seo (2018) recently indicated, "the classification of the game genre is perhaps the most difficult category to code because of the overlapping nature of these genres" (p. 402). Digital games were categorized based on different aspects of the games such as game platform (the hardware used to play the game); game genre (the purpose and content embedded in the game); or game mode (single or multiplayer game and online or offline game) (Apperley, 2021).

Parenting and peer conformity only encourage the initiation of one's behavior. But it will encourage problematic behavior because someone meets challenges and satisfaction with online activities (Linayaningsih & Virgonita, 2019) It happens to the behavior of playing online games that can cause interference with psychological aspects, social and public or college work. Online games, according to (Fauzi, 2019), are a fun place to play for children and adolescents. Various strategies, adventures, and music can cause attraction for everyone who plays online games and forms social networks. The influence of PUBG online games on student learning achievement states that one of the online-based games is very popular because it gets pleasure, reduces stress, meets and acquainted with many friends, is free, increases cooperation, improves English language skills, avoids free promiscuity and drugs, (Fauzi, 2019). As Gee (2012) defines, a digital game is a well-designed experience, which is underpinned by playing and involves problem-solving tasks which can generate motivation, engagement, and creativity.

Using digital games makes students active participants in the 21st-century technological community. While playing games, children experience and explore complicated worlds suggested by digital games in which they playfully go downhill and uphill (Takeuchi & Vaala, 2014). Mobile phones with user-friendly interfaces, ubiquitous access, and enhanced information storage and recovery capabilities propose a decent stage for learning (Gabarre et al., 2015; Godwin-Jones, 2014; Miangah Mosavi & Nezarat, 2012). Kolb (2012) believes that mobile devices can assist learners to learn more successfully and with pleasure. Hajim (2012) states that using mobile devices helps students have easy access to the information they need.

Playing digital games can transport joy and ingenuity into the classes (Pomerantz & Bell, 2007). These factors are vital, especially for language learning classes where learners get bored easily and quickly throughout the long period of learning a second language. As Reinders and Wattana (2014) state, digital games offer an appealing atmosphere and promote learning engagement that has recently been discovered for their educational potential.

Language learning games or reproductions with specific linguistic or cultural objects can be fruitful, especially when learners, who are persuaded by an external component, use these games in random contexts (Godwin-Jones, 2014). Furthermore, it plays as a background of addiction among gamers and influences their behavior (Ulfa, 2017). In online games, gamers could interact with each other. Generally, online games demand gamers to accomplish a certain mission, achieve the highest score, and become a winner in certain groups of online games.

Digital games create a competitive learning atmosphere in which learners collaborate and can work together (Derakhshan & Davoodi Khatir, 2015). They provide a context for them to speak and use the L2 language vocabulary items (Gee, 2012). Vocabulary games provide an opportunity for learners to use the target language flexibly and collaboratively by shifting language class to a real-world context (Huyen & Nga, 2003). Multimedia games can offer multimedia contexts in which children are provided with vocabulary, main sentences, and short conversations; hence, they collaborate, and finally, the language vocabulary learning is invigorated (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. The authors demonstrated the benefits of using mobile technologies in informal language learning, highlighting the importance of social interactions and collaboration as crucial elements in developing language learning.

Berns et al. (2016) conducted a study in which they established a game-based mobile learning application, named VocabTrainerA1 app, to aid language learners. The study intended to discover the learners' learning motivation, perceived usefulness, and attitude toward the value of the application as well as the development of their linguistic proficiency. The mobile application included both individual and collaborative tasks, requiring learners to cooperate and resolve an assassination secret game.

The results of Kurniawan (2017) show that the intensity of playing online games influences academic procrastination among Guidance and Counseling students of the second semester in batch 2016 Universitas PGRI Yogyakarta. It is further expected that students could reduce the intensity of playing online games to avoid

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academic procrastination. The research conducted by Suplig (2017) describes the forms of online game addiction, the negative impact of online game addiction in terms of social intelligence, and the effort to avoid online game addiction among adolescents.

