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A Literature Review and Meta-analysis of Digital Games and Second Language Learning

by

Hui Zhang

A Major Research Paper  
Submitted to the Faculty of Graduate Studies  
through the Faculty of Education  
in Partial Fulfillment of the Requirements for  
The Degree of Master of Education  
at the University of Windsor

Windsor, Ontario, Canada

2018

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A Literature Review and Meta-analysis of Digital Games and Second Language Learning

by

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March 29, 2018

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### **Abstract**

Exposed to traditional language learning strategies, students will gradually lose interest in and motivation to not only learn English, but also any language or culture. Hence, researchers are seeking technology-based learning strategies, such as digital game-mediated language learning, to motivate students and improve learning performance. This paper synthesizes the findings of empirical studies focused on the effectiveness of digital games in language education published within the last five years. Nine qualitative, quantitative, and mixed-method studies are collected and analyzed in this paper. The review found that recent empirical research was conducted primarily to examine the effectiveness by measuring language learning outcomes, motivation, and interactions. Weak proficiency was found in vocabulary retention, but strong proficiency was present in communicative skills such as speaking. Furthermore, in general, students reported that they are motivated to engage in language learning when digital games are involved; however, the motivation is also observed to be weak due to the design of the game and/or individual differences. The most effective method used to stimulate interaction language learning process seems to be digital games, as empirical studies demonstrate that it effectively promotes language education. However, significant work is still required to provide clear answers with respect to innovative and effective learning practice.

**Keywords:** Digital Games, Video Games, Serious Games, Language Education, CALL, DGBLL

## **Acknowledgement**

I would like to acknowledge and thank the following important people who have supported me throughout my master's degree.

First and foremost, I wish to thank my advisor, Dr. Zuo Chen Zhang for taking me under his supervision. He has been supportive by offering constructive remarks and guidance since the days I began working on the major research paper. Dr. Zhang deserves more than just a word of thanks.

I would also like to acknowledge Dr. Christopher J. Greig as the second reader of this research paper, and I am gratefully indebted to him for his valuable comments on this paper.

Finally, I must express my very profound gratitude to my parents, who provide me with unfailing support and continuous encouragement, and to my boyfriend, who has thanked me in his master thesis.

This accomplishment would not have been possible without them. Thank you.

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## **Chapter I: Introduction**

The current generation of learners in 21st century was born with access to vast applications of information and communication technology, which means much of their communication, connection, collaboration, and recreation occur via digital devices (Beck & Wade, 2006). Hence, traditional teaching and learning practices, such as classical classroom lecturing followed by endless amount of drilled exercise combos, are facing serious challenges (Huang & Huang, 2015). Therefore, inspiring and innovative teaching and learning methods stimulated by technology are in urgent demand for modern learners. As a result, education reform with heavy involvement that integrates multimedia has been researched and tested to develop effective student-centered pedagogies with emerging technologies. For example, Gee (2007) observes that video games, as an outcome of technology and with its exciting and entertaining features, have lured millions of players and have proven to be a potential platform for educators to utilize with the aim of improving learning motivation. Moreover, with the proliferation of globalization, learning is no longer limited to schools. Instead, it has branched out into diverse aspects of daily life, such as work environments, civic structures, and personal lives (Cope & Kalantzis, 2000). Indeed, millions of youths spend a significant amount of their time playing digital games using second languages via various devices like computers, cellphones, and tablets (Kow & Nardi, 2010).

Hence, researchers argue that through active and intensive immersion, language learners can benefit significantly from game-playing as it can promote constructive, situated, and experiential learning (Squire 2008; Woo, 2014). Overall, the prolific amount of experimental

research justifies the learning nature of digital games as they can improve language learning outcomes by stimulating motivation and interaction.

### **Research questions**

Focusing on the wide application of digital games on language learning, this review collects the related articles published from 2013 to 2017 to explore the following questions:

1. What benefits does the inclusion of digital games provide with respect to the outcome of additional language learning and education?
2. How does the utilization of digital games improve learning motivation with regard to additional language learning and education?
3. In what ways does the use of digital games provide interactions that improve additional language learning and education?

### **Terminology**

**Digital games (DGs).** The term ‘digital game’ refers to any game played using electronic device that employs consistent rules or constraints, has a clear goal, provides feedback and monitors progress via scores or other methods (Wouters, Van Nimwegen, Van Oostendorp & Van Der, 2013).

**Video games (VGs).** Video games are a category of digital games, and their primary purposes is so-called ‘entertainment’ (Girard, Ecalle, & Magnan, 2013).

