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Synthesis of Research on Video Games for the Four Second Language Skills and Vocabulary Practice

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Abstract

The purpose of the present paper is to identify trends in the digital game-based second language learning research by synthesizing findings according to game types and genres, and their effect on reading, writing, speaking, listening skills, and vocabulary outcomes. A total of 26 studies were synthesized. The synthesis concludes that overall, both commercial and serious games and synthetic immersive environments have positive effects on learning outcomes, especially vocabulary. At the same time, the effectiveness of one game type or genre may depend on learners' gender, second language proficiency, gaming experience, and specific educational objectives. Traditional drill-and-practice may be more effective for vocabulary consolidation than some commercial games. Some learners may still prefer conventional instructions. Recommendations for further research are discussed.

Keywords

Digital Game-Based Learning, Video Games, Second Language Learning, Second Language Acquisition

1. Introduction

Computer games have been a part of our lives for over 50 years. In 1962, Steve Russell started the gaming movement with the development of *Spacewar* [1]. Since that time, the gaming industry has been constantly changing and growing. Presently, people worldwide spend 21 billion hours a week playing online video games [2] and not only for the sole purpose of entertainment. The research established the relationship between video gaming and real life learning [3]. In fact, theorists argue that when learners play some video games abstract

concepts from textbooks make a real or "situated meaning" [4] because they "treat the game as a world and they probe it and reflect on its responses in hopes of accomplishing their goals" [5]. Moreover, some video games facilitate the development of reading comprehension, basic knowledge, decision-making, collaboration, inductive logic, and strategic planning [6]. In such a way, video games are engaging environments that support repeated and challenging [7] interactions to help learners practice and enhance skills.

In the domain of computer assisted language learning (CALL), there are two approaches of implementing video games into the second language classroom: (1) adopt commercial off the shelf (COTS) games, which are created with the purpose of entertainment and (2) design synthetic immersive environments (SIEs) or serious games to support specific educational objectives. In other words, COTS games act, "as environments that may incidentally support language-specific learning" and serious games and SIEs "include an identifiable teaching presence specifically for improving some aspect of language proficiency" [8]. The main difference between serious games and SIEs is the design and delivery of the educational context. SIEs are virtual online collaborative spaces or platforms such as multi-user virtual environments (MUVEs) that have integrated features of commercial massively multiplayer online games (MMORPGs) [9]. Serous games, for instance, *Food Force*, have the features of commercial video games and can be played alone.

Peterson [10] identified the following game genres of both COTS and serious games and SIEs: MMORPG, simulation, adventure, first person shooter, sports, rhythm, manipulation, and MUVEs. MMORPGs, for example, *World of Warcraft* and *Ultima Online* require players to interact and collaborate with each other to complete quests in the virtual world. Simulation games, for instance, *The Sims*, simulate the situations that may occur in a real life. The distinctive feature of adventure games such as *Bone* is a narrative and interactive storyline. First person shooter games (e.g., *Counter-Strike*, *America's Army* or *Call of Duty*) were designed to repel the attacks with the weapon from a first person perspective. In sports video games players are a part of a sport team and encounter a simulation of football (*FIFA*), baseball (*MLB*), basketball (*NBA*), or hockey game (*NHL*). Rhythm games (e,g., *Dance Central*, *PaRappa the Rapper*, *Guitar Hero*) combine music, aural or textual language, and players' physical actions. In manipulation games such as *Word War* or *The Writing Pal* players should modify text, or match pictures with aural language in order to win the game. MUVEs are simulations of virtual world with a user-created content. Other types of SIEs may include augmented reality games (ARGs) that integrate augmented reality technology in such a way that real-life object or information becomes interactive and manipulative through digital devices; adaptive hypermedia system (AHS) for the teaching of languages at early age; and custom built platforms such as VirtUAM (**Appendix A**). With the development of new technologies video games can be played on a variety of platforms such as Personal Computers (PC), mobile devices (cell phones, tablets), and consoles (e.g., PlayStation, Xbox, Wii). In spite of the growing popularity of video games for language learning, there has been comparatively little exploration of the relationship between video games and second language acquisition.

In the area of second language acquisition, video games have attracted increasing attention from educational scholars over the last decade. A number of researchers [8] [10] [11] synthesized findings in this domain. Cornillie, Thorne and Desmet [8] quantitatively compared 82 studies in the field of digital game-based second language learning to explore the changes in research types from 1984 to 2010. The researchers found that the majority of studies were focused on conceptual design, development, and technological evaluation of game- based learning environments. The authors concluded that such attention to design issues might constitute a solid foundation for the "advancement of tutorial CALL tools as embedded elements within gaming environments" [8]. This large-scale meta-analysis is significant in terms of further research design applications; however, it does not address the relationship between video games and second language acquisition.

In a recent longitudinal literature review, Peterson [10] observed 27 studies published from 1970 to 2011 in the field of CALL. The review suggests that video games have positive effects on second language learners' engagement, motivation, spoken and written output, reading comprehension, pronunciation, and vocabulary acquisition. The negative aspects of gaming include learners' production of frequent errors, the lack of in-game features control, and mismatch between learners' expectations and game content. Although Peterson covered more than three decades of publications and discussed the methods, procedures, and limitations of each study in-depth, the question of gender, age, second language proficiency, and gaming experience and their relationship to video games language outcomes was not raised.

