## Research Paper
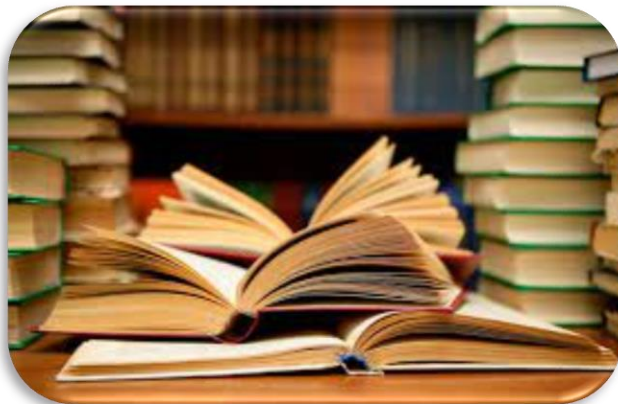
**The Effect of Collaborative, Online Augmented Reality Games on EFL Learners' Speaking Performance and Communication Apprehension**

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**ABSTRACT**

The use of computer games as a type of computer-assisted language learning has recently gained significance among EFL syllabus designers and teachers. One specific type of such games is augmented reality (AR) in which language learners can be immersed in a virtual environment that interacts with the real environment around them. Accordingly, this research studied the effect of collaborative, online augmented reality games on EFL learners' speaking performance and communication apprehension. To this end, a total of 60 Iranian female EFL learners at the intermediate level of proficiency were selected by convenience sampling method and were put into two groups of equal size (30 learners in each group) for 10 sixty-minute sessions: the experimental group received ordinary book-based speaking activities together with collaborative AR gaming practices; the control group received only book-based speaking activities with no AR games included. The participants took a pretest and post-test before and after treatment sessions measuring their speaking proficiency and their communication apprehension level via the 'communication apprehension' section of the FLCAS questionnaire. The results of the study showed that the group who engaged in speaking practices and activities with the help of AR games significantly outperformed the book-bound group in terms of both speaking ability improvement and reduction in communication apprehension levels. Therefore, these findings imply that EFL syllabus designers and teachers need to include computerized technologies, such as AR games, into their language courses to boost the pace of English learning and reduce communication apprehension levels of their students.

**Keywords**: EFL learners, communication apprehension, speaking skill, AR games

تاثیر بازی های واقعیت افزوده برخط مشارکتی بر عملکرد گفتاری و اضطراب ارتباطی زبان آموزان ایرانی

اخیرا استفاده از بازی‌های رایانه‌ای به عنوان یکی از روش‌های یادگیری زبان در میان طراحان برنامه‌درسی و آموزگاران اهمیت یافته است. یکی از انواع این بازی‌ها، واقعیت‌افزوده است که در آن زبان‌آموزان می‌توانند در محیط مجازی در حالی که با محیط واقعی پیرامونشان در تعامل هستند غرق شوند. بنابراین، این تحقیق تاثیر بازی‌های واقعیت‌افزوده برخط مشارکتی بر عملکردگفتاری و اضطراب‌ارتباطی زبان‌آموزان را مورد مطالعه قرار داده است. به همین منظور ۶۰ زبان‌آموز دختر ایرانی با سطح مهارت متوسط به روش نمونه‌گیری آسان انتخاب شدند و در دو گروه مساوی (در هر گروه ۳۰ یادگیرنده) برای ۱۰ جلسه ۶۰ دقیقه‌ای قرار گرفتند. گروه آزمایشی، فعالیت‌های عادی مکالمه براساس کتاب را به همراه تمرین‌های بازی‌های مشارکتی واقعیت‌افزوده دریافت کردند. گروه کنترل فقط تمرین‌های  مکالمه‌ای مبتنی بر کتاب را بدون بازی‌های واقعیت‌افزوده دریافت نمودند. شرکت‌کنندگان قبل و بعد ازجلسات آموزشی یک پیش‌آزمون و پس‌آزمون را گذراندند که مهارت مطالعه و سطح اضطراب ارتباطی آنها را با استفاده از قسمت "اضطراب ارتباطی" پرسشنامه اندازه‌گیری اضطراب کلاس زبان خارجی مورد سنجش قرار می‌داد. نتایج این تحقیق نشان داد گروهی که در  تمرینات مکالمه و فعالیت‌هایی با کمک بازی‌های واقعیت‌افزوده شرکت کردند در هر دو حوزه‌ی بهبود توانایی مکالمه و کاهش میزان اضطراب ارتباطی نسبت به گروه محدود به کتاب به شکل چشمگیری بهتر عمل کردند. بنابراین، این یافته‌ها دلالت بر این دارد که لازم است طراحان برنامه‌درسی و آموزگاران، فن‌آوری رایانه‌ای نظیر بازی‌های واقعیت‌افزوده را در دوره‌های آموزشی زبان خود بگنجانند تا سرعت یادگیری زبان انگلیسی را افزایش و میزان اضطراب ارتباطی دانش‌آموزان را کاهش دهند.
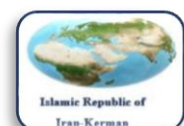
**واژگان کلیدی:** یادگیرندگان انگلیسی به عنوان زبان دوم، اضطراب ارتباطی، مهارت صحبت کردن، بازی‌های واقعیت افزوده

# INTRODUCTION

Along with various technological advances in the second decade of the new millennium onward, augmented reality (AR) gaming has recently achieved popularity among younger generations on their mobile devices such as smartphones and tablets (Perry, 2021). AR is a 3D technology which reflects digital information in the real world and improves users' visualization of the real world with virtual objects via graphic computation and object-recognition technologies (Abad-Segura et al., 2020). AR games, in turn, are computer games which put the gamer in a virtual world based on their current physical location in which they have to complete some gaming tasks either alone or in collaboration (Perry, 2018). The positive impacts of AR gaming on learning and education include reduced anxiety and apprehension, enhanced performance and motivation and improved collaboration among learners in a contextualized environment (Huang et al., 2021). Consequently, AR gaming has received a surge of interest among researchers, practitioners, and teachers in the field of second language (L2) learning, especially learning English as a foreign language (EFL) where contextualized learning in an English-speaking environment is conducive to learning (Hsu, 2017). Given the potential of AR gaming for EFL education, learners can gain abundantly from this type of technology for advancing the language skills that need constant mutual communication and collaboration on learners' part (Radu, 2014).

One such language skill that requires interactive practice by EFL learners in a collaborative context is the speaking skill (Ur, 2009). Speaking and conversation proficiency is a vital skill for EFL learners to communicate effectively with other non-native and native speakers. Speaking happens everywhere as a daily activity and has been argued to be the most challenging skill for language learners to be mastered due to cognitive as well as affective considerations (Harmer, 2007). According to Mehrgan (2013), one of the main goals of most EFL instructional programs is to enable learners to communicate effectively with confidence and the lowest degrees of anxiety and communication apprehension in English. Hence, foreign language anxiety and its major component apprehension play an important role in learners' speaking performance (Horwitz, 2001).