**Serious games/educational games (SGs).** Serious games, sometimes referred to as educational games, are another category of digital games and are designed based on pedagogy with the intended purpose of promoting education (Zyda, 2005). For the purposes of the current study, the only difference between SGs and VGs lies in their so-called purpose: pedagogical usefulness for SGs, and entertainment for VGs.

**Game-enhanced learning (GEL).** Game-enhanced learning refers to the application of commercial or off-shelf VGs that are not intentionally designed for educational purposes (Reinhardt & Sykes, 2014).

**Game-based learning (GBL).** Game-based learning is an innovative pedagogy that integrates gaming elements into teaching and learning and is sometimes referred to as gamification (Trybus, 2015).

**English language learners.** In the context of the current study, English language learners (ELLs) refers to non-native English speakers who are not currently fluent in English but who are in the process of developing their English proficiency (Wolf, Herman, Bachman, Bailey, & Griffin, 2008). Learners are not limited to age groups or learning settings.

**Computer-assisted language learning (CALL).** Computer-assisted language learning refers to the use of computers or other technologies to create interactive learning environments that assist learning in general and language learning specifically (Stockwell, 2012).

**Mobile-assisted language learning (MALL).** Mobile-assisted language learning is defined as the use of mobile technologies and portable devices to assist learning in general and language learning specifically (Kukulska-Hulme & Shield, 2007).

**Massively multi-player online role-playing games (MMORPGs).** Another popular gaming format is massively multi-player online role-playing games. These are role-playing games where numerous players simultaneously interact within a continuous virtual world (De Souza, e Silva, & Roazzi, 2010).

## **Chapter II: Methodology**

### **Meta-Analysis**

The term meta-analysis, coined by Glass (1976) refers to the “analysis of analyses”, or more specifically the “statistical analysis of a large collection of analysis results from individual studies for the purpose of integrating the findings” (p. 3). Additionally, Hunter, Schmidt, and Jackson (1982) further explain that meta-analysis as a research methodology that is used to synthesize various research findings from a number of studies that are related to the same topic. Thus, in a meta-analysis, the research findings of primary studies serve as the raw data. Based on the analysis and integration of these findings, the meta-analysis could lead to a more comprehensive overview of the same research topic. Typically, a quantitative method is applied in meta-analysis to estimate the correlation among variables through statistical evaluation in order to provide accurate and comprehensive results. However, as increasing significance drawn from qualitative research, Stern and Harris (1985) propose a new meta-research method: qualitative meta-analysis, also known as meta-synthesis. Compared to quantitative meta-analysis, the process of qualitative meta-analysis is considered to be not merely aggregative but interpretive (Noblit & Hare, 1988), providing more descriptive details to address the research questions explicitly. Given the diversity of approaches and instruments used in assessing the effectiveness of utilizing games to enhance language learning, using statistical techniques to code and synthesize the findings may create a bias. Thus, a qualitative meta-analysis is applied to provide a comprehensive synthesis of existing literatures in the past five years. This research paper follows the universal procedure of the meta-study outlined by Paterson, Thorne, Canam and Jillings (2001), which requires researchers to formulate research questions, select primary

research, perform a meta-data analysis, employ a meta-method, and then create a meta-synthesis and dissemination. This ensures the reliability and validity of the findings.

### **Studies Collection and Selection**

The studies were collected and selected through a four-step process. The initial search began via Google Scholar, where several keywords strings were used: “game,” “video game,” “digital game,” “online game,” “computer game,” “mobile game,” “serious game,” “game-based,” “game-enhanced,” or “MMORPGs.” These were paired with a second keyword string that included the words/phrases “language,” “language learning,” “language acquisition,” “second language learning,” “second language acquisition,” “EFL,” or “ESL”. The search results were also limited to studies published between 2013 and 2017 and peer-reviewed journal articles. After the initial search, 267 articles were identified. The second step involved evaluating each article’s applicability to the current study by reviewing their respective abstracts, which allows the researcher to eliminate articles that were not relevant. Once this was completed, 78 results remained. The third step involved assesses the quality of the research. The selected 78 articles collectively appeared in 41 different journals, among which, 34 either published less than three articles or did not publish regularly. These were eliminated, leaving 47 articles from seven journals. In the fourth and final step, nine articles were chosen to meet four key criteria according to the study’s research questions:

1. The article should be empirical research—whether qualitative, quantitative, or mixed—and thus must involve at least one of observation, surveys, or experiments, and must also demonstrate correlations between games and language learning.