Reinhardt [11] evaluated 28 articles published from 2002 to 2012 and looked at CALL informed and digital game-based second language learning parameters such as second language acquisition approach, research

methods, measures and instruments, second language focus, game genre, context, and design elements, and learners' perceptions. Reinhardt found that video games are beneficial for second language learners' confidence and willingness to communicate, literacy development, and autonomous learning. Among the challenges, Reinhart underlined the linguistically diverse and complicated in-game language and learners' focus on game mechanics at the expense of language acquisition. However, Reinhardt did not mention learner demographics and did not draw any conclusions about which particular language skills can be developed through gaming, nor did he separate the language outcomes by game types and genres.

2. Purpose and Significance of Synthesis

In spite of growing attention to the effectiveness of video games on second language acquisition, the lack of a systematic research review in this area is evident. The review of previous research analyses identified gaps in the data collected. The lack of data synthesis on sample, game types, and genres requires further exploration. Commonly agreed upon views on language teaching and learning recognize that vocabulary, listening, reading, speaking, and writing are essential for the development of second language proficiency [12]. In order to gather more conclusive evidence about the educational value of video games, a stronger focus on the use of video games in these domains of language acquisition would be beneficial.

Digital game-based second language learning is a relatively new field, so there is limited number of empirical studies, which makes it difficult to conduct a meta-analysis. A synthesis of best evidence, on the other hand, is possible [11]. Reinhardt [11] argues that "exploratory and descriptive syntheses are important to determine common, operative elements of any analysis". Thus, the purpose of the present paper is to identify trends in the digital game-based second language learning research by synthesizing findings according to game types and genres, and their effect on the four language skills and vocabulary outcomes. This synthesis addresses to fill the gap in the literature and answer the following questions:

1) What video game types and genres are more accessible with respect to language variety, delivery, and language skills practice?

2) Is there a relationship between participants' age, gender, language proficiency, gaming experience and video games language outcomes?

3) What video game types have greater potential for second language skills and vocabulary acquisition?

3. Method

3.1. Data Collection and Inclusion Criteria

The electronic databases searched in the current review included ERIC, SpringerLink, Scopus, IEEE Xplore, Science Direct, ProQuest Dissertations & Theses, and Google Scholar. The search was focused on the research published in the peer-reviewed journals, government reports, PhD dissertations, and conference proceedings relevant to ESL, CALL, and gaming. The search terms used were "digital game-based learning" and "video games" in combination with "second language learning" and "second language acquisition". To address the main purpose of a synthesis, studies were considered relevant if they (1) contained evidence of video games' effects on four language skills and vocabulary outcomes, (2) provided sample data (gender and/or age, and second language), (3) provided information on game types and particular skills acquisition, (4) were in English, and (5) were published from January 2005 to January 2015. The synthesis focus is on qualitative, quantitative, and mixed-method studies involving male and female participants that are over 6 years old. Studies were excluded from the analyses if they had no information on game types or genres and if they were focused on affective variables such as motivation and attitudes. **Figure 1** shows the screening process of the 26 selected papers.

3.2. Data Analysis and Coding

The 26 papers that met the inclusion criteria were coded according to both video game and CALL-informed parameters [11]. Video game parameters included game types (COTS or Serious & SIEs), game genres based on Peterson's [10] system, game language, second language focus (four language skills and vocabulary), and device (PC, console, or mobile). CALL-informed parameters involved sample's demographics (gender, age, second language and gaming proficiency). The following categories were used for samples' age distribution: "6 - 7 years old", "11 - 16 years old", and "16+". Second language proficiency was categorized according to "0" (no proficiency) "elementary/beginner", "intermediate", and "advanced" levels. Gaming proficiency categories
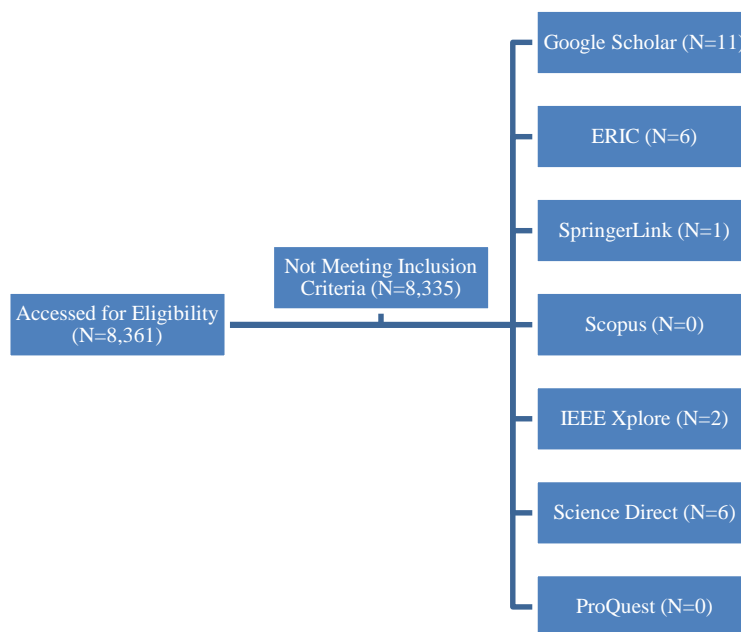
Figure 1. The screening process of papers.

included "gamers" (regularly played video games for over 3 years) and "non-gamers" (limited or no prior gaming experience). Additionally, seven articles [13]-[19] were included in a discussion section since they addressed some of the research questions such as gender and second language proficiency but they were excluded from the main list since they do not touch upon four language skills outcomes.