The term speech anxiety refers to the feeling of fear and apprehension that is experienced by a person when asked to speak and communicate orally in a strange or unusual situation in L1 or L2. Horwitz et al. (1986) regard foreign language anxiety as a kind of shyness reflecting fear or apprehension regarding communicating orally with other individuals. They maintain that language anxiety includes the three components of communication apprehension, test anxiety, and fear of negative evaluation, among which the first one (i.e., communication apprehension) is the most frequent one observed among EFL learners. Learners who show communication apprehension feel uneasy and anxious when asked to speak in the target language in front of others (Sparks & Ganschow, 2007). Therefore, the one main goal of teachers and syllabus designers in instructed contexts of EFL education should be the reduction of EFL learners' anxiety and communication apprehension by creating a collaborative, stress-free environment (Gregresen & Horwitz, 2002). It seems that the advancements in computerized technology have made such a task easier by providing teachers with AR gaming technology (Lai & Chang, 2021). Many recent studies have investigated the impact of technology-based instruction on different aspect of teaching and learning English as a foreign language (e.g. Vahid Dastjerdi, 2024). However, only a few studies have dealt with the effect of AR games on teaching and learning English. Accordingly, given that little is known about the effect of AR games on EFL learners' speaking abilities particularly in the Iranian

EFL context on the one hand and the impact of such technology on reducing learners' communication and speaking apprehension on the other, this study aimed to accomplish two purposes. First, to bridge the above-mentioned gap, this study examined the effect of collaborative, online AR games on improving Iranian EFL learners' speaking proficiency as compared with traditional real-world classroom practice. Second, it investigated the effect of collaborative, online AR games on helping Iranian EFL learners reduce their communication apprehension while speaking in English.

**Research Questions**

Accordingly, in this study, the following research questions and hypotheses guided the design of the study:

**RQ1:** Does using collaborative, online AR games have any statistically significant effect on the speaking performance of Iranian intermediate EFL learners?

**RQ2:** Does using collaborative, online AR games have any statistically significant effect on the communication apprehension of Iranian intermediate EFL learners?

In line with the above-mentioned research questions, the following research hypotheses were formulated:

**H01:** Using collaborative, online AR games does not have any statistically significant effect on the speaking performance of Iranian intermediate EFL learners.

**H02:** Using collaborative, online AR games does not have any statistically significant effect on the communication apprehension of Iranian intermediate EFL learners.

**Significance of the Study**

The increasing popularity of AR environments in general and AR games in particular has made this technology a promising method for teaching and learning languages across the world (Lee, 2020). One avenue of research to examine the effect of AR games on language learning is to study whether AR games can improve EFL learners' speaking performance via providing more communication practice and reducing their communication apprehension. Speaking has played an important role for much of the history of L2 language teaching and learning and reducing speaking anxiety and apprehension has been considered an important goal of language teachers in their classrooms (Graham-Marr, 2004).

Accordingly, the significance of this study is as follows: The results of the study can shed light on how and whether AR games can help Iranian EFL learners enhance their speaking proficiency as compared to traditional class-room English speaking practices. Moreover, the results can also reveal whether such a virtual, online game-based environment can reduce Iranian EFL learners' communication apprehension and speaking anxiety. By so doing, the findings of the current research can prove beneficial for both EFL teachers and syllabus designers to weigh the advantages of using AR games in EFL instructional contexts and develop methodologies and syllabuses based on such an understanding.

## REVIEW OF THE RELATED LITERATURE

Augmented reality (AR) is a sort of online technology that overlaps virtual world and objects onto the real world and real-world objects (Abad-Segura et al., 2020). According to (Radu, 2014), AR comprises three main features: it combines the real world with the virtual word on a platform (e.g., smartphones, websites, etc.), it creates real-time interaction in the virtual world, and presents a three-dimensional environment. The popularity of AR technology in the past few years is mostly due to the great accessibility of mobile devices like smartphones and tablets to the majority of the world's population. The positive impacts of AR technology in general and AR games in particular on learning languages have been recently reported as this type of technology develops skills and knowledge, enhances learning experience, and improves collaborative learning (Cheng & Tsai, 2016).

AR games refer to computer/digital games that are played in a real-world environment with a virtual layer on top of it (Mills et al., 2020). They are now available free of charge in the market with educational purposes with entertainment as an added value (Zhang & Zou, 2020). Research shows that AR games can have positive effects of learning and retention (Huang et al., 2021) as well as on learners' motivational and affective factors (Connolly et al., 2012). AR games have made it possible for users/players to interact with both the objects in the virtual world and people in the real world and hence avoid the social isolation resulting from anxiety and apprehension.

AR-based systems and technology have been recently involved in various levels of education from early preschool programs to the curriculum programs of colleges and universities (Sirakaya & Alsancak Sirakaya, 2018). Even though AR can be employed in a wide gamut of scenarios, Yuen et al. (2011) have categorized them into five major groups: discovery-based learning, object modeling, skills training, AR books, and AR games. The use of AR books and AR games has been particularly increasing in the past decade with 3D pop-books gaining increased popularity among children including printed triggers such as images and QR codes which activate a virtual overlay comprising texts, images, audio and video. This medium can provide children with a more immersive experience of learning and instruction.

It has been proposed that AR systems have many educational advantages which traditional educational methodologies and even other types technologies cannot provide learners with (Tosik-Gün & Atasoy, 2017). The development of educational AR applications has been increased so that different academic programs can use such technologies for instructional purposes. There has been a king of paradigm shift in the use of computerized technologies in educational contexts including all areas of the educational domain. According to Giasiranis and Sofos (2017), the main advantages of using AR in education include raising students' interest and classroom engagement, practical firsthand learning, cheaper costs of learning, easily available study materials, and enhancement in the memory capacity of learners.

The investigation of the role of AR technology in L2 learning, particularly in ESL and EFL contexts, has gained popularity in the second decade of the new millennium. In one early study, Hwang et al. (2016) studied the effect of AR-based educational games on EFL learners' language achievements and attitudes. They used a competitive gaming approach to place learners in the context. They compared two classes: one class taught with traditional book-based language activities and one with AR-based games on smartphones. Their experimental findings showed that AR can significantly improve the
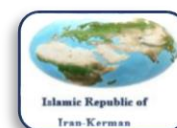
language achievements of the learners and enhance their overall attitudes towards using technology in the classroom. Similarly, Taskiran (2018) also observed that using AR games could positively influence EFL learners' motivation regarding learning the English language. In another similar study, Chen et al. (2020) investigated the impact of AR-enhanced theme-based EFL activities on Chinese EFL learners' language achievements, motivation, and attitudes. The effects of AR were mediated by using captions (i.e., non-caption, English caption, and Chinese caption) and proficiency levels of the learners (i.e., less proficient and proficient). The researchers included six classes in their study all using tablets for AR purposes. Factorial analysis was conducted and the results showed that captions could not significantly affect knowledge comprehension, but English proficiency played a meaningful role in this regard. The researchers observed that English captions put a heavy cognitive load on learners and hindered less proficient learners from gaining knowledge. Thus, it seems that AR-based videos with English captions are more suitable for more proficient EFL learners as less proficient ones cannot benefit much from them. Moreover, more proficient learners had more positive attitudes toward using AR technology than their less proficient counterparts.