2. Due to the diversity of language systems, the target language learned in the research must be limited to English, while the original/first language could be any language other than English to ensure the data related to additional language learning.
3. The articles must measure at least one dimension of language learning effectiveness, and pure self-reported attitude surveys were excluded.
4. This research focuses on nondisabled population, so articles related to special language system such as ASL sign language were excluded.

## **Chapter III: Literature Review**

### **Digital Games in Second Language Learning**

#### **A Brief Review of CALL and MALL Development**

As early as the 1960s, CALL systems were introduced as an innovative student-centered platform to facilitate language learning (Stockwell, 2012). With a perfect combination of human's verbal and non-verbal information processing system (Paivio, 1971), CALL was recognized as beneficial in both cognition and memory, which are essential in language learning. Along with the rapid development of modern technology, significant amounts of educational applications popped up to investigate more inspiring learning possibilities (Golonka, Bowles, Frank, Richardson, & Freynik, 2012). For example, a web-based CALL system was introduced to help Chinese students learn English vocabulary (Ma & Kelly, 2006) and improve academic writing skills by providing thorough and individualized feedback (Lee, Wong, Cheung, & Lee, 2009). Furthermore, Liu, Moore, Graham, and Lee (2002) illustrate the theoretical foundation and effectiveness of CALL systems with regard to speaking and listening skills in K-12 education, and further demonstrate that the affective factors, such as learning motivation and anxiety, could be positively influenced by CALL. Meanwhile, the automatic speech recognition technique (ASR) was integrated into CALL system to improve speaking skills, especially pronunciation (Neri, Mich, Gerosa, & Giuliani, 2008). A meta-analysis was conducted to collect the studies of MALL and demonstrate that the students supported with MALL gain improved learning results in additional language learning compared to students supported with traditional learning methods (Grgurović, Chapelle, & Shelley, 2013). Between the time when CALL systems were first introduced until the current study began, a variety of educational applications in CALL research have been implemented, from web-based applications (Golonka et al., 2012),

to ubiquitous mobile-based learning environments (Hsu & Ou-Yang, 2013), and from vocabulary acquisition, to English writing skills.

With the propagation of mobile technology, Joiner, Stanton and Luckin (2003) argue that the wireless technology and mobile devices could be introduced to provide more integrative learning environment, which lays a good technological foundation for MALL, a mobile version of CALL. The unique advantage of the innovative mobile learning pattern was noticed and examined in various learning settings. Chinnery (2006) provides an overview of the capable mobile devices, such as tablets and smartphones, and their educational value in language learning. Colpaert (2004) notes that the mobile technology become more prevalent in educational settings “as soon as tools become available” that allow “teachers and researchers to develop their own mobile applications and tools” (p. 262). For example, the concept of wireless technology-enhanced learning classroom (WiTEC) and mobile-computer-supported collaborative learning (MCSCCL) are recognized as more convenient, effective, and time-efficient approaches with respect to teaching and learning practice (Liu et al., 2002; Zurita & Nussbaum, 2004). A recent study conducted in Iran argues that a short message service (SMS) is effective in learning English idioms because such services help to motivate students and allow them to be in constant contact with the fluid language through global connections (Hayati, Jalilifar, & Mashhadi, 2013).

Based on these findings, Zhytska (2012) concludes that CALL offers eight key advantages: “experiential learning; motivation; enhance student achievement; authentic materials for study; greater interaction; individualization; independence from a single source of information; [and] global understanding” (pp. 26-27).

### **A Brief Review of Digital Games Development**



Digital games have been an attractive entertaining option with millions of players using major languages. Hence, “Ubiquity, diversity and accessibility” are recognized as tags for digital games (Reinhardt & Sykes, 2012, p.32). In terms of platforms, digital games are not limited by the physical boundaries and could be installed and played via every possible digital device, including game consoles (PS4, Xbox, Nintendo and so forth) TVs, computers, or any other ubiquitous portable electronics (Cellphones, Electronic Learning Machines, iPads and so forth). Categorized by players, digital games could be divided into three categories: single-player games such as *Speed Race* and *Warcraft*, which allow students to connect with the material individually; multi-player games such as *StarCraft* and *NBA*, which allows for connection between players; and massive multiplayer game such as *World of Warcraft* and *Playerunknown’s Battlegrounds*, which facilitates broader social interactions (Gee, 2007). Adding the emergence of Internet, the interaction between players could extend from real world to virtual social space (Wang & Burton, 2013).