In the context of EFL and language learning several studies focused on the amount of time EFL learners spend playing digital games and whether it had any effect on their EFL learning. In other words, researchers examined if the frequency of playing digital games (such as hours of play per day, days of play per week, and years of play) among EFL learners affects their EFL achievement. Exploring this relationship is essential to inform the variable of EFL students' patterns of playing digital games (Alamr, 2019).

Yılmaz, Yel, and Griffiths (2018) investigated the effect of heavy digital gaming (more than 2.5 hours per day) on students' social and educational status by interviewing teachers and peers of three heavy gaming students. The interviews showed that the teachers pointed out a positive side of heavy gaming concerning English language learning. The teacher stated "playing video games appears to help students learn English words, and this contributes positively to their foreign language learning by increasing their motivation toward the English course" (p. 157).

Since the vast majority of digital games are designed in English and games are played all over the world, online social interactions mostly occurred in English. Several studies have researched the effect on or discussed the potential of, online gaming for benefitting EFL in general, or specific English skills. Dixon and Christison (2018) in their explorative study investigated the usefulness of Massive Multiplayer Online Role-Playing Games (MMORPG) as a second language acquisition tool. The findings of their study showed that playing online digital games (such as MMORPG) promoted second language acquisition by providing opportunities for social interaction in L2 learning through collaborative problem-solving tasks.

3. Methodology

3.1 Participants

The participants were 30 students who were taking English courses at a private language institute in Iran. To select a homogenous sample of students in terms of language proficiency, they were given a copy of the Solutions Placement Test (SPT) based on which 30 intermediate EFL learners were ultimately chosen as the prospective participants of the study. These were then randomly assigned to one experimental and one control group, each consisting of 15 language learners.

3.2 Interview

Interviews are a very flexible data collection method, and an interview study, therefore, offers the potential for investigating topics in an open-ended way. As a form of qualitative verbal commentaries, interviews appear to be the most commonly used method (Song, 2015). According to Flick (2009), one of the reasons for the growth in the popularity of qualitative interviews is that they allow participants to express their views more openly than would be possible in a standard questionnaire. After the quantitative phase, the participants were asked if they would be interested in participating in follow-up interviews. To cover all aspects of the issue in question and to answer the questions in the researchers' minds not covered in the questionnaire, an interview was carried out to collect more precise information on M-learning. The interview was of a semi-structured type, and it was conducted with 6 teachers chosen based on their consent.

In addition, to add depth and detail to the quantitative portion of the present study, an eight-item semi-structured interview was conducted with volunteer participants. The interviews with participants provided an opportunity to understand the thinking opinions as to different aspects of mobile-language learning. The participants were asked questions to provide information on the features of MALL they had found very useful, their interest in the use of the application, their learning management, and their learning experience in M-learning. For this purpose, the related literature was used to extract the pertinent questions. The items were verified by experts in TEFL. The following questions were finally extracted from the literature and are based on expert opinions:

Which features have you found the most useful?

What did you like most about the applications?

Have you ever enjoyed working with the application?

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To what extent do you believe you were in control of the learning environment?

How did you like the MALL-based language learning?

What is your idea about the application?

Have you ever enjoyed learning with the virtual platform?

What is the affective impact of the M-learning?

3.3 Materials and Instruments

Twenty grammar (see Appendix A) and 20 vocabulary items (see Appendix B) chosen randomly from the mobile game app called Elevate. They were chosen as the base material to be taught to both groups of participants before the onset of the intervention program in an attempt to measure their command of L2 vocabulary and grammar and to check the participants' homogeneity at the beginning of the experiment.

3.4 Procedure

Making sure that the learners delivered a lackluster performance on the test and that they performed the same on vocabulary and grammar, the researchers started the treatment during which the experimental group received the intervention program. The participants in the experimental group were assigned to receive treatment on their vocabulary and grammar knowledge via a mobile game app called 'Elevate.'