4. Results

4.1. Papers Identified by Search Terms

Table 1 shows the number of papers identified in each database using the specified search terms. The data demonstrates increased interest of scientific community in regards to the issues of second language learning through video games since 8361 papers were published during the last decade. However, only 26 publications met the inclusion criteria. The majority of papers were found in Google Scholar (42%), followed by ERIC (23%), Science Direct (23%), IEEE Xplore (8%), and SpringerLink (4%). The findings of these studies were summarized in Appendix A with respect to game type and title, second language and second language focus, sample data, method, instruments, outcomes, and researchers' names.

Table 2 shows the number of qualified papers split by the source of publication. Most of the articles were published in peer-reviewed journals (65%), followed by conference or symposium proceedings (31%), and government reports (4%).

4.2. Learner-Gamers Profile

4.2.1. Gender and Age

The results in Table 3 disclosed that 5011 learners took part in the studies. For these studies, 46% of the participants were male, 37% were female, and the gender and/or age of the participants was unknown for the remaining 17%. The bulk of the research involved participants that were 11 - 15 years old (73%) whereas learners of 16+ years consisted of 26% of the sample and 6 - 7 year olds represented 1% of the sample.

4.2.2. Second Language and Second Language Proficiency

The findings in Table 4 indicated that the majority of learners learned English (90%) as a second language (ESL) with less focus on Arabic (7%), German (2%), Japanese (0.4%), and Chinese (0.3%). Most of the learners (8%) had no prior knowledge of second language, followed by intermediate (3%), elementary or beginner (2%), and

Table 1. Total number of papers identified in search and number of papers meeting inclusion criteria.

Database	Total Number of Papers	Number of Relevant Papers
Google Scholar	5140	11
ERIC	95	6
SpringerLink	511	1
Scopus	3	-
IEEE Xplore	139	2
Science Direct	1037	6
ProQuest Dissertations & Theses	1436	-
Total	8361	26

Table 2. Total number of qualified papers split by publication source.

Source	Title	Number of Papers
Journals	Procedia-Social and Behavioral Sciences	1
	Educational Media International	1
	Language Learning & Technology	2
	Asian Social Science	1
	Computers & Education	2
	Interactive Learning Environments	1
	Foreign Language Annals	1
	CALICO	1
	International Journal of Artificial Intelligence in Education	1
	Speech Communication	1
	Interactive Technology & Smart Education	1
	Computer Assisted Language Learning	2
	Journal of Computer Assisted Learning	1
	The Reading Matrix	1
Conference/Symposium Proceedings	ICEEPSY (2011)	1
	DIGITEL (2008; 2010)	2
	Edutainment (2011)	1
	EUROGRAPHICS (2006)	1
	ICFDG (2009)	1
	ICCE (2012)	1
	Sandbox Symposium (2008)	1
Report No.	ED-04-CO-0036/0002	1
Total		26

Table 3. Number of learners split by gender and age.

Gender	Age				Total
	6 - 7	11 - 15	16+	N/A[a]	
Male	-	2027	260	-	2287
Female	40	1638	199	-	1877
N/A[a]	-	-	843	4	847
Total	40	3665	1302	4	5011

[a]Information is not available.

Table 4. Number of learners split by second language and second language proficiency.

L2	L2 Proficiency					Total
	0	Elementary/Beginner	Intermediate	Advanced	N/A	
English	40	4	125	44	4258	4471
German	-	85	-	-	15	100
Arabic	365	-	-	-	-	365
Japanese	-	-	20	-	1	21
Chinese	-	-	-	-	13	13
Total	405	89	145	44	4287	4970 (41[a])

[a]Number of native speakers involved.

advanced (0.9%) language proficiency participants. The proficiency level of 86% of the learners was not specified.

4.2.3. Second Language Proficiency and Gaming Experience
Table 5 shows the number of learners split by their second language proficiency level and gaming experience. The results revealed little attention of the research community to the relationship between these variables since the gaming experience of the majority of the participants (98%) was not indicated. Nevertheless, 1.6% of learners considered themselves as gamers and 0.4% of the learners as non-gamers.

4.3. Video Games Profile

4.3.1. Language of Games
Table 6 shows that 24 video games were used in the studies. Among 24 games, 11 were COTS, 13 were serious games and SIEs, respectively. The 91% of the COTS games were in English, followed by Japanese (9%) language. Serious games and SIEs were developed for English (62%), German (15%), Japanese (8%), Arabic (8%), and Chinese (8%) languages acquisition. In addition, the most popular titles of COTS games used in the reviewed papers were *Ever Quest II* (MMORPG), *The Sims* (simulation), and *Bone* (adventure).

4.3.2. Second Language Outcomes
Table 7 shows the number of COTS and serious games and SIEs split by genre and second language focus. The results indicate that the majority of COTS games were used for vocabulary enhancement (81%), with less focus on listening (55%), reading (45%), speaking (18%), and writing (18%). The serious games and SIEs were applied for vocabulary (54%), followed by listening (54%), speaking (38%), writing (23%), and reading (15%) skills acquisition.

4.3.3. Device
Table 8 shows that the most popular device for delivery of COTS games was personal computer, PC (82%) and

Table 5. Number of learners split by second language proficiency and gaming experience.

L2 Proficiency	Gaming Experience			Total
	Non-Gamer	Gamer	N/A	
0	-	-	405	405
Elementary/Beginner	1	-	88	89
Intermadiate	21	-	124	145
Advanced	2	-	42	44
N/A	-	81	4206	4287
Total	24	81	4865	4970 (41[a])

a. Number of native speakers involved.

Table 6. Number of games split by type, genre, and second language.