Furthermore, the game genres are also diverse, ranging from action games (like *King of Fighters*) to casual social networking games (SNGs, like *Happy Farm*) based on synthetic immersive environments (SIMs). Among these genres, role-playing (like *Dungeons & Dragons*), simulation (like *Rock 'N' Roll Racing*) or strategic games (like *Civilization*)—created based on authentic situations and compelling stories—are perceived to be more suitable to support learning (Franciosi, 2017). These types of games usually provide players with an obstacle to overcome, a problem to solve, or a decision to be made in a variety of situations (Koster, 2005), which will motivate the learners to explore and develop problem-solving skills related to their interests. Thus, digital games have proven to be effective tools with respect to helping students acquire skills through experimentation and immersion in game settings (Squire, 2008). For

example, Merabet, Connors, Halko, and Sánchez (2012) illustrate how audio-based environment simulators in digital games could engage the blind to explore the spatial world, helping them achieve unprecedented physical navigation ability. Apart from physical skills, digital games are also perceived as being able to effectively help students acquire knowledge (Robinson, 2003).

### **A Brief Review of Digital Games in MALL**

Gee (2007) argues that by incorporating learning principles, digital games could provide an ideal environment for entertaining and enjoyable language learning. As a result, the intensive use of digital games to assist language learning has attracted significant attention. Hence, digital games embodied in MALL share both the advantage of digital games and CALL. However, due to the different purposes of the games, it is important to understand that digital games can be categorized into two streams: video games (VGs), also known as vernacular games, and serious games (SGs), also known as educational games. VGs and SGs could be both commercial and ‘off-the-shelf’. What distinguishes them is their respective so-called purposes, entrainment or education.

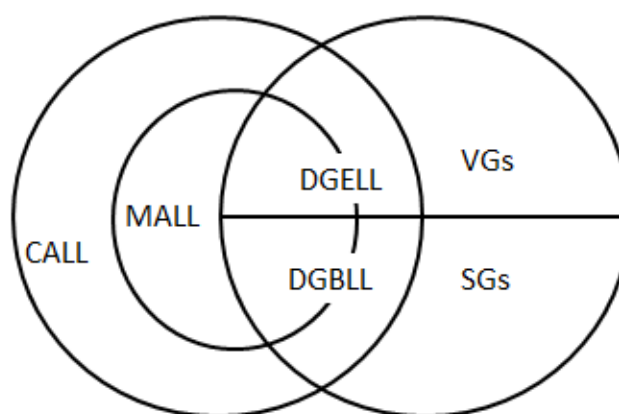
Video games are one type of digital games that are designed purposely for entertainment, rather than knowledge teaching (Girard et al., 2013). The term “game-enhanced” (Reinhardt & Sykes, 2012) learning is used to address learning processes that occur in a natural game discourse. Emerging in such an informal learning environment, players acquire and share knowledge through spontaneous interaction with the game communities (Franciosi, 2017; Kow, & Nardi, 2010). Ryu (2013) examined the informal learning process by conducting a content analysis of game community discussion of *Civilization*, a commercial MOOPG. Players are observed to learn simple words or phrases during the game and are reported to be active within the online gaming community, which offers an informal but effective environment to practice the

acquired language with native speakers and more fluent peers. Hence, video games are capable of facilitating language learning in natural discourses. This idea encapsulates the term “extramural English (EE)”, coined by Sundqvist (2009), which refers to English that users engage in in various forms, including in-game contexts and formal learning settings such as classrooms. Laufer and Hulstijn (2001) also define this phenomenon as incidental learning. Some experimental research shows neutral or negative learning outcomes in relation to incidental learning as the primary purpose of video games is entertainment (Reinhardt & Sykes, 2012). The truth is that without well-designed learning objectives, input, and evaluation system, informal learning results are difficult to assess. Evidence supports the benefits of game-enhanced learning, noting that video games could provide a platform that could motivate language learners and encourage interactions that facilitate authentic language learning (Reinhardt & Sykes, 2012), and such benefits could be enhanced via the introduction of more purposeful learning materials and content.

SGs can be defined in a number of ways. Marsh (2011), though, offers the most comprehensive definition, defining them as “digital games, simulations, virtual environment and mixed reality/media that provide opportunities to engage in activities through responsive native/story, gameplay or encounters to inform, influence, for well-beings, and/or experience” (p. 63). Girard et al. (2013) emphasizes that SGs are defined by the fact that their usefulness is their primary and intended purpose. Compared to VGs, SGs are more focused on their educational purposes, which means they are developed and guided by certain rules and principles. This overlaps with gamification, which Werbach and Hunter (2012) define as the process of adding gaming elements and game design techniques to non-game contexts in order to empower and engage learners and sustain a relax and entertaining learning environment. More importantly,

gamification provides a robust framework and multiple design principles for game-based learning. Borrowing design principles and practices from video games, gamification and SGs involve rules, goals and objectives, outcomes and feedback, and competitions and interactions (Prensky, 2007).