The learners received at most 5 games every session, which engaged their grammar and vocabulary. They were given some time to pass each game and the application provided them with feedback at the end of each training session. The first section demonstrated the whole study plan throughout the day. The sessions continued level by level which showed that the learners had to get the required grade in vocabulary and/or grammar to allow them to go to the next skill. Next, in the Activities section, the learners had two parts in-game: game and study.

In-Game section, for each of the two skills of grammar and vocabulary, the application had different types of training; for example, for vocabulary, as Figure 1 shows, the application provided the learners with 'Error Avoidance' which helped them choose proper words or phrases to improve vocabulary skill and stop mixing commonly confused words, and at the end, it gave trainer the necessary feedback.

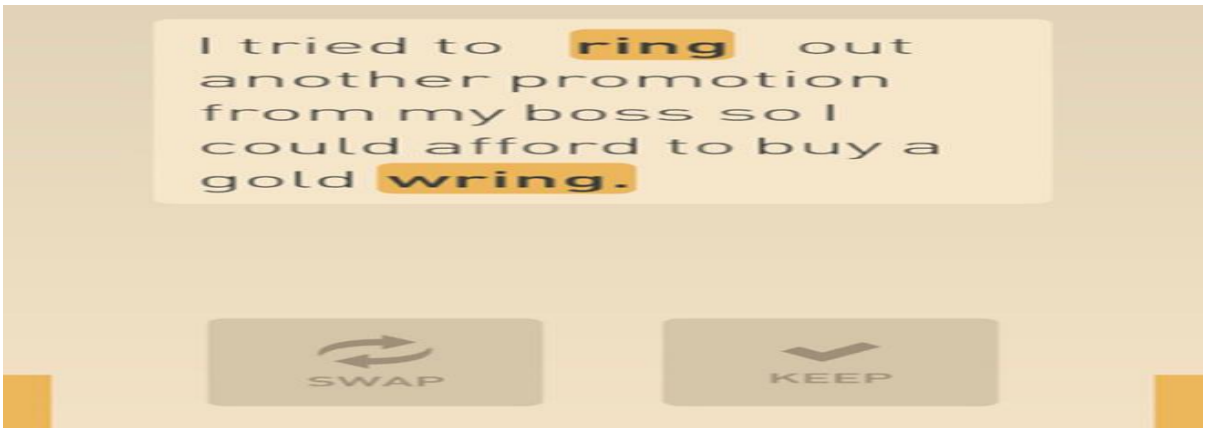

Figure 1. The activities section of the game: Game and study

Immediate feedback was given at the end of each training which proved useful for learners to find out what their problems were. As observed in Figure 2, one sample of the feedback given by the application is as follows:

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Figure 2. The feedback decks of Elevate

While the experimental group received training on grammar and vocabulary through working with Elevate, the control group, instead, did not receive any special type of treatment except the teacher's conventional method of grammar and vocabulary instruction in a teacher-fronted fashion. In teaching vocabulary, the teacher read the words and gave the meaning of the words either in English or in the students' mother tongue. Teaching grammar in the control group, the teacher instructed grammar from the learners' book using the whiteboard in the classroom.

The learners attended the class for eight sessions, each week two days for 45 minutes of the class time, and in each session, they were taught one set of five vocabulary items and one grammar point through the app. After the treatment period, the posttests were given to both groups to estimate the participants' vocabulary and grammar knowledge at the end of the treatment, to know the amount of progression from the pretest; that is to scale their performance scores in comparison to their performance in the pretest.

The interviews were recorded. Next, they were transcribed and analyzed by the researchers and were finally verified and coded using a commercial qualitative data analyzer called MAXQDA. The method employed in the analysis of the qualitative data was based on a model of inductive the analysis proposed by Strauss and Corbin (1998), which suggests that qualitative data analysis involves codification of data fragments in three distinct phases, namely 'open', 'axial', and 'selective' coding (p. 101–103). Once the coding was completed, a second rater, a colleague, was invited for an inter-coder reliability check, or inter-coder agreement (Creswell, 2012). Cohen's Kappa was conducted to calculate the ratio of coding agreements. According to Viera and Garrett (2005), a kappa of 1 indicates perfect agreement, whereas a kappa of 0 indicates agreement equivalent to chance. For the present study, the inter-rater agreement calculated by Kappa statistics turned out to be 0.88, which showed an almost perfect agreement as it was between 0.81-0.99.