Tsai (2020) focused on the effect of AR on Taiwanese EFL learners' degree of vocabulary learning. In this study, AR-based vocabulary instruction was compared with traditional lecture-based method in a quasi-experimental design. The researcher used tests, questionnaires, and interviews to triangulate the data. The results of the research revealed that AR was significantly more effective than the traditional lecture-bound method in increasing the vocabulary knowledge of EFL learners. Moreover, EFL learners were more motivated to learn English vocabulary via using AR systems than using lectures. Overall, Tsai (2020) argues that AR can provide EFL learners with a lot of potentials provided that the necessary technology is available to the EFL syllabus designers and teachers. In another study, Wang and Khambari (2020) investigated the use of AR games on EFL learners' improvements in learning English grammatical structures. They studied how teacher's role is influenced by AR games in the classroom, and how AR games could improve the learning of English grammar of Chinese EFL learners. The results of the study showed that AR games could enhance learners' motivation, grammar scores and reduce learning mental pressure as a fun activity. Moreover, AR games could present a learning environment which facilitated collaborative learning via enhancing learning motivation and providing more discussion, time and learning materials for EFL learners.

In the ESL context, Khoshnevisan (2020) investigated the effect of AR-infused instruction of idiomatic expressions on Iranian EFL learners' idiom achievement, motivation, and perceptions. The participants of the study were Iranian EFL students studying English at university level in the United States. They were instructed Vivid-Phrasal idioms vi traditional flashcards in the control group and AR-infused flashcards in the experimental group. His findings showed that both types of instruction increased ESL learners' idiomatic achievements equally with no significant difference. Yet, AR-infused materials increased the motivation of learners to learn idioms more than the traditional method. Belda-Medina (2022) also investigated the attitudes and perceptions of EFL pre-service teachers regarding AR as an authoring tool in mobile collaborative learning in teacher training programs. The participants of the study were 229 Spanish EFL pre-service teachers studying English at university to become teachers in the future. The results showed that pre-service teachers lacked practical training in creating AR materials

and implementing AR appropriately from technological and instructional perspectives, but they all had positive attitudes towards using AR technology in EFL teacher training programs for more collaborative learning. It should be mentioned that the majority of participants also mentioned that although AR is a promising instructional tool, meticulous training is needed to make future teachers ready to use such a technology appropriately and practically.

More recently, Marrahi-Gomez and Belda-Medina (2023b) studied the effect of AR on vocabulary acquisition and motivation of secondary-level EFL learners. They also measured the perception of students toward AR and investigated the effect of AR on students' motivation. Quantitative and qualitative data analysis revealed positive attitudes of students toward AR and their strong interest in it. However, no statistically significant difference was found in vocabulary acquisition between the experimental and the control group. In another study, Marrahi-Gomez and Belda-Medina (2024) examined the effect of AR on English grammar learning and student motivation in secondary education. Using a mixed-methods approach, they also assessed students' attitudes toward the use of technology in language classes. Through convenience sampling, they divided their secondary-school participants into a control group, which followed traditional education, and an experimental group which went through AR-based teaching. The results showed a strong interest and positive attitude toward integrating AR technology into grammar learning. However, the experimental group showed no statistically significant improvement in grammar learning compared to the control group. The authors suggest that more research is needed to explore the long-term impacts of AR on language learning.

As the above review of literature shows, little is known about the effect of AR games on EFL learners' speaking abilities particularly in the Iranian EFL context on the one hand and the impact of such technology on reducing learners' communication and speaking apprehension on the other, this study aimed to accomplish two purposes. First, to bridge the above-mentioned gap, this study examined the effect of collaborative, online AR games on improving Iranian EFL learners' speaking proficiency as compared with traditional real-world classroom practice. Second, it investigated the effect of collaborative, online AR games on helping Iranian EFL learners reduce their communication apprehension while speaking in English.

## METHODOLOGY

### Participants

The participants of the study were selected based on the convenience sampling method form EFL learners studying at a language institute in Tehran, Iran. The age range of the participants was between 16 and 25. All the participants spoke Persian as their first language, and none of them had the experience of living in an English-speaking country. The participants included 60 adult females EFL learners who were placed at the intermediate level by the routine institute's placement and achievement testing procedures. Nevertheless, in order to make sure that all learners belonged to the intermediate level of proficiency, the Oxford Placement Test was administered, and only learners within the score range of 40 to 60 (B1 intermediate in CEFR proficiency levels) were included in the study (Gómez-López et al., 2010). The learners were then divided into two groups randomly: one experimental group ($N = 30$), who received ordinary book-based speaking activities and task together with extra practices via online AR games for

10 1-hour sessions, and the control group (*N* = 30), who received only ordinary book-based speaking activities and tasks for 10 1-hour sessions.

## Materials and Instruments
### Oxford Placement Test (OPT)
Oxford Placement Test (OPT) is one of the most frequent, standard tests for placing ESL/EFL learners at their appropriate language proficiency level. The OPT scoring scale ranges from 0 to 120 with CEFR proficiency levels from Pre-A1 up to C2. The sample of the OPT used in this study included 25 multiple-choice pictorial items, 15 questions in the format of multiple-choice cloze text, 20 grammatical multiple-choice items, and 10 multiple-choice vocabulary items. The whole test lasted 40 minutes. This test was done to make sure that all participants of the study belonged to the intermediate level (scores from 40 to 60).

### Speaking Test
The speaking test used in the study for both the pretest and post-test was a researcher-made speaking task with two main sections: Section 1 asked for general information requiring students to briefly introduce themselves plus talking about some general easy topics related to work, education, homeland and leisure. The second part was adopted from the assessment package of the main course book (i.e., Top Notch 3), which consists of some open-ended questions as well as a picture description based on the content of the course (the treatment and teaching program). The test was also piloted by 10 intermediate learners to be checked for the reliability of the scores achieved by the students (internal consistency of test) and any possible ambiguities and issues in terms of the structure and content. The participating learners' speaking performance in both pretest and post-test were scored based on a range from 1 to 20 according to Farhady et al.'s (1994) speaking rating scale.

### Communication Apprehension Questionnaire
In this study, in order to investigate learners' communication apprehension, the communication apprehension section of the foreign language classroom anxiety scale (FLCAS) developed by Horwitz et al. (1986) was used. The communication apprehension section of this scale includes seven items with a 5-point Likert-scale ranging from strongly agree (1) to strongly disagree (5). The higher the score, the less communication apprehension with each participant's score ranging from 7 (the highest apprehension) to 35 (the lowest apprehension). The reliability of this scale has been confirmed in the literature (e.g., $\alpha$ = 0.93 in Horwitz et al., 1986). It should be noted that the Persian version of the apprehension scale was utilized in this study for a better understanding on learners' part. The Persian back-translated version is also reported to have a high reliability ($\alpha$ = .75) by Mojerloo (2018).