Game-based language learning specifically refers to the “use of games and game-inclusive synthetic immersive environments that are designed intentionally” (p. 39) for language learning. SIMs, which are common in and thus critical to game-based language learning, are defined as online immersive social spaces that incorporate the benefits of MMOG to produce explicit, educationally related outcomes in simulated, relevant interactional contexts (Sykes, Oskoz & Thorne, 2008). SIMs have been proven to be an effective way to encourage collaboration in a variety of game-like, goal-directed activities (Sykes, 2008). In addition, SGs offer the possibility to integrate the instructions, learning materials, and pedagogical frameworks into the game design. Reinhardt and Sykes (2012) outline three key advantages to educator-designed educational games as following: specific elements can be included by customizing design parameters, gameplay data can be collected for evaluative purposes with regard to comprehension and participation, and it allows students to put learning content into immediate practice, which allows for real-time modifications that improve game content to promote desired learner behaviours. To this end, figure 1 illustrates the relationships between CALL, MALL, Game-enhanced language learning (DGELL), Game-based language learning (DGLL), VGs, and SGs.



*Figure 1. Concept map of key terms*

### **Effectiveness of Digital Games in Language Learning**

Language acquisition or learning is a complicated process influenced by various factors, ranging from individual differences to teaching strategies (Lightbrown & Spada, 2013). Furthermore, the criteria used to assess learning and acquisition outcomes are also a controversial issue. Implementing digital games into language learning makes this situation even more complicated. For example, “the use of digital games is usually a complement to [an] existing course, and as such, it is difficult to control for all the variables that can have an effect on learning outcomes” (Reinders, 2017, p. 333). Hence, early research on CALL focuses on the validity of affordance that digital games offer in language teaching (Hubbard, 2008), but no empirical evidence or implementing rules have been mentioned. Reinders (2017) notes that a variety of qualitative studies have demonstrated a positive correlation between language learning and socialized intensive interaction, engagement, and other affective factors such as motivation and willingness to communicate. However, the language learning outcomes have not been evaluated and illustrated explicitly until some experimental studies conducted in recent years

(Golonka et al., 2012; Sub, Kim & Kim, 2010). Evidence on these subjects can be categorized under two subheadings: effectiveness in affective factors and language acquisition.

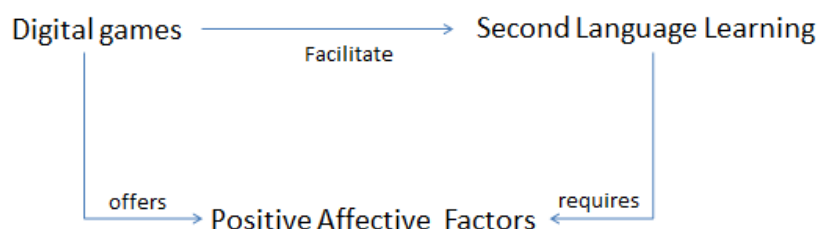
### **Learning Outcomes**

In digital game-based/-enhanced learning environment, it is difficult to examine the language learning achievement because other variables stimulated by digital games cannot usually be controlled. Reinders (2017) observes that language learning performance is, to some extent, related to the fact that games afford opportunities to interact in the target language and stimulate the learning motivation (Whitton, 2007), or support cognitive development (Woo, 2014), or a combination of these benefits (Cheng & Dörnyei, 2007). Though not all variables can be controlled, language development could be observed along with certain factors. Chiu, Kao, and Reynolds (2012) analyzed 14 experimental studies and compared the overall effectiveness of the language learning outcomes calculated from two different game-based learning environments: action-based drill/practice environments, and meaningful and engaging environments. By using statistic techniques to calculate the overall learning effectiveness, their meta-analysis draws the conclusion that “meaningful and engaging games allow for more learning to occur” (p. E106). However, without a detailed description of the collected works, their research fails to illustrate which learning results are being assessed and which indicators are reliably correlated with increased learning. The issue with developing conclusive dates is that language is learned and acquired through multiple dimensions. These dimensions include linguistic competence and practical communicative skills. Linguistic competence may refer to one’s comprehension of grammatical rules, vocabulary, pronunciation, and/or spelling (Canale & Swain, 1980), while practical communicative include skills such as listening, reading, and speaking.