3.5 Data Analysis

Having collected the required data, the researchers used Statistical Package for Social Sciences (SPSS) version 25 as the statistical tool for analyzing the data. Paired and independent samples t-tests were carried out to yield an estimate of the size of both within- and between-subjects effects, respectively. The statistics of the pretest and posttest scores of the two study groups are summarized in the following tables.

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4. Results

Having collected the required data, the researchers used Statistical Package for Social Sciences (SPSS) version 25 as the statistical tool for analyzing the data. Paired and independent samples t-tests were carried out to yield an estimate of the size of both within- and between-subjects effects, respectively. The statistics of the pretest and posttest scores of the two study groups are summarized in the following tables.

Table 1. Study groups' performance scores on the grammar pretest

Study groups	N	Mean	Std. Deviation	Std. Error Mean
Experimental group	15	13.8667	1.59762	.41250
Control group	15	14.5333	1.88478	.48665

Table 2. Study groups' performance scores on the vocabulary pretest

Study groups	N	Mean	Std. Deviation	Std. Error Mean
Experimental group	15	14.1333	1.59762	.41250
Control group	15	14.4000	1.35225	.34915

As shown by the tables, the mean scores are almost equal, suggesting that, before the treatment, the two groups were homogeneous concerning grammar and vocabulary knowledge. In addition, the participants performed below average, showing that their grammar and vocabulary knowledge was not at an acceptable level and hence we need to expand their knowledge in these areas.

The analysis of the posttest results, as observed in Tables 3 and 4, demonstrated that the mean scores on the posttest were much higher than those of the pretest, suggesting that the participants made significant progress as a product of the treatment effect; however, a further glimpse reveals that the mean scores differed greatly, suggesting that the two treatment conditions might have differentially impacted the participants' knowledge of vocabulary and grammar.

Table 3. Study groups' performance scores on the grammar posttest

	N	Mean	Std. deviation	Std. error mean
Experimental Group	15	17.6000	1.24212	.32071
Control Group	15	15.6667	1.83874	.47476

Table 4. Study groups' performance scores on the vocabulary posttest

	N	Mean	Std. deviation	Std. error mean
Experimental group	15	17.0000	1.30931	.33806
Control group	15	15.8667	1.50555	.38873

As seen, the experimental group gained a much higher mean score, suggesting that using a mobile application and engaging learners in online gaming had proved more effective in harnessing their grammar and vocabulary knowledge. Comparison of the participants' test performance scores before and after receiving treatment on their grammar knowledge also allowed for estimating the size of within-subjects effects or the degree to which the participants of the two groups progressed during the experiment.

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Table 5. Differences between the grammar pretest and posttest means of the study groups

Pairwise Comparison of the Means		Mean	N	Std. deviation	Std. error mean
Pair 1	Experimental group posttest scores	17.6000	15	1.24212	.32071
	Experimental group pretest scores	13.8667	15	1.59762	.41250
Pair 2	Control group posttest Scores	15.6667	15	1.83874	.47476
	Control group pretest Scores	14.5333	15	1.88478	.48665

As shown in Table 5, the difference between the means of the two groups in the pretest and posttest is fairly large, displaying that the groups made acceptable development over the course mainly due to the effect of the treatment. Yet, it cannot be argued, based on the scores only, whether the huge mean difference is also statistically significant. The comparison of the participants' test performance scores before and after receiving treatment on their vocabulary knowledge also allowed for calculating the size of within-subjects effects or the degree to which the participants of the two groups progressed during the experiment.