Game Type	Game Genre	L2					Total
		English	German	Japanese	Arabic	Chinese	
COTS	MMORPG	1	-	-	-	-	1
	Simulation	1	-	-	-	-	1
	Adventure	6	-	-	-	-	6
	First Person Shooter	1	-	-	-	-	1
	Sports	-	-	1	-	-	1
	Rhythm	1	-	-	-	-	1
	Manipulation	2	-	-	-	1	3
	Adventure	1	1	1	-	-	3
	MMORPG	1	-	-	-	-	1
Serious Games & SIEs	MUVEs	-	-	-	1	-	1
	VirtUAM	-	1	-	-	-	1
	AHSs	1	-	-	-	-	1
	ARGs	3	-	-	-	-	3
Total		18	2	2	1	1	24

Table 7. Number of games split by game type, genre, and second language focus.

Game Type	Game Genre	L2				
		Vocabulary	Reading	Writing	Listening	Speaking
COTS	MMORPG	1	-	-	-	-
	Simulation	1	-	-	-	-
	Adventure	6	4	2	4	2
	First Person Shooter	-	-	-	1	-
	Sports	-	1	-	1	-
	Rhythm	1	-	-	-	-
	Manipulation	2	-	1	-	-
	Adventure	2	1	-	1	-
	MMORPG	-	1	1	1	1
Serious Games & SIEs	MUVEs	1	-	-	1	1
	VirtUAM	1	-	1	1	-
	AHSs	1	-	-	-	-
	ARGs	-	-	-	3	3
Total		16	7	5	13	7

Table 8. Number of games split by game genre and device.

Game Type	Game Genre	Device		
		PC	Console	Mobile
COTS	MMORPG	1	1	-
	Simulation	1	1	1
	Adventure	6	4	2
	First Person Shooter	1	1	-
	Sports	-	1	-
	Rhythm	-	1	-
Serious Games & SIEs	Manipulation	3	-	-
	Adventure	3	-	-
	MMORPG	-	-	-
	MUVEs	1	-	-
	VirtUAM	1	-	-
	AHSs	1	-	-
	ARGs	-	-	3
Total		18	9	6

console (82%), followed by mobile devices (27%). The majority of serious games and SIEs can be delivered on personal computer (75%) and mobile devices (25%).

5. Discussion of the Findings

The purpose of this section is to provide answers to the research questions addressed at the beginning of the paper by summarizing the findings.

5.1. Question 1: What Video Game Types and Genres Are More Accessible with Respect to Language Variety, Delivery, and Language Skills Practice?

In response to this question, literature suggests that in terms of second language variety, serious games and SIEs provide more options compared to COTS games. Since serious games and SIEs allow the targeting of specific educational objectives, theoretically, they can be developed in any language. Although some COTS games support several languages, the majority of them are usually in English or Japanese [13]. In such a way, there are more COTS games available to practice English and Japanese as second language, while serious games and SIEs are suitable for a wide variety of languages enhancement such as German, Arabic, and Chinese.

The synthesis of research identified that both COTS and serious games and SIEs provide opportunities for second language skills acquisition. However, while both types of games were used for reading, writing, listening, speaking skills, and vocabulary enhancement, serious games and SIEs were more introduced than COTS games in such areas of language acquisition as speaking and writing. In other words, serious games and SIEs offer more support for language skills development. Addressing the question of what types of games are more accessible with respect to delivery, literature suggests that COTS games, especially adventure games, offer more options since they can be played either on personal computer, console, and mobile devices or on all three devices. The vast majority of serious games and SIEs can be played on a personal computer only. Thus, both COTS and serious games and SIEs provide opportunities for second language enhancement in terms of language variety, delivery, and language skills practice but specific language objectives and technology availability should determine the type of game, which may better suit the needs of teachers and learners.

5.2. Question 2: Is There a Relationship between Participants' Age, Gender, Language Proficiency, Gaming Experience and Video Games Language Outcomes?

In response to the question, the synthesis found some evidence of the relationship between age, gender, and language outcomes. With respect to the relationship between age and video games outcomes, this synthesis uncovered that reviewed studies did not consider this variable at all. However, the findings of a meta-analysis conducted by Wouters, Van Nimwegen, Van Oostendorp and Van Der Spek [20] revealed that learning through video games is more effective for children than adults. It is noteworthy, only 58% of analyzed studies provided information on both participants' gender and age. Since age variable may affect learning outcomes, this question requires closest attention.

In reference to the relationship between gender and video games language outcomes, research suggests that male participants usually play video games more than female, which may facilitate better vocabulary acquisition for males than females [16]. Literature also identified that male and female learners prefer different game genres. Males enjoy first-person shooter [21], MMORPGs [19] and adventure games [22], while females prefer offline single-player simulation games [16]. This may also result in better vocabulary performance of males than females [23]. To the contrary, Hitosugi, Schmidt and Hayashi [22] found no gender effect on vocabulary outcomes regardless of the fact that female participants did not like adventure game. In such a way, even though, the findings revealed some relationship between gender, age and video games outcomes, there is not enough evidence of true relationship between these variables due to a limited number of studies, which also yielded conflicting results.