Bern et al. (2013) designed a 3D simulation game to observe the correlation between digital games and second language learning. Their findings demonstrate that the game supported significant development in vocabulary acquisition and listening skills. In addition, students also reported that their motivation stayed at a higher level. In this case, the effectiveness in language achievement refers to the development in vocabulary acquisition and listening skills, but it is impossible to isolate the affective factors, such as motivation, in this research when the learning achievement is being evaluated. Suh, Kim, and Kim (2010) explore the use of a MMORPG in Korea elementary schools. After comparing a control and experimental group, they conclude that the experimental students who were learning English with the assistance of self-designed MMORPGs secured higher test scores in reading and writing tests. The study also identifies motivation and participation as dependent variables that are influenced by digital games and that in turn influence the language performance.

### **Affective Factors**

Both psycholinguistic and sociolinguistic frameworks emphasize the significance of affective factors, such as motivation and interaction in the language learning process (Donato & McCormick, 1994; Long, 1985; Long 1996). Krashen (1981) argues that additional language learners are more likely to achieve better learning outcomes when they have high motivation, positive attitude, high confidence, and less anxiety. Fittingly, the mechanisms in digital games—including virtual environment, characteristics, and design principles—are perceived as being able to create a relaxed and engaging learning platform (Gee, 2007). Thus, games can enhance language learning. This construct is presented in Figure 2.



*Figure 2. Affective factors between digital games and language learning*

Multiple studies have focused on the benefits that digital games bring to affective factors—such as student engagement, motivation, collaboration and socialization—and argue that these factors will significantly improve language learning (Duff, 2007; Tarone, 2007).

Commercial MMORPGs have the potential to support learning environments. This is demonstrated by Reinders and Wattana (2011), who investigated the use of commercial games and found that the learner's willingness to communicate was significantly enhanced. Other achievement was rooted in social interaction and communication, such as greetings, requests, and questions. However, the complexity and accuracy of language output were not observed. Peterson (2012) conducted a qualitative study involving interviews, observations, and a questionnaire to evaluate the impact of *NineRift*, a social, online game. Participants showed positive attitude with regard to active interaction and participation as the gaming environment was perceived to be engaging, motivating, and enjoyable. The findings further illustrate the positive effect on their English fluency. Likewise, Ryu (2013) investigated the capability of digital games to facilitate language learning in natural discourses. By analyzing the gamers' discourses, the study shows the online game community has the potential to provide an ideal environment for players to communicate. This discourse was perceived to be a casual and unstructured learning environment that stimulated informal language learning.



## **Chapter IV: Theoretical Foundation**

The mystery of language acquisition and learning has been explored and analyzed by scholars from multiple dimensions and has been supported by robust theories (Chomsky, 2003; Skinner, 1957; Vygotsky, 1978). To be more specific, systematic research considered and interpreted the general patterns of language acquisition and learning, ranging from linguistic components to communicative skills (Reinders & Wattana, 2011). In addition, recent studies have witnessed a progressive development based on theoretical foundations of language learning and acquisition. Through behaviourism, Skinner (1957) emphasized the significance of imitation and retention. Chomsky (2003) started from the cognitive perspective and proposed the Innatism Hypothesis, arguing that language learning is prevailingly dominated by certain reflection areas of the brain. Once the reflection areas being activated, acquisition turns into a natural process along with the maturation. Theories of social interaction were also introduced, contributing to communicative language development and helped to construct a sounded language learning system (as cited in in Lightbrown & Spada, 2013). Regardless of the theory, it is clear that motivation and interaction significantly facilitate language development.

Bourgonjon, Valcke, Soetaert, and Schellens (2010) indicate that playing and learning are connected theoretically, as illustrated above. Thus, with motivation and interaction as the connectors, it can be argued that digital games are valuable tools to assist language learning outcomes. In addition, recent studies add credits to the Game Based Language Learning (GBLL) framework as well. For instance, stimulation games can help develop vocabulary learning (Miller & Hegelheimer, 2006; Ranalli, 2008; Thorne, 2008). Moreover, learners see significant improvement in their language communicative competence when playing digital games (Peterson, 2012), in part because they are more engaged in game-based learning and therefore

have higher levels of motivation to engage in learning (Squire, 2008). Previous research show abundant evidence on the positive impact that digital games plays on language learning from difference aspects. The following section will investigate the second language learning from cognition hypothesis, interactional framework and motivational theory which are also embodied in video games to facilitate second language learning in an engaging, effective and attractive way.