Table 6. Differences between the vocabulary pretest and posttest means of the study groups

Pairwise comparison of the means		Mean	N	Std. deviation	Std. error mean
Pair 1	Experimental group posttest scores	17.0000	15	1.30931	.33806
	Experimental group pretest scores	14.1333	15	1.59762	.41250
Pair 2	Control group posttest scores	15.8667	15	1.50555	.38873
	Control group pretest scores	14.4000	15	1.35225	.34915

As can be inferred from the comparison, the vocabulary command of the experimental group greatly developed in comparison to that of the control group. It shows that engaging students through mobile applications will be much more effective and beneficial than exposing them to traditional and teacher-fronted instruction. In other words, MALL-based learning excels at having students engaged and letting them perform better compared to conventional methods. The results of inferential analysis, paired and independent samples t-tests, which give an estimate of the size of both within- and between-subjects effects, helped the researchers estimate the extent to which the findings of one study can be generalized over a diverse range of similar research situations.

Table 7. Results of the Independent Samples T-Test reported based on the grammar pretest statistics

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As shown in Table 6, the probability value for Levene's test exceeds 0.05 alpha level, which proposes that the

		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

homogeneity of variances assumption is justified, and the condition is met for using parametric tests like t-test. A further glimpse at the table shows that the Sig. value for the t-test is higher than the 0.05 alpha value, which says that the mean difference on the pretest of grammar is not statistically significant. Further evidence comes from the fact that it can be observed that the confidence interval contains zero, which in turn suggests that the two groups belonged to the same population at the start of the experiment.

Table 8. Results of the Independent Samples T-Test reported based on the vocabulary 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
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

As Table 8 shows, the probability value for Levene's test exceeds 0.05 alpha level, which offers that the assumption of homogeneity of variances is justified and, therefore, the condition is met for using parametric tests like t-test. A further glimpse at the table shows that the Sig. value for the t-test is higher than the 0.05 alpha value, which shows that the mean difference on the pretest of vocabulary is not statistically significant. Further evidence comes from the fact that it can be observed that the confidence interval is zero, which in turn shows that the two groups belonged to the same population at the beginning of the experiment.

Table 9. Results of the Independent Samples T-Test reported based on the grammar posttest statistics

	Levene's Test for Equality of Variances	T-test for Equality of Means

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		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

As shown in Table 9, the assumption of homogeneity of variance is justified ($p > 0.05$), which allows for the use of parametric tests such as the test of statistical significance. The probability value for the t-test, as seen in the table, is smaller than the 5% level of significance; however, the confidence interval contains no zero, which shows that the between-subjects effects are statistically significant. This in turn carries the implications that the two modalities of instruction had produced differential impacts on students' learning of L2 grammar. Since the mean difference is in favor of the experimental group, one can argue that the experimental group was privileged in comparison to the control group in terms of the participants reaping greater benefits from the mobile-assisted instruction.

Table 10. Results of the Independent Samples T-Test reported based on the vocabulary posttest statistics

		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

As Table 10 shows, the assumption of Homoscedasticity of variance is justified ($p > 0.05$), which allows for the use of parametric tests such as the test of statistical significance. The probability value for the t-test, as seen in the table, is smaller than the 5% level of significance; however, the confidence interval includes no zero, which implies that the between-subjects effects are statistically significant. This in turn carries the implications that the two modalities of instruction had produced differential impacts on students' learning of L2 vocabulary. Since the mean difference is in favor of the experimental group, one can argue that the experimental group was privileged in comparison to the control group in terms of the participants reaping greater benefits from the mobile-assisted instruction.

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

Paired differences	T	Df

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		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 shown in Table 11. above, the difference between the means of the two groups in the pretest and posttest is statistically significant at the preset alpha level ($p < 0.05$), displaying that the groups made significant growth over the course of the study; however, the rate of progress achieved by the two groups is not comparable in size, implying that the two treatment conditions had improved the participants' L2 grammar knowledge to a varying extent.

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

		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

Comparison of the participants' test performance scores before and after their receiving treatment on their writing ability also allowed for estimating the size of within-subjects effects or the degree to which the participants of the two groups progressed during the course of the experiment. As can be observed in Table 12, the difference between the means of the two groups in the pretest and posttest is statistically significant ($p< 0.05$), displaying that the groups made acceptable development after the study mainly due to the experiment. Yet, the mean difference between the posttest means, which is in favor of the experimental group, clearly suggests that the achievements gained by the two groups are not comparable in size, implying that the two treatment conditions had improved the participants' L2 vocabulary skills to a varying extent.