Some relationship can be also established between learners' second language proficiency level and video games language outcomes. Findings in the research involving COTS games uncover that commercial games, particularly, MMORPGs [24], adventure [25] [26], and rhythm [27] may be challenging for the lower-level second language proficiency learners and inexperienced gamers because difficult game language, game missions, and game mechanics of these genres may cause cognitive overload. The findings also indicate that learners with elementary or beginner second language competency show little evidence of willingness to communicate in a target language [14] and are not able to significantly enhance vocabulary [24] through MMORPGs. By contrast, findings in the serious games and SIEs section suggest that learners with relatively low levels of second language proficiency may improve vocabulary [28]-[31], listening [28] [30] [32], writing [30], speaking [28], and reading [32] skills. ESL learners with a higher level of proficiency also may improve their academic writing skills [33] and vocabulary [22] but not significantly enhance listening and reading [32]. In such a way, COTS games may be challenging for second language learners with lower-language proficiency, while serious games and SIEs may facilitate better language outcomes for them. Thus, there is some evidence of the relationship between second language proficiency and video games language outcomes; however, the lack of studies focusing on this issue as well as the lack of information on participants' demographics leave the question inconclusive.

In regards to the question whether there is a relationship between gaming experience and video games language outcomes, findings reveal little attention to this issue since only 15% of the reviewed studies provide information on learners' gaming experience. At the same time, literature suggests that novice players may experience cognitive overload [19]; therefore, they usually need more time to get accustomed to the game's mechanics. Consequently, this can decrease the students' ability to communicate in a target language [15] during playing. In addition, unexperienced gamers with advanced second language proficiency may limit the participation in gaming sessions because of unfamiliarity with the game mechanics and in-game language. Meanwhile, experienced gamers with a high-beginner second language proficiency that act as mentors for less experienced players may improve their communicative competence [17]. In such a way, there is some evidence of the relationship between gaming experience and language outcomes but these findings should be treated with caution since only few studies discussed this question.

5.3. Question 3: What Video Game Types Have Greater Potential for Second Language Skills and Vocabulary Acquisition?

In response to this question, the research suggests that both types of games are promising in terms of second language skills and vocabulary acquisition. In spite of the challenges with the game mechanics the majority of the ESL learners are able to succeed in vocabulary learning through MMORPG [24] [34] [35], simulation [36]-[38], and adventure [23] [25] [26] [39]-[41] games. At the same time, synthesis revealed that vocabulary of

MMORPGs, sports, first-person-shooter, and strategy games is limited by specific terminology such as sports, military, history, and geography [13] [18] [21]; therefore, these game genres may suit better for specific lexicon learning. To the contrary, simulation games such as *The Sims* are helpful for the expanding the 2000 most frequent English words list [36]-[38]. In addition, although COTS facilitate vocabulary acquisition, there is not enough evidence that gaming is better than traditional classroom instructions [34] [35]. Some learners may still prefer conventional drill-and-practice approach [37].

Furthermore, findings disclose that different game genres may differently affect language skills outcomes. Sports and adventure games are found to be helpful for learners' listening and reading comprehension [25] [26] [40] [42] but less effective for writing and speaking [26] [40]. First-person shooter games [21] show little evidence of listening comprehension improvements and rhythm games [27] are less effective for vocabulary acquisition. In such a way, COTS games offer a variety of opportunities to enhance certain language skills, primarily, vocabulary but they may better suit the needs of more advanced second language learners who would like to practice language skills and interact with people who share common interests beyond the classroom.

Similarly to COTS, serious games and SIEs may be also challenging for learners since this type of games may contain difficult vocabulary [22], require immediate response and more advance game mechanics skills [43]; therefore, more scaffolding is necessary [22] [44]. At the same time, MUVEs [28], VirtUAM [30], AHSs [29], manipulation [31] [43], and adventure [22] [44] games are found beneficial for vocabulary acquisition; manipulation [33] and VirtUAM [30] for writing; and MMORPG for listening, reading, and writing [45]. Similarly to COTS, different types of serious games and SIEs may also differently influence the language outcomes. For instance, ubiquitous games or ARGs [46] and MUVEs [28] may increase gains in speaking and listening comprehension while MMORPG and adventure show little evidence of speaking [45] and listening [32] improvement. In addition, some of the participants may have less confidence in serious video gaming approach for second language acquisition in comparison to traditional classroom activities [44] [46]. In such a way, depending on the educational objectives the use of one or the other game genre may result in better language outcomes.

6. Conclusion and Recommendations

As in the previous reviews [11] this synthesis found lack of high-quality studies on video games implications for second language acquisition. Although 26 studies involving over 5,000 participants qualified for inclusion in terms of four language skills and vocabulary outcomes, 50% of the studies involved a small number of participants. The bulk of the research also did not provide information on participants' gender and exact age (42%), second language proficiency level (50%), and gaming experience (85%). Only 12 studies had experimental design.

Keeping this limitations in mind, there are several noteworthy points. First, generally, both COTS and serious games and SIEs have positive effects on learning outcomes, especially vocabulary. However, the effectiveness of one game type or genre may depend on learners' gender, second language proficiency, gaming, experience, and educational objectives, for example, language learning beyond the classroom. Second, traditional drill-and-practice may be more effective for vocabulary consolidation than COTS games. Finally, some learners may still prefer conventional instructions; therefore, learners' personal preferences and learning styles should be taken into consideration.

In such a way, more high-quality studies focusing on the relationship between age, gender, second language proficiency, gaming experience, and video games outcomes and more empirical evidence, are clearly needed. In addition, research in the field of second language acquisition through video games should focus more on game design features that facilitate second language skills enhancement. The findings of this review add to the growing body of evidence to the effects of video games for second language skills and vocabulary acquisition providing a number of key points that could be used to enrich second language learners' experience.

7. Limitations

The present synthesis is limited by the publication period of the articles, the search terms used, inclusion criteria, and a relatively small number of papers (26) included in the review. Due to the limited scope of the current paper, theoretical rationales of the studies and studies limitations are not discussed here as well. The biases associated with the articles selected and coded by a single researcher should also be taken into account since they may affect reliability of the synthesis.