### AR Games
For the experimental group to engage in playing and practicing with online, collaborative games in their classes, two popular free-of-charge AR games in a form of smartphone applications were used: PORORO World-AR Playground and ARLOOPA: AR Camera. In the first game, users can team up and

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collaboratively pass through different levels in a friendly and fun atmosphere. In the second game, users can create 3D objects in a virtual world can add up different characteristics to them. Both games are suitable for language learners to use language communicatively in pairs and/or groups to deal with the tasks and challenges provided in the virtual world.

**Main Course book**

The course book based on which the main speaking topics and activities for both groups were selected was Top Notch 3 3rd Edition (Saslow & Ascher, 2015). This series is the main course book used in the syllabus of the institute. In this study, we taught based on a handful of selected units of the books (two books: Top Notch 3 A and B) which are all communicative in nature with a lot of speaking exercises, activities, and tasks.

## PROCEDURE

To begin with, 60 adult Iranian female students studying in a language institute in Tehran, Iran, whose proficiency level was intermediate were selected to participate in the study. In order to make sure of their real proficiency level, the OPT test was also administered (40-60 scores as intermediate). The participants were then assigned randomly to two groups: one group as the experimental group received speaking practices and activities based on the course book plus extra AR game-based practices, and one group as the control group only received course book-based speaking activities and practices. The learners in the experimental group engaged in the conversations and speaking activities and tasks of the target course book units in a form of pair-work and group-work activities and classroom discussions. Moreover, they were also required to team up in groups of three and four to engage in the gaming process on their smartphones after they had downloaded the two AR games of the study (PORORO World-AR Playground and ARLOOPA: AR Camera) and were informed by the teacher how to play the game and pass through the levels collaboratively using only the English language. About 20 minutes of each session was devoted to gaming. Learners played the game levels in collaboration while trying to deal with the challenges of the game levels cooperatively using English language. The teacher also provided feedback while monitoring their performance or when learners had language questions. The teacher also wrote down some useful words, phrases, and idioms on the board which could help learners while communicating which other playing AR games. On the contrary, the control group only had ordinary practices of the speaking activities and tasks of the target book practiced in the classroom in a form of pair-work and group-work activities. No online games were practiced whatsoever in the treatment sessions of the control group.

Both groups had 10 1-hour sessions as their instructional period. Before the instruction began, both groups completed their speaking and communication apprehension questionnaires as the pretest. At the end of the instructional period, they had the same speaking test and communication apprehension questionnaire as the post-test. It should be noted that all learners of the study were informed about the procedure and purpose of the study, and their consents were received. Finally, learners' scores in the pretests and post-tests were compared for statistically significant differences within and between the groups.
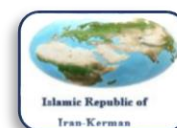
After collecting the data, using a pretest and a posttest design, various statistical analyses including both descriptive and inferential statistics were used. Descriptive statistics were used to observe means and standard deviations of the speaking and communication apprehension scores of the two groups. Then, to investigate the research questions and hypotheses, normality tests and t-tests (paired- and independent-samples) were used to analyze the collected data from the two groups.

## DATA ANALYSIS AND RESULTS

### Results of Descriptive Statistics

To begin with, the descriptive statistics of the speaking pretest and post-test scores gathered in the experimental and control groups are shown in Table 1. Besides, Figure 1 shows the bar graph of the scores of the two groups.

**Table 1**

*Descriptive Statistics of Speaking Scores of the Two Groups*

| Groups | Tests | N | Minimum | Maximum | Mean | Std. Deviation | Skewness | Kurtosis |
|---|---|---|---|---|---|---|---|---|
| Experimental | Pretest | 30 | 7.00 | 16.00 | 11.500 | 2.161 | -.195 | -.303 |
| | Post-test | 30 | 9.00 | 18.00 | 14.100 | 2.343 | -.329 | -.335 |
| Control | Pretest | 30 | 6.50 | 15.00 | 11.250 | 2.117 | -.332 | -.780 |
| | Post-test | 30 | 8.50 | 16.00 | 12.400 | 1.927 | -.302 | -.693 |

**Figure 1**

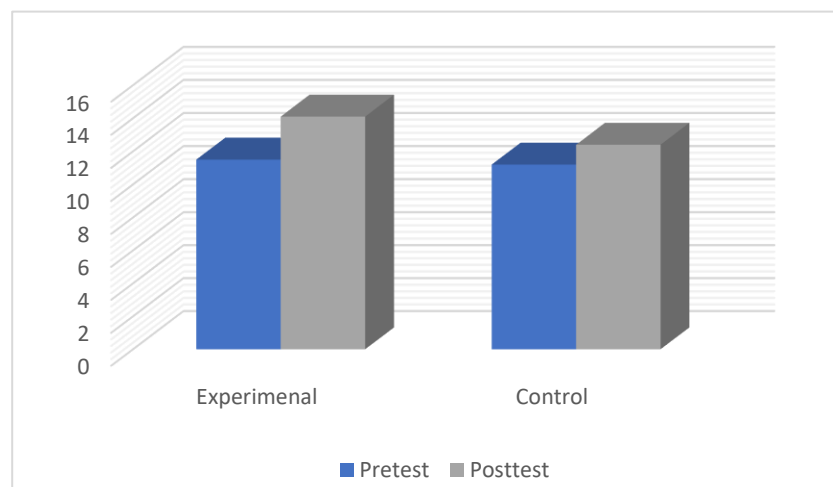*Speaking mean scores of the two groups*



Table 1 demonstrates that the speaking scores of the learners in both groups improved after having treatments from pretest to post-test: the experimental group increased from $M = 11.500$ to $M = 14.100$, and the control group increased slightly from $M = 11.250$ to $M = 12.400$. As also shown in Figure 1, the mean score of the experimental group increased considerably and more than the mean score of the control

group which rose slightly. Nevertheless, to statistically check if these improvements and differences are meaningful and significant, inferential statistics need to be conducted.

In terms of the communication apprehension scores, the descriptive statistics of the pretest and post-test scores of the learners in two groups are shown in Table 4.2. Figure 4.2 also demonstrates the bar graph of the communication apprehension scores of the learners in two groups. As can be seen, the overall results of the descriptive statistics of communication apprehension scores revealed that although the mean score of experimental group improved from $M = 19.066$ to $M = 24.733$ from the pretest to post-test, the mean scores of the control group did not change considerably (decreased negligibly) from $M = 19.100$ to $M = 19.066$ from the pretest to post-test (see also Figure 2). Yet, inferential statistics should be conducted to check if such differences are significant or not.