In an attempt to provide corroboration for or offer initiation on the quantitative findings of the present study, the third research question was further divided into several ancillary probes that sought to seek the participants' opinions as to different aspects of mobile-language learning. For example, concerning the aforementioned finding and in response

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to these questions 'Have you ever enjoyed working with the application?', 'What did you like most about the applications?', and 'Which features have you found the most useful?', 90% of the control group learners and 82% of participants in the experimental group reported that they had greatly enjoyed working with the multimedia applications and that they had found M-learning remarkably efficient in actively engaging them in the learning of English grammar and vocabulary items. One participant voiced his opinion in the following way:

> What I liked most about the application was that I was so excited that I hadn't worked with such an application inside the classroom before. The virtual icons were realistic and amusing; I enjoyed the time that it made me ponder my thoughts around finding the correct answer, I loved the setting, the grammar and vocabulary items were fabulous which I barely heard of them before, and I was always curious to see what could happen next…

Another explanation for the present finding is the possibility that learning through MALL-based learning suites can be more or less learner-centered, and hence the pace of learning can be partly under the rein of the learners themselves. In response to probes like 'To what extent do you believe you were in control of the learning environment?', 75% of the control group individuals and 80% of respondents in the experimental group, who represented a sizable percentage of individuals, reported that they could partially control the pace of learning and that they had found the whole experience to be partly learner-centered and individualized. One participant expressed her opinion in this way:

> Though I couldn't control the time of receiving items, for instance, I could still control some parts: I could pause the scene, I could rewind it if I missed an explanation or an example, or I could review my answers when receiving feedback and the option of correcting them…

In response to questions like 'How did you like the MALL-based language learning?', 'What is your idea about the application?', 'Have you ever enjoyed learning with the virtual platform?', and generally, when asked to share their opinions about the affective impact of the M-learning, a great many participants in the experimental group (around 97%) reported that they had been overwhelmed by the application as time passed. One participant shared the following experience:

> As the continuity of information was one-way, I never thought I was doing something fun. Everything looked real and rather informative: The feedback given by the application was right on the spot when checking our answers.

In contrast, only a small number (around 32%) of the participants in the experimental group reported that they had found the application and data informative. Those who liked the application, however, complained that they had found it a bit difficult to keep up with the continuity of information as time passed by. One participant conveyed the following idea:

> I had a hard time placing myself and keeping up with the pace of the application at first but gradually I coped with it; as time passed by, I found myself catching up and could direct my concentration on the data which were being injected toward me.

The interview probes revealed that the experimental group had found M-learning slightly challenging as they struggled to process aural and visual texts and also put together disparate fragments of information while they were working with the application. One participant gave the following comment about M-learning;

> Most of the things looked natural; I also found different parts engaging, but following both the flow of information and the texts was a bit challenging. Overall, I found the amount of receiving data somehow distracting…

Likewise, one participant in the control group voiced his opinion in this way:

> Though it gradually became something practical and usual, the majority of what I received during the learning time was always before my eyes. I had no difficulty following the flow of information and the visual texts given by the application at the same time because I essentially viewed them as one visual unit than two separate elements.

5. Discussion

The present study intended to investigate the impact of MALL or M-learning on the growth of English vocabulary and grammar of Iranian intermediate male and female EFL learners and compared it with the effects of teacher-fronted

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instruction on the same skills and population. Based on the analysis of the paired samples t-tests, great improvement in terms of developing the learners' repertoire of L2 grammar and vocabulary during the study was reported. The results of the tests of between-subjects effects were shown to be statistically significant at the 5% alpha level, which suggests that no statistically significant difference was found between the means of the two study groups. The implication is that the two modalities of instruction had produced differential impacts on students' knowledge of L2 grammar and vocabulary and that mobile-assisted instruction as delivered via Elevate had comparatively shown to be more effective in developing the students' command of L2 grammar and vocabulary.