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Appendix A. Summary Table of COTS and Serious Games and SIEs Findings

Game Genre	Game Title	L2	L2 Focus	Sample (M/F; Age; L2P & G/N) a	Method	Instruments	Findings	Authors
MMORPG	Ever Quest II	English	Vocabulary	4 (16+; beginner, intermediate, advanced; non-gamers)	Qualitative: Case Study Intervention: 16 hours	Post-game questionnaire Chat messages Game observations Interview Post-vocabulary assessment	(+) Intermediate and advanced ESL students increased their vocabulary by 40% as well as generated six times more chat messages than the high-level beginner and 2.5 times than the intermediate student; all four participants correctly defined 35% of words that were used only once in conversation with non-player characters and 55% of words that were introduced more than five times. (−)High-level beginner and low-intermediate ESL participants experienced cognitive overload.	Rankin *et al.* (2006)
	Ever Quest II	English	Vocabulary	24 (16+; advanced) 7 (16+; native speakers)	Mixed Method: Between Subject Experimental/ Content Analysis Intervention: Four hours	Pre-test Post-test Chat logs	(+) The ANOVA analysis of post-test scores revealed statistically significant difference between groups (p = 0.01): students who played with native speakers performed higher (55.56 ± 5.06) compared to single players (82.22 ± 5.54). (−) Students who had traditional classroom instructions performed significantly (ANOVA, p = 0.02) higher on *Vocabulary in Sentence Usage* post-test (score 54.78/100) than students (score 16.16) who played game; no statistical difference between groups for Vocabulary in the Context of the Game and Vocabulary outside the Context of the Game.	Rankin *et al.* (2008)
	Ever Quest II	English	Vocabulary	18 (16+; advanced) 8 (16+; native speakers)	Mixed-Method: Experimental/ Content Analysis Intervention: Four hours	Pre-game vocabulary assessment Post-test assessment Chat messages	(+)The ANOVA analysis of *Vocabulary in a Context of a Gameplay* post-test scores revealed statistically significant difference between groups (p < 0.05): students who played with native speakers performed better (score 83.33/100) than students who had traditional classroom instructions (60) and students who played the game alone (57). (−) Participants with traditional classroom instructions and participants who played game alone had similar scores in the vocabulary post-test (60 and 57); students with traditional instructions outperformed (score 54.78/100) students who played alone (16.16) and with native speakers (13.10) on Vocabulary outside the Game Context post-test.	Rankin *et al.* (2009)
Simulation	The Sims	English	Vocabulary	18 (M10/F8; 23; intermediate)	Quantitative: Experimental Intervention: Four 55 minute sessions	Pre-test Post-test Weekly quizzes Post-project Survey Questionnaires	(+)Students from all groups enhanced vocabulary (7.30 ± 0.73); Students with mandatory supplemental materials performed better (7.88 ± 2.48) than students with optional (6.61 ± 1.62) and no materials (6.89 ± 0.58); 94% of participants reported that supplemental materials were helpful. (−) The Tukey-Kramer post-hoc test revealed statistically significant difference only between students' scores who had mandatory and optional materials (p = 0.035).	Miller & Hegelheimer (2006)

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	Game	Language	Skill	Participants	Method / Intervention	Data Collection	Findings	Reference
Simulation	The Sims	English	Vocabulary	9 (16+; intermediate)	Mixed Method: Experimental Intervention: Four 55 minute sessions	Pre-test Post-test Weekly quizzes Post-project Survey (open-ended and Likert scale questions)	(+) Analysis of pre- and post-test scores indicated the statistically significant (paired-samples t-test: 0.05) increase of vocabulary by 14%. Students with mandatory materials outperformed (8.56 ± 1.33) learners with optional (5.78 ± 2.22) and no materials (6.89 ± 1.96); students found supplemental materials helpful (3.7 ± 0.5). Students reported that gaming experience was enjoyable (4±0.5) but it was not easy to play the game (3.4 ± 1). (−) One-way ANOVA established statistically significant difference only between students who had mandatory and optional supplemental materials (MD = 2.78, p = 0.01); students reported slightly disagreement that they could play the game without supplemental materials (2.6 ± 1.3).	Ranalli (2008)
	The Sims	English	Vocabulary	3 (M; 25.6; beginner)	Mixed-Method: Case Study Intervention: 4.5 hours per week during two months	Observations of a game play Semi-structured interviews Self-report checklist Pre-test Post-tests Vocabulary lists	(+) Participants independently acquired over 120 words; increased mark for participant 1 was 33.33, for participant 2 - 30.00, and for participant 3 - 23.33. The lack of both teacher's control and rigid syllabus as well as a stress-free gaming environment facilitated the autonomous learning and development of personal learning strategies.	Bakar & Nosratirad (2013)
Adventure	Sid Meier's Pirates Telltale Sam & Max	English	Vocabulary Listening Reading	15 (16+)	Qualitative: Case Study Intervention: Over 10 hours	Reflection paper	(+) Participants enhanced vocabulary, listening, and reading. (−) Difficult vocabulary; scaffolding support was required	Chen & Huang (2010)
	Bone	English	Vocabulary Listening Reading Writing Speaking	35 (M12/F23; 19; intermediate)	Quantitative: Case Study Intervention: N/A	Self-report Survey questionnaire (open ended and Likert scale questions)	(+) 11 participants reported that game helped with the vocabulary enhancement (3.83 ± 0.80), 18 listening (3.69 ± 0.60), and 16 reading (4.14 ± 0.52). (−) Difficult game missions and game language; the lack of game mechanics control; no/less gains in speaking (3.00 ± 0.85) and writing (3.10± 0.72).	Chen & Yang (2011)
	Bone	English	Vocabulary	22 (M3/F19; 19; intermediate)	Quantitative: Experimental Intervention: Two hours	Pre-test Post-test	(+) Two paired-samples t-tests revealed statistically significant difference between vocabulary pre- and post-tests in both groups; the post-test scores of note taking group was higher (6.27 ± 3.07) compared to the pre-test (4.27 ± 3.13). The group without note taking performed better on the post-test (5.91 ± 1.51) compared to the pre-test (4.09 ± 1.38). (−) No significant difference between groups in vocabulary gains: t(20) = −0.99, p = 0.746, 95% [−0.134, 0.97].	Chen & Yang (2013)