### **The Cognition Hypothesis**

Lightbrown and Spada (2013) argue that during the additional language learning process, individual differences—including intelligence, aptitude, learner styles, and age—are believed to be associated with essential cognitive features, indicating a direct impact on learning outcomes. The Critical Period Hypothesis suggested by Chomsky (2003) indicates that language acquisition is affected by the brain development which is closely related to Critical Period. Hence, it suggests the best language learning period is before the critical period. Thus, younger learners are categorized as advantaged groups in language learning from the cognitive perspective.

However, Dekeyer (2000) reports that a correlation could be found between adults' aptitude scores and additional language success while such a correlation could not be proved among children. Therefore, the additional language learning process and strategies of children and adults are not parallel due to the differences in factors such as cognitive development and metalinguistic knowledge. From one perspective, the process can be interpreted as the learning sequence. For example, children may pick up the spoken language in a quicker pattern, while adults may be fast learners in written forms of languages. From another perspective, strategies could be translated into the complexity of learning trajectories. Therefore, it is unclear whether there is a specific learning theory that could accommodate both young and mature additional language learners in a productive way.

The cognition hypothesis was introduced with fundamental pedagogic claim as pedagogic tasks should be designed and then sequenced for learners on the basis of increases in their cognitive complexity (Robinson, 2003). Based on the definition, both the sequence and complexity are addressed and highly valued by this framework in terms of additional language teaching and learning. It further explains that task-based language teaching (TBLT), as outlined by Robinson (2003), is the kernel operation of the framework. In addition, sequence and complexity are two independent variables that could be manipulated to meet the learner's characteristics. For example, grammatical knowledge of the target language is not mastered by additional language learners in the same order due to the influence of their native languages. In addition, learners' responses are varied as well when learning the written or spoken form of an additional language. Therefore, the proper adjustment of the sequence is necessary to optimize the learning process. When it comes to the complexity of language, children and adults are advantaged in different aspects of cognitive development. For children, the complexity may be buried within the language itself; for the adults, the task numbers and settings could be designed with relatively complicated and advanced linguistic elements. To further expand the operational cognition hypothesis framework, Robinson and Gilabert (2007) introduced a taxonomic system that integrates three elements: "Task Complexity, Task condition, and Task Difficulty" (p. 161). These correspond to the taxonomy of the gamification elements, seeking the set for completion, the context, and their relationships (Robinson & Bellotti, 2013). That is to say, there is a pathway through which to transfer the additional language learning tasks-based theory to gamification theory based on their underlying similar characteristics.

Vandewater, Shim and Caplovitz (2004) suggest that digital games requiring rapid responses could improve cognition with respect to attention, recognition, memory, and fine-

motor skills. These skills acquired from the video gaming world would be perfectly fitted in real-world activities. Furthermore, research has directly explored the relationship between language learning and video games. MMORPGs have proven to be effective at enlarging students' vocabulary (Rankin, Morrison, McNeal, Gooch, & Shute, 2009).

As a language learning facilitator, VGs innately possess potential educational elements. Evidence to support this has been found from various sources, ranging from military training to literacy acquisition. For instance, Hayes and Silberman (2007) demonstrate that video games were introduced into military training system during the 1980s. With proper technologies and certain settings incorporated, digital games could imitate authentic training scenarios during exercise to introduce advanced and remote weapons or devices. Furthermore, games involving advanced technology could improve cognition by providing opportunities for learners to engage with virtual 3D spatial objects. VGs could also utilize language puzzles to enhance vocabulary through a digital channel. However, these benefits cannot be isolated from language as the medium, which relates back to the Task Condition in the cognition hypothesis, though integrating language learning into a game setting can observably facilitate informal learning at a high frequency. Unlike formal learning, which relies on the fixed contexts or settings, informal learning is not limited by space and time and “can be seen as a transitional route into the formal study and a complementary as well as an alternative mode of learning (Kukulska-Hulme, 2015, p. 287). Therefore, integrating a target language into VGs can promote informal learning and could serve as an innovative way to stimulate language learning.