The results of the present study support the generative/cognitive theory of multimedia learning proposed by Chang et al. (2011). According to this theory, the interactive feature of materials contributes to a lower cognitive load, and the stability of dual channels of visual and textual queues allows for increased opportunities to acquire the content. The results also give support to the contiguity principle developed by Mayer (2001), which claims that the efficiency of multimedia teaching magnifies when terms and photos are provided alongside in time or place.

Furthermore, a study done by Berns et al. (2016) supports the results of the present study as it is proven that multimedia learning can benefit learners with autonomous language learning in both class and out-of-class assignments. What is more, with mobile phones' omnipresence, chances are high that students can be benefited from adequate and successful language acquisition. It is found that mobile devices are particularly useful mini-computers that fit in students' pockets, is always with them, and are nearly always on. Using mobile phones as one of the multiple modalities has been endorsed by Moreno (2006) as it is noted that when information is presented in multiple modalities, the modality effect is produced, which in turn, leads to the seamless integration of information and eventually efficient knowledge acquisition.

Similarly, the findings of the study done by Berns et al. (2016), using a game-based mobile learning application, named VocabTrainerA1 app, to aid language learners revealed that the MALL application significantly reinforced the language learners' learning motivation and language proficiency. Supporting the findings of the current study, their study revealed that mobile-assisted language learning can assist language learners in several ways, four of which involve opportunities for peer collaborating, personalizing learning experience, improving linguistic abilities, and enhancing learning motivation. In addition, the findings of the current study corroborate the results of Getkham's (2004) research that sought to compare the performance of two groups of traditional printed texts and multimedia computer programs, as the study indicated that the multimedia group was less prone to forgetting the vocabulary items taught than did the other group. The results of both studies concluded that a multimedia program could help students sustain vocabulary knowledge.

In a study on the effects of digital games on the growth of foreign language vocabulary in the Iranian context, Aslanabadi and Rasouli (2013), as in the current study, showed that the experimental group that was taught by an online language teaching game as compared to the control group that faced traditional method exhibited that using language games for teaching vocabulary not only brought fun for learners but also motivated learners and promoted their confidence. The results of the present study are also incongruent with the findings of the study done by Wu (2015) who found that MALL is an adaptive process: Language learners' proficiency level, perceptual learning style, and learning behavior play a role in the process. Using this application of vocabulary instruction, the learners were able to recognize how learning style and behavior could influence vocabulary learning.

To prove dual code theory and the rationale for applying multiple annotation types for aspects such as listening, vocabulary, or even grammar, the current study findings are in line with the results of the study carried out by Huang et al. (2008) on Taiwanese learners' access to video content and their interaction with each other using text-based methods such as responding to questions raised by the teacher via SMS showed that the learners could shape representations of knowledge through both visual and text channels, sustaining learning which is suited to students' learning style. The studies, including the current one, reviewed, show that the dual coding theory proposed by Paivio (1986) certifies that learning occurs through a combination of verbal (or text) and nonverbal (visual) codes that allows for various means through which information is processed, resulting in two separate mental representations of concepts.

Basal et al. (2016) believe in the employment of mobile applications in the learning and teaching process as they claim that learning vocabulary in the classroom may be disadvantageous due to time constraints and the heavy responsibility of the learner. The advantage of using mobile phones and mobile applications in vocabulary teaching is having an

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opportunity to learn beyond classroom borders.

6. Conclusion and Implications

Multimedia learning can bring myriad benefits to learners with autonomous language learning in both class and out-of-class assignments. What is more, with the omnipresence of mobile phones, chances are high that students can be benefited from adequate and successful language acquisition as Prensky (2003) declares, mobile phones are particularly useful mini-computers that fit in students' pockets, are always with them, and are nearly always on.