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Adventure	Back to the Future	English	Vocabulary Listening Reading Writing Speaking	60 (M10/F50; 19)	Quantitative: Survey Intervention: One hour	Survey questionnaire (open ended questions and Liker scale)	(+) 37 participants reported that game was helpful for vocabulary improvement (M = 4.17), 26 listening (M = 4.17), and 12 reading (M = 4.00); (−) Difficult in-game vocabulary; less gains in speaking (M = 3.00) and writing (M = 2.78).	Yang & Chen (2012)
	Runaway: A Road Adventure	English	Vocabulary	40 (M20/F20; 23-27/ intermediate)	Quantitative: Experimental Intervention: 120 hours	Pre-test (TOEFL) Post-test (Spearman-Brown reliability: 0.803) Questionnaire (Liker scale)	(+) Experimental group outperformed control group in post-test: 16.75 ± 1.585 compared to 14.05 ± 1.326. (−) In experimental group male participants performed better than female; female participants enjoyed adventure video game less than male	Vahdat & Behbahani (2013)
	L.A.Noire	English	Vocabulary	25 (M; 14-16)	Qualitative Intervention: N/A	Interview Observation of a game play	(+) Positive effects on gaining new vocabulary and its retention.	Shahriarpour & Kafi (2014)
First Person Shooter	America's Army	English	Listening	38 (M22/F16; 16+)	Mixed-Method: Experimental Intervention: N/A	Pre-test Post-test Interview Questionnair (open-ended & quantitative) Observations of a game play	(−) No significant gains in listening comprehension (game tutorial group: pre-test 43.57 ± 15.98 compared to the post-test 47.86 ± 21.19; vocabulary group: 47.33 ± 20.82 compared to the post-test 47.33 ± 22.52; female participants reported the lack of interest in the First-Person Shooter games.	Anderson et al. (2008)
Sports	Jiikyoo Powafuru Pro Yakkyu 6	Japanese	Listening Reading	1 (M; 27; gamer)	Mixed-Method: Case Study Intervention: 30-minutes twice a week (one month)	Pre-test Post-test Observation of a game play Game logs (self-report) Interview	(+) Enhancement of listening (seven additional expressions on the aural post-test were translated) and reading comprehension (pronounced 12 more kanji on the post-test and read some statistics in kanji). (−) Difficulty to focus both on game mechanics and on language learning.	DeHaan (2005)
Rhythm	Parappa the Rapper 2	English	Vocabulary	80 (M65/F15; 18-24; gamers)	Quantitative: Experimental Intervention: 20 minutes	Pre-test Post-test Delayed Post-test Opinion self-report Cognitive Load Questionnaire: mental effort (a > 0.85) and material difficulty (a = 0.4583)	(+) Two-week delayed vocabulary post-test indicated that watchers forgot more words (from 23.27 to 16.03) than gamers (from 7.42 to 5.15) because gamers spend more mental effort; although this difference was not statistically significant (t(39) = 1.78, p = 0.082). (−) Cognitive overload; a paired-samples t-test suggested that players recalled significantly fewer words compared to watchers (t(39) = 11.63, p < 0.05); both group noticed and recalled less known words than they reported in the written pre-test of game lyrics (e.g., watchers decrease was from 35.8 to 21.70 words, while gamers' from 35.7 words to 7.23).	DeHaan et al. (2010)