**Table 2**

*Descriptive Statistics of Communication Apprehension Scores of the Two Groups*

| Groups | Tests | N | Minimum | Maximum | Mean | Std. Deviation | Skewness | Kurtosis |
|---|---|---|---|---|---|---|---|---|
| Experimental | Pretest | 30 | 10.00 | 29.00 | 19.066 | 5.871 | -.025 | -1.243 |
| | Post-test | 30 | 16.00 | 33.00 | 24.733 | 4.933 | -.105 | -1.135 |
| Control | Pretest | 30 | 12.00 | 28.00 | 19.100 | 4.071 | .307 | -.666 |
| | Post-test | 30 | 13.00 | 28.00 | 19.066 | 4.456 | .288 | -1.175 |

**Figure 2**

*Communication apprehension mean scores of the two groups*
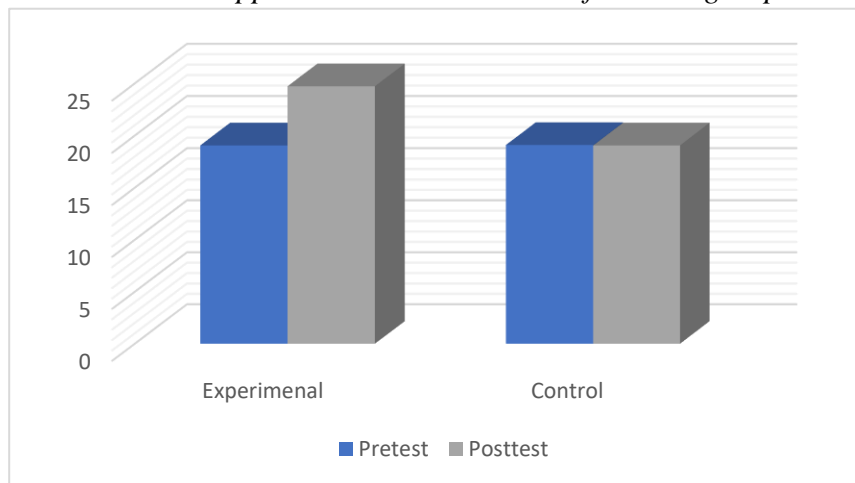


**Results of Normality of Distribution of Test Scores**

In order to conduct parametric inferential statistics, the distribution of scores for dependent variables should be normal for each value of the independent variable. To check whether this assumption is met or not for the continuous, interval scales of the study, the Kolmogorov-Smirnov and Shapiro-Wilk tests

of normality were utilized. Accordingly, Table 3 depicts the results of Kolmogorov-Smirnov and Shapiro-Wilk tests for the speaking scores of the learners in two groups in the pretest and post-test. Moreover, the normality graphs of the two groups' speaking scores are also shown in Figure 3.
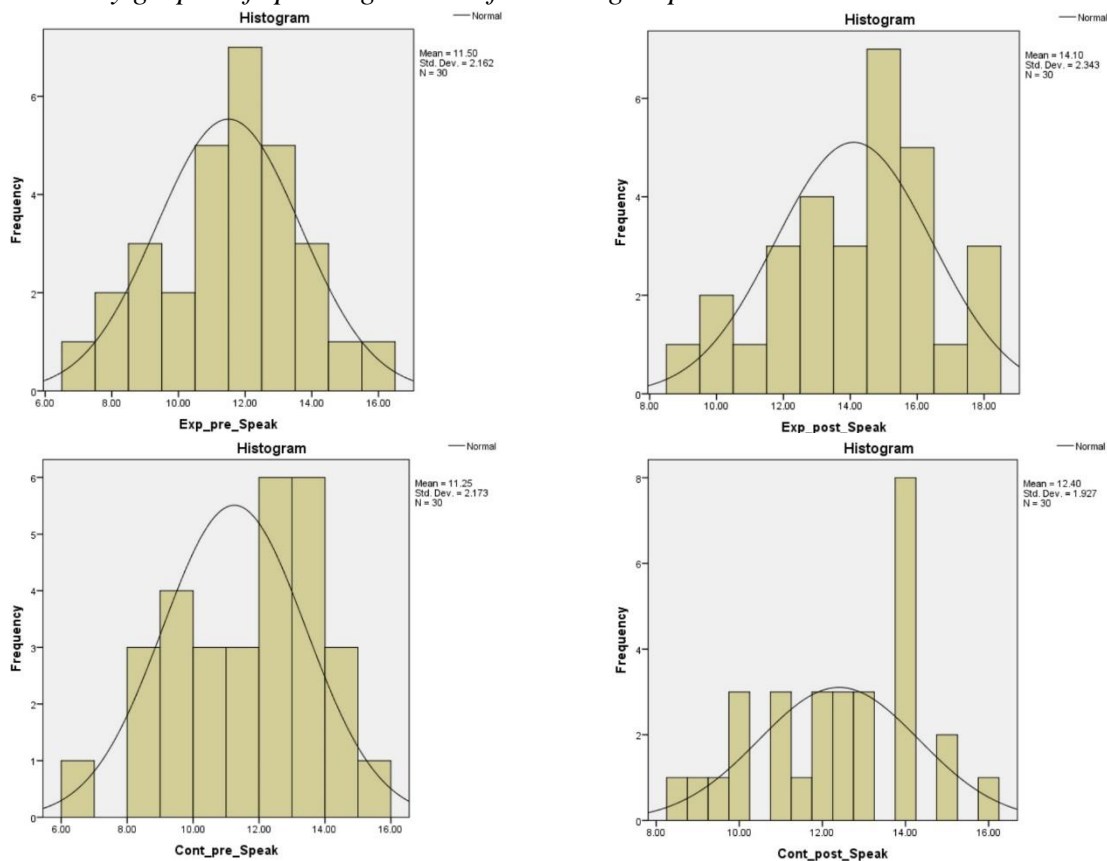
**Table 3**
*Results of Tests of Normality for Speaking Scores of the Two Groups*

|  | Kolmogorov-Smirnov | | | Shapiro-Wilk | | |
|---|---|---|---|---|---|---|
| Groups/Test | Statistic | df | Sig. | Statistic | df | Sig. |
| Experimental Pretest | .158 | 30 | .054 | .975 | 30 | .671 |
| Experimental Post-test | .101 | 30 | .200 | .969 | 30 | .523 |
| Control Pretest | .168 | 30 | .053 | .956 | 30 | .241 |
| Control Post-test | .163 | 30 | .0.58 | .935 | 30 | .068 |

**Figure 3**
*Normality graphs of speaking scores of the two groups*



According to the results of Kolmogorov-Smirnov and Shapiro-Wilk tests of normality observed in Table 3 as well as the schematic presentation of the data in the normality graphs (Figure 3), the speaking scores of both groups were normality distributed ($P > 0.05$). Thus, the data of speaking scores met the assumption of the normality of distribution, hence statistically appropriate for conducting

parametric inferential statistics for measuring significant differences and testing the null-hypotheses of the study.

Regarding communication apprehension scores, the distribution of scores for dependent variables had to be normal for each value of the independent variable so that parametric inferential statistical tests are legitimate. To check this assumption, the Kolmogorov-Smirnov and Shapiro-Wilk tests were used. Table 4 shows the results of Kolmogorov-Smirnov and Shapiro-Wilk tests for communication apprehension scores of the two groups. Besides, the normality graphs of the reading motivation scores of the two groups of the study are also shown in Figure 4.