Furthermore, teachers must be aware of the importance of delivering effective vocabulary and grammar instruction that can be achieved via MALL. As Schmitt (2010) asserts, EFL teachers and learners are still uncertain of the best possible ways to follow vocabulary learning strategies in language classrooms. The materials developers should also regard the importance of utilizing technology-enhanced language instruction in the Iranian EFL context. In this regard, they can integrate technology-based materials in their development process of material for Iranian English language learners. They should be aware that, in the Iranian EFL context, the conventional method of presenting language skills that have been dominating the pedagogical materials should be redesigned and should be replaced by technological and digital tools of language instruction.

With technology-enhanced language learning (TELL), educators would no longer be limited to textbooks in their institutions. As noted by Alqahtani (2015), by merging technology and language learning, the benefits in language achievements on the concepts of vocabulary and grammar are the hallmark. In the meantime, with the ubiquity of technology, there is a tendency to use mobile-based programs to learn a second language. Multimedia learning can benefit learners with autonomous language learning in both class and out-of-class assignments. What is more, with mobile phones' omnipresence, chances are high that students can be benefited from adequate and successful language acquisition.

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Appendix A: Sample Grammar Test

1. She saw a group of deer cross the road, which _____ a huge driving hazard. (Was)
2. Last night, Joe _____ to bed early. (Went)
3. The furniture from the estate _____ up for auction. (is)
4. Right now, gees _____ south is V shaped flocks. (are migrating)
5. Under material law, citizens are denied _____ right to travel freely. (Their)
6. When she heard the news, she she _____ her arms in the air. (threw)
7. I like to sing while I _____. (cook)
8. I was born in _____ United Kingdom. (the)
9. The recruits were ordered to speak with_____ Baddetto. (General)
10. When my sister sings, everyone_____. (listens)
11. Maya _____ calls people back. (almost never)
12. Claire and Sarah left _____ corporate jobs to start non-profits organization. (Their)
13. If it were up to _____, we all would spend more time outside. (me)
14. Every U.S president must _____ at least 35 years old to be eligible for office. (be)
15. He _____ 10 miles yesterday. (jogged)
16. _____ and Blake are expecting a baby. (she)
17. He and _____ are excited to try their recipe. (I)
18. The boy lost a pair of glasses and _____ looking for them. (is)
19. The first _____ was introduced in the mid-1960. (ATM)
20. We _____ at the fundraiser last week. (volunteered)

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Appendix B: Sample Vocabulary Test

1. The act of making something eight or proper: (correction)

cor- with or together rect- straight or right ion- act or process of

2**.** Able to be heard: (audible)

au- hear ible- able to

3.System for sending written notes by wire: (Telegraph)

tele- distant graph- written or recorded

4. Related to one with skill and creativity: (artistic)

art- skill ist- one who does ic- relating to

5.Located in the middle of something: (central)

Centr- center al-relating to

6.One who creates with great skill: (artist)

art- skill ist- one who does

7.Word with the same meaning as another: (synonym)

Syn- with or together onym- name or word

8.To instantly carry something across space: (teleport)

tele- distant port-carry

9. A person who writes about another's life: (biographer)

bio- life graph- written or recorded er- one who has or does

10. Screen that receives distant images: (television)

tele- distant vis- see or sight ion-state or condition of

11. Relating to numbers: (numeric)

numer- number ic- relating to

12.Relating to a city: (urban)

urb- city an- relating to

13.Able to be seen: (visible)

vi- see or sight ible- able to

14.One who oversees people or events: (supervisor)

super- above or over vis- see or sight or- one that is or does

15.Done using one's hand: (Manually)

manu- hand al-relating to ly- in the manner of

16.Related to the sea: (marine)

mar- sea ine- made of or like

17.To give something for a good cause: (donate)

don-give ate-do or perform

[DOR: 20.1001.1.25384015.2023.8.1.4.0]

18.One who studied the mind: (psychologist)

psych- mind ologist- one who studies

19.Process of carrying between places: (transportation)

trans- across or beyond port- carry ation- action or progress

20. The process of pulling together to shorten: (contraction)

con- with or together tract- pull or drag ion- act or process of

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