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MUVEs	Tactical Iraqi	Arabic	Vocabulary Listening Speaking	365 (16+; no L2 proficiency)	Mixed-Method Intervention: Study 1: 40 hours (twice a week over a period of three months); Study 2: 40 hours (eight hours per day for five days; Study 3: 40 hours (12 hours of classroom instructions and 28 hours one day gaming session)	Study 1: Questionnaire Study 2: Post-project standard oral Proficiency interview Study 3: Final mission rehearsal exercise All studies: Post test Game logs	(+) Statistically significant improvement of vocabulary and Arabic culture as well as listening and speaking (p < 0.01). (−) Decrease of language self-efficacy because the game did not meet participants' expectations.	Johnson (2010)
VirtUAM	OpenSim: The Supermarket Game	German	Vocabulary Listening Writing	85 (16+; beginner)	Quantitative Intervention: N/A	Pre-test Post-test Questionnaire	(+) vocabulary enhancement, listening (98% participants passed post-test compared to 37% of the participants who passed the listening pre-test), writing (40% of participants passed the writing post-test compared to 2% who passed the writing pre-test).	Berns *et al.* (2013)
AHSs	SHAIEx	English	Vocabulary	40 (F; 6-7; no L2 proficiency)	Quantitative: Experimental Intervention: Three 90 minute sessions per week for 45 days	Post-test	(+) Statistical significant difference (t(38) = 2.10, p = 0.042) between experimental and control groups in the post-test vocabulary scores: 7.8 ± 1.54 compared to 6.6 ± 2.03 respectively.	Aghlara & Tamjid (2011)
ARGs	Campus Environment Campus Life Campus Story Campus Environment	English	Listening Speaking	64 (13-14)	Mixed-Method: Quasi-experimental Intervention: Three game sessions	Pre-test (a = 0.78) Test 1, 2 &3 (a = 0.74, 0.82, 0.84) Post-test (a = 0.81) Survey (Likert scale, a = 0.91) Interview	(+) Game-based approach produced better learning outcomes (89.44 ± 7.45) compared to the non-gaming (81.25 ± 9.59) as well as games increased students' learning motivation (4.15 ± 0.66) more than traditional approach (3.63 ± 0.62). (-) Participants reported that games should be used in combination with traditional teaching instructions.	Liu & Chu (2010)
	No Name	English	Vocabulary	100 (M87/F13; 16+)	Mixed-Method: Quasi-experimental Intervention: Two 50 minutes lessons a week (six weeks)	Pre-test Post-test Questionnaire Interview	(+) Participants in gaming group outperformed participants from a group with traditional instructions (11.78 ± 2.269 compared to 8.59 ± 2.718); 68% of participants preferred gaming to traditional instructions. (−) Advanced game skills were required; immediate response distracted from learning.	Yip & Kwan (2006)
Manipulation	Word War	Chinese	Vocabulary	13 (16+)	Quantitative: Experimental Intervention: Three one hour long sessions	Pre-test Immediate quizzes after completion of each mode Post-test Survey (Likert scale)	(+) Vocabulary improvement throughout three modes of learning trough game (flash cards, speaking mode, and listening mode) from week one to week two at 0.344; from week two to week three at 0.702; and from week one to week three at 0.768.	McGraw *et al.* (2009)
	The Writing Pal (W-Pal)	English	Writing	16 (ESL) + 26 (native speakers) (M18/F24; 16+)	Quantitative: Correlation Intervention: Eight sessions of 1.5 - 2 hours each	Pre-test Post-test (SAT-style essay: r > 0.60.) Daily surveys (game motivation & attitudes)	(+) English native speakers (ENS) and ESL participants improved their writing performance: ENS scores increased from pre- to post test (2.67 ± 0.53 compared to 3.13 ± 0.48) as well as the ESL (2.97 ± = 0.62 compared to 3.22 ± 0.80).	Allen *et al.* (2014)

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	The Forgotten World	English	Listening Reading	3640 (M2002/F1638; 12-15)	Mixed-Method: Experimental Intervention: Once a week for 40 - 45 minutes for 2 semesters	Pre-test Post-tests (the IPT 2004 Reading Test; the MAC II Listening Test) Post-game questionnaire Teachers' observations	(+) Lower-level English proficiency students had more gains in listening through gaming than students with traditional instructions (mean gain 9.03 points compared to 5.47 points) and reading (8.5 points compared to 5.7 points). (−) No significant statistical differences in listening comprehension gains between the treatment group (mean gain = 5.97) and the control group (mean gain = 4.80) as well as in reading (7.92 compared to 6.85).	Green et al. (2011)
Adventure	Food Force	Japanese	Vocabulary	20 (M9/F11; 20.7; intermediate non-gamers)	Mixed-Method Intervention: Five 50-minute sessions	Pre-test Immediate post-test Delayed post-test Affect survey (α = 0.89 for Study 1, α = 0.86 for Study 2)	(+) Participants learned more vocabulary words through gaming (Study 1: 22.44 ± 5.70; Study 2: 25.73 ± 13.4) than through traditional instructions (Study 2: 15.82 ± 4.83); there was no loss in vocabulary after five weeks as well as better retention of vocabulary through gaming (Study 1: 22.33 ± 6.08; Study 2: 26.55 ± 13.45) compared to traditional instructions (Study 2: 12.82 ± 5.08). No gender effect was found in a game pre-, post-, and delayed vocabulary tests results (−) Difficult game language; female participants enjoyed gaming less than male.	Hitosugi et al. (2014)
	Ausflug Nach Munchen	German	Vocabulary	15 (16+)	Mixed-Method: Experimental Intervention: N/A	Homework exercises Essay Self-report (Liker scale) Post-test Debriefing interview	(+) Participants in a game-based instruction group outperformed participants in a reading-based instruction group in vocabulary retention and usage of topic-specific vocabulary in the assessment essay; gaming group exerted more mental effort and reported lower levels of difficulty with the assessments. (−) Scaffolding support required; participants from a text-based group expressed higher level of satisfaction and confidence with the instructions than participants from a gaming group	Neville et al. (2009)
MMORPG	Nori School	English	Listening Reading Writing Speaking	220 (11-13)	Qualitative: Quasi-experimental Intervention: 40-minute sessions twice a week for two months	Pre-test (a = 0.85) Post-test Motivation test (a = 0.89) Self-directed learning skill test (a = 0.93) Computer use ability test (a = 0.87) Game skill test (a = 0.90) Survey	(+) Treatment group outperformed the control group in the listening post-test (20.09 ± 5.27 and 17.71 ± 6.44, respectively), reading (7.06 ± 2.83 and 6.00 ± 3.20), writing (8.02 ± 2.62 compared to 6.82 ± 3.12). (−) No statistically significant difference between experimental and control groups in speaking (12.36 ± 3.37 compared to 11.61 ± 3.38).	Suh et al. (2010)

[a]M = male; F = female; L2P = second language proficiency; GP = gaming proficiency.