**Table 4**

*Results of Tests of Normality for Communication Apprehension Scores of the Two Groups*

|  | Kolmogorov-Smirnov | | | Shapiro-Wilk | | |
|---|---|---|---|---|---|---|
| Groups/Test | Statistic | df | Sig. | Statistic | df | Sig. |
| Experimental Pretest | .125 | 30 | 200 | .943 | 30 | .111 |
| Experimental Post-test | .113 | 30 | 200 | .956 | 30 | .247 |
| Control Pretest | .146 | 30 | 103 | .956 | 30 | .246 |
| Control Post-test | .128 | 30 | 200 | .935 | 30 | .068 |

**Figure 4**

*Normality graphs of communication apprehension scores of two groups*
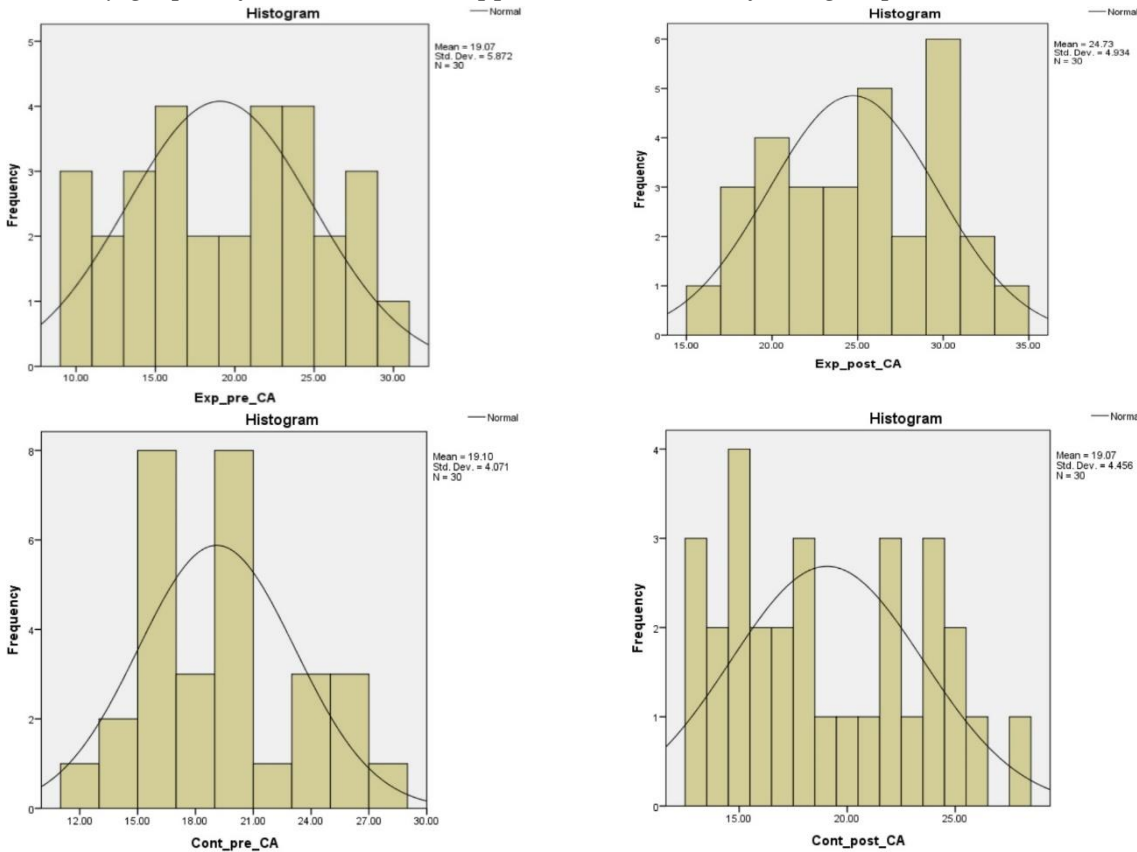
According to the results of Kolmogorov-Smirnov and Shapiro-Wilk tests of normality observed in Table 4 as well as the schematic presentation of the data in the normality graphs (Figure 4), the speaking scores of both groups were normality distributed ($P > 0.05$). Thus, the data of speaking scores met the assumption of the normality of distribution, hence statistically appropriate for conducting parametric inferential statistics for measuring significant differences and testing the null-hypotheses of the study.

**Inferential Statistics: Testing the Research Hypotheses**
**Testing the First Research Hypothesis**
The first research hypothesis of the study proposed that using collaborative, online AR games does not have any statistically significant effect on the speaking performance of Iranian intermediate EFL learners. The results of descriptive statistics (see Table 1) showed that both groups improved in their mean scores from the pretest to post-test though the improvement in the control group was very slight: the experimental group from $M = 11.500$, $SD = 2.161$ in the pretest to $M = 14.100$, $SD = 2.363$ in the post-test and the control group from $M = 11.250$, $SD = 2.117$ in the pretest to $M = 12.400$, $SD = 1.927$ in the post-test. However, to check whether these differences were significant or not, independent-samples and paired-samples t-tests were run.

First, an independent-samples t-test was run to see if the two groups were significantly different from each other regarding speaking pretest and post-test scores. Table 5 shows the results.

**Table 5**
*Results of Independent-Samples T-Test for Between-Group Differences in Speaking Scores in Pretest and Post-test*

| | F | Sig. | t | df | Sig. (2-tailed) | Mean Difference | Std. Error Difference | Lower | Upper |
|---|---|---|---|---|---|---|---|---|---|
| Pretest Speaking Equal variances | .107 | .745 | .745 | 58 | .657 | .2500 | .5595 | -.8700 | 1.3700 |
| Post-test Speaking Equal variances | .773 | .383 | 3.069 | 58 | .003 | 1.7000 | .5538 | .5912 | 2.8087 |

As observed in the results of the independent-samples t-test (Table 5), it can be concluded that although both groups were not significantly different in the pretest ($t(58) = .745$, $P > 0.05$), they became significantly different in the post-test ($t(58) = 3.069$, $P < 0.05$). This proves that the experimental group significantly outperformed the control group in terms of speaking performance after receiving online AR games as a treatment. However, to examine within-group significant differences in the pretest and post-test scores of the two groups, a paired-samples t-test was run. Table 6 depicts the results.

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**Table 6**

*Results of Paired-Samples T-Test for Within-Group Differences in Speaking Pretest and Post-test Scores*

| Groups | Mean | Std. Deviation | Std. Error Mean | 95% Confidence Interval | | t | df | Sig. (2-tailed) |
|---|---|---|---|---|---|---|---|---|
| | | | | Lower | Upper | | | |
| Experimental | -2.600 | 1.499 | .273 | -3.1598 | -2.040 | -9.497 | 29 | .000 |
| Control | -1.150 | 1.001 | .182 | -1.523 | -.776 | -6.291 | 29 | .000 |

The results shown in Table 6 reveal that the speaking scores of both groups significantly improved in the post-test after receiving the treatments. However, as also shown by the results of the independent-samples t-test and considering the mean scores of the two groups, it can be concluded that whereas both types of treatment could improve the speaking scores of Iranian EFL learners, online AR games-based instruction was significantly more effective than the traditional book-bound speaking practice. Thus, based on these results, the first research null-hypothesis of the study is rejected.