When Task Complexity and Task Difficulty are borrowed from the cognition hypothesis and joined, the concept of hierarchy formed and could be interpreted as Set for Completion and Relationships in gamification. Gee (2014) suggests that an unavoidable challenge that game

designer met is how to make the game longer and more challenging since gamers do not want short and easy games. Learners lose their interest immediately if the games are too easy and do not feature continuous level upgrades, regardless as to how beneficial the game might be. On one aspect, to some extent, game difficulty levels represent the knowledge mastery of Bloom's taxonomy with regard to remembering or evaluating. In addition, games are regarded as a form of “multiliteracies in the wild”. Multiple element—including text, sound, images, actions, and symbols—make sense separately or as a combination (Beavis, 2012). Hierarchies in games could be found according to the diverse collocation of these linguistic elements and cognitive development levels: this provides the justification of suitable learning settings based on the combination of the extent associated with complexity and difficulty.

### **Motivation Theory**

Shunk, Pintrich, and Meece (2010) define motivation as the psychological process responsible for initiating and continuing goal directed behaviours. Hence, the motivated individual not only has goals, desires, and aspirations, but also expends effort, is persistent and attentive to the task at hand, enjoys the activity, experiences reinforcement from success and disappointed from failure, and is motivated to make use of strategies to achieve their goals (Kormos & Csizér, 2008). However, above mentioned performance may not be observed from individuals who are lack of motivation. The motivational theory is also applicable to additional language learning. Cheng and Dornyei (2007) likewise note that more motivated learners enjoy more successful language learning experience than unmotivated learners. In terms of digital games, Sailer, Hense, Mandl and Klevers (2013) outline six game design elements that enhance motivation and facilitate additional language learning: “Trait, Behaviouristic Learning, Cognitive, Self-determination, Interest, and Emotion” (p. 31). These elements establish links between

language learning and digital games that could serve as effective learning strategies, working under the context of motivational theory as the sophisticated foundation.

Due to the significant role that motivation plays in additional language learning, studies that integrated motivational factors in the context of additional language theory are ongoing. Gardner and Lambert (1972) argue that the most influential illustration of this is instrumental motivation and integrative motivation. Instrumental motivation has been associated with short-term practical or immediate goals (Proske, Roscoe & McNamara, 2014). In this condition, the motivation could be passing an exam, getting a reward, or completing a task. In contrast, integrative motivation seeks long-term and sustained development. Most of the cases could be found and analyzed based on social aspects, such as values or identity.

Starting from the personal perspective, motivation could be divided into intrinsic and extrinsic motivation (Dörnyei & Schmidt, 2001). Extrinsic motivation emphasizes stimulation or power from the external world, whether positive or negative. To some extent, extrinsic motivation shares similar characteristics with instrumental motivation since the driving force is not considered to be voluntary and its duration is considered to be relatively short. This includes negative reinforcement. In digital games, structural playable elements—such as rules, goals, objectives, outcome, feedback, conflict, competition, challenge, opposition, representation, and narrative—are designed to inspire learners' extrinsic motivation (Prensky, 2007). In contrast, intrinsic motivation predicated on the individual's interests and inner space fulfillment, which could be interpreted as the enjoyment one derives, the learning it permits, or the feeling of accomplishments it evokes (Figuerola, 2015). Therefore, learner motivation increases when the learning experience is more engaging. For instance, learners' intrinsic motivation will stay at a high level if the pedagogy incorporates corpora diversity and multimodalities, including text,

images, audio, and video. Given the fact that digital games are exemplars of multimodalities, players are intrinsically motivated by creating joyful, relaxing, and fantastic learning environment, which in turn supports achievement, mastery, autonomy, and a sense of belonging (Hoffman & Nadelson, 2010). Overall, digital games are effective tools with regard to motivating learners engaged in life-long language learning while providing high mental satisfaction.

Cultural and linguistic diversity has been highly encouraged and valued through the emergence of theoretical research on sociocultural motivation, which became increasingly prevalent due to the development of multicultural conceptions (Cope & Kalantzis, 2000). According to Squire (2008), inhabiting new skills, values, and identities will provide strong motivation and improve learning potential. Norton (2000) develops the motivational concept of ‘investment’ to describe the relationship between learners and a target language. Thus, applying the motivational mechanism to language learning allows learners with higher motivation to develop a sense of social identity. Accordingly, digital games, especially simulation games, emphasize the strong correlation between real life and game environments (Wu, Chen, & Huang, 2014), which underscores the need to provide authentic in-game environment. However, learners are not limited by who they are in the real world since role-playing is an essential strategy that equips learners with new identities to explore and to learn based on characterized factors. Digital games designed with flexible variants are meant to meet the special learning demands of a wide range of social groups. Due to different age, linguistic, ethnical, and special learning groups, among others, education requests