**Testing the Second Research Hypothesis**

The second research hypothesis of the study proposed that using collaborative, online AR games does not have any statistically significant effect on the communication apprehension of Iranian intermediate EFL learners. The descriptive statistics showed that unlike the experimental group which improved considerably in their mean communication apprehension scores ($M = 19.066$, $SD = 5.871$ in the pretest to $M = 24.733$, $SD = 4.933$ in the post-test), the control group experienced no improvement in the mean scores ($M = 19.100$, $SD = 4.056$ in the pretest to $M = 19.066$ $SD = 4.071$ in the post-test) (see Table 2). Nevertheless, to check whether these differences were significant or not, independent-samples and paired-samples t-tests were used.

First, independent-samples t-test was run to see if the two groups were significantly different from each other regarding communication apprehension scores in the pretest and post-test. Table 7 shows the results.

**Table 7**

*Results of Independent-Samples T-Test for Between-Group Differences in Communication Apprehension Scores in Pretest and Post-test*

| | | F | Sig. | t | df | Sig. (2-tailed) | Mean Difference | Std. Error Difference | Lower | Upper |
|---|---|---|---|---|---|---|---|---|---|---|
| Pretest CA | Equal variances | 7.787 | .007 | -.026 | 58 | .980 | -.0333 | 1.3045 | -2.5446 | 2.5779 |
| Post-test CA | Equal variances | .210 | .648 | 4.669 | 58 | .000 | 5.6666 | 1.2137 | 3.2370 | 8.0963 |

As depicted in the results of independent-samples t-test (Table 7), it can be proved that although there was no significant difference in the pretest scores of communication apprehension ($t(58) = .026$, $P > 0.05$), there was a significant difference in the post-test ($t(58) = 4.669$, $P < 0.05$). This proves that the experimental group significantly outperformed the control group in terms of reducing communication apprehension level after receiving online AR games as a treatment. However, to examine within-group significant differences in the pretest and post-test scores of the two groups, paired-samples t-test was used. Table 8 shows the results.

**Table 8**

*Results of Paired-Samples T-Test for Within-Group Differences in Communication Apprehension Pretest and Post-test Scores*

| Groups | Mean | Std. Deviation | Std. Error Mean | 95% Confidence Interval Lower | Upper | t | df | Sig. (2-tailed) |
|---|---|---|---|---|---|---|---|---|
| Experimental | -5.6666 | 2.9517 | .5389 | -6.7688 | -4.5644 | -10.515 | 29 | .000 |
| Control | .0333 | 1.9025 | .3473 | -.6770 | .7437 | .096 | 29 | .924 |

The results shown in Table 8 reveals that only the communication apprehension scores of the experimental group who received online AR games as treatments reduced significantly ($t(29) = -10.515$, $P < 0.05$) and not the communication apprehension scores of the control group ($t(29) = .096$, $P > 0.05$). Thus, it can be concluded that online AR games significantly reduced the level of communication apprehension among Iranian EFL learners. Consequently, the second research null-hypothesis of the study is also rejected.

**DISCUSSION**

The current study aimed to investigate the effect of collaborative, online AR games on Iranian intermediate EFL learners speaking performance and their level of communication apprehension. Two groups underwent treatment in line with the purpose of the study: the experimental group, who received online AR games-based instruction, and the control group, who received ordinary book-based speaking activities. In general, it was found that AR games as extra communicative activities could significantly improve learners speaking scores. Moreover, it was also observed that using AR games in a collaborative context could reduce the degree of communication apprehension among the learners.

The first research hypothesis of the study proposed that using collaborative, online AR games does not have any statistically significant effect on the speaking performance of Iranian intermediate EFL learners. The results showed that both types of instruction used in this study, that is online AR-based and ordinary book-bound instructions, were effective in improving EFL learners' speaking proficiency, but the level of improvement was significantly higher among those EFL learners who played online AR games as speaking activities and tasks. The positive effects of using computer games and AR games

which combine reality with a virtual world for the purpose of education (Perry, 2018) has been recently brought into the attention (e.g., Abad-Segura et al., 2020; Huang et al., 2021; Perry, 2021). Hsu (2017) maintained that using virtual world via online AR games can be specifically helpful for learners of English in EFL contexts because they are usually in short of communication with other English-speaking interlocutors. Indeed, as argued by Huertas-Abril et al. (2021), AR gaming can provide both ESL and EFL learners with extra communicative opportunities beyond traditional language classrooms and help them reduce negative affective filters, such as anxiety and apprehension, via practicing the target language abundantly.

The findings of this study showed that using AR games was more effective than traditional book-based speaking activities which are common in many EFL syllabuses. This result is already echoed in the literature regarding other language skills and psychological variables in different learning contexts. For example, Lai and Chang (2021) reported that AR games played on EFL students' cellphones not only increased the rate of English vocabulary learning but also raised their learning motivation. Similarly, Wang and Khambari (2020) found that game-based AR could enhance the degrees of collaboration among English learners and help them improve in making English sentences in both speaking and writing. Moreover, in the Iranian EFL context, Khoshnevisan (2020) observed that AR games as classroom activities improved EFL learners' idiomatic achievements and motivation. The Iranian EFL learners in Khoshnevisan's (2020) study, not only increased their learning motivation by playing AR games tailored for English learning but also were able to use English idiomatic structures more frequently with less anxiety and apprehension.

One of the main reasons for such learning improvement is that AR games are very motivating for young and teenage language learners in nature. Computer games in general are a very powerful tool to be used for educational purposes because they can provide students with visionary attractions and world-like free experiences which they cannot have access otherwise (Mayer, 2009). Therefore, AR games which are more interactive and real-life in essence can act as an extra drive for learners to engage with the process of language learning and use as much as possible (Wang & Khmabari, 2020). This advantage is reflected in EFL teachers' and learners' positive perceptions regarding using AR games in language learning. For example, Taskiran (2018) reported that Iranian EFL learners considered AR gaming as a great potential for language learning, especially for oral communicative skills, provided that the technology and required internet platforms support the smooth implementation of games in the classroom on students' tablets or mobile phones. Although, as also stated by Wang et al. (2016), teachers should also be educated on how to make use of such technology for language learning purposes and let their students benefit from AR games for different language skills under their supervision.

The other finding of the study concerns the significant positive effect of using collaborative online AR games on reducing EFL learners' level of communication apprehension. In this study, it was observed that traditional book-based speaking activities could not have significant effects on decreasing learners' communication apprehension whereas AR games did so to a high degree. As one main component of foreign language anxiety, communication apprehension has been defined as the level of fear or anxiety of an individual arising from either real or anticipated communication with other individuals (McCroskey & Richmond, 1995). It is regarded as one of the main negative affective filters that can influence the development and performance of speaking skills in EFL learners and users (Horwitz, 2010; Korpela,

2011). Research has revealed that high levels of communication apprehension make learners strive to avoid communication orally, slowing down the process of L2 speaking development (Mojerloo, 2018; Seifoori, 2016).

The results of the second research question of present study are in line with those of Marrahi-Gomez and Belda-Medina (2003b; 2004), who showed that students had positive attitudes toward and strong interest in using AR in EFL classes. Having positive attitudes toward a specific activity or technique in the language class can lead to a better and more friendly atmosphere in the class and the decrease of communication apprehension. Few other studies have been conducted on the effects of AR games on the psychological aspects of ESL and EFL learners. Among these studies, most have focused on motivation. For example, Taskiran (2018) observed that game-based AR delivered via cell phones can increase Turkish EFL learners' motivation and make the process of language learning quite enjoyable for them. Although foreign language anxiety was not the focus of the study, Taskiran (2018) argues that games in general and computer games in particular can help learners feel less anxious and more confident in language performance. Similarly, Tsai (2020) found that AR games could increase intrinsic motivation among Chinese EFL learners which results in more confidence and lower levels of anxiety and apprehension. Khoshnevisan (2020) also reported the positive effects of AR gaming on Iranian EFL learners' motivation and perception towards learning English. Korosidou (2024) also showed that using AR applications in EFL classes of very young learners improved their motivation and satisfaction with the EFL class. Korosidou believes that the reason why young EFL learners found AR applications motivating and engaging is that AR approach is fun, interesting and easy for them, which results in better long-term learning. However, Hsu (2017) observed that not all type of game-based AR activities might be helpful for language learners because they may increase learners' learning and task performance anxiety in the classroom. Interestingly, he found that although both types of self-directed and task-based teacher-guided techniques led to higher learning outcomes in EFL learners, similar to the findings of this study, self-directed AR techniques increased the level of anxiety and communication apprehension but task-based ones did not.

Marrahi-Gomez and Belda-Medina (2023) summarize the advantages and disadvantages of using AR in EFL classes. According to them, the advantages of AR technology include:

1. Motivating factor: AR technology is more motivating than traditional materials because it engages several senses of the learners in a constructive process.

2. Economic factor: students of all ages possess a mobile device, which makes mobile learning superior to traditional learning in terms of portability, cost, flexibility, and ease of use.

3. Better emotional relationship outcomes: AR systems improve students' emotions toward learning and help students learn better as a result.

4. Interactivity factor: AR systems have interactive implementation in real-time, which means that the learners can change their activities based on AR.

5. Better understanding of abstract concepts: AR makes it possible to facilitate understanding of elements which are usually considered to be abstract.

6. Retention factor: According to the results of empirical studies, incorporating AR in the curriculum enhances the retention of concepts.

7. Autonomy factor: AR increases students' autonomy because it makes it possible for the students to learn and share knowledge among themselves.

The disadvantages of AR, according to Marrahi-Gomez and Belda-Medina (2023a), include the following:

1. Distraction factor: While using AR in the classroom, the students receive lots of information to be assimilated. They also have to work with different tools at the same time. This makes it difficult for the student to concentrate. The mobile device itself can also be a distracting factor because the student may decide to use it for other activities outside the objectives of the class.

2. Complexity factor: Some students may not have enough previous technological knowledge about the use of AR.

3. Control factor: In AR-incorporated classes, the teacher does not have full control of the students' learning, which is not favored by the teachers who prefer traditional methodology.

4. Skill factor: The teacher may not have enough technological knowledge about the use of AR.

5. Content factor: The content of the subject taught is provided in a generalized way and cannot be tailored to the individual needs of the learners.

Generally speaking, the use of AR technology in EFL classes has both advantages and disadvantages. However, as the results of the majority of the previous studies showed, the advantages seem to exceed the disadvantages. Moreover, based on the overall results of the current study, it can be concluded that game-based AR can positively influence the speaking performance of EFL learners and reduce their communication apprehension levels.

## CONCLUSION

The main finding of the study was that using collaborative, online AR games could significantly improve the speaking performance of the Iranian intermediate EFL learners. In general, the findings revealed that both AR game-based, collaborative instruction and ordinary book-based instruction were effective in enhancing the speaking proficiency of the learners, but in comparison, collaborative learning presented in an online AR-based game was statistically more effective. The other finding of the study concerns the significant positive effect of using collaborative online AR games on reducing EFL learners' level of communication apprehension. In this study, it was observed that traditional book-based speaking activities could not have significant effects on decreasing learners' communication apprehension while AR games did so to a high degree.

The use of computer games in teaching L2 has been developing in the past two decades with the advancements of computer games on PC platforms and then on smartphones and tablets (Perry, 2018). Among the newest types of computerized technologies is Augmented Reality (AR) games, in which the game player is located in a life-like virtual reality and is able to interact with various virtual items and objects around them (Huang et al., 2021). In general, research shows that this technology is conducive to the process of learning L2 especially in terms of learning grammar and vocabulary (Khoshnevisan, 2020; Lai & Chang, 2021; Tsai, 2020; Wang & Khmabari, 2020). Yet, few studies have put the limelight on the role of AR games and collaborative learning in improving EFL learners' language performance (Taskiran, 2018). According, focusing on the Iranian EFL context, this study investigated how AR game-

based collaborative instruction could enhance Iranian EFL learners' speaking performance as well as reducing their level of apprehension while engaging in speaking tasks.

The results of the study showed that AR games can provide an effective medium for collaborative learning in a less stressful learning environment by significantly increasing Iranian EFL learners' speaking performance but reducing their communication apprehension in English speaking. These findings highlight the importance of using AR games in EFL classrooms to present learners with ample communication practice in virtual contexts which represent real-life language use. As communication apprehension is regarded a powerful hindrance in L2 communication, EFL syllabus designers and language teachers can start to make use of such computerized online and/or offline games to foster an efficient communicative environment for the EFL learners. Consequently, more attention needs to be directed towards the use of computerized technology and computer games in EFL classrooms in the field of EFL instruction in the new millennium.

The present study, like any other studies, suffered from a number of limitations. Firstly, we could not have a randomly selected sample due to time and cost constraints. Therefore, the samples of the study were selected based on convenience sampling method. Thus, it can be argued that the studied sample cannot adequately represent the whole population. Secondly, the participants of the study included 60 Iranian intermediate EFL learners studying English in a language institute. No more participants were available to us. Thus, the generalizability of the findings to the whole Iranian EFL population needs to be done cautiously.

Based on the above-mentioned limitations, a number of suggestions for further research can be provided. The inclusion of more students both from the same level of proficiency and also different ones can present a bigger picture of the role of AR games and collaborative learning in teaching speaking skill to EFL learners across proficiency levels. Therefore, future studies can regard proficiency level as one of the main covariables of the study to see how the effectiveness of using computerized and online technology is influenced by the level of EFL command of the students.

The current study followed a quantitative design to answer the proposed research questions. For a more comprehensive understanding of the cons and pros of using computer games in general and AR games in particular in EFL instruction and both teachers and learners' attitudes towards such methodology, qualitative data can be also collected via interviews and observations. In this way, a mixed-method study can delve deeper into the minds of both teachers and learners regarding the practicality and efficiency of using AR games to teach English and compare such findings with quantitative results of the actual effects of implementing such instruction.

Last but not least, this study focused on the speaking skill among intermediate EFL learners in Iran. Computer games of different kinds, including AR games, as well as collaborative learning can be utilized for teaching different language skills and components such as listening, reading, writing, vocabulary, and grammar. Therefore, future studies can also focus on other language skills and components to see how this new line of educational technology can prove effective in improving EFL learners' performance in various language aspects in the Iranian EFL context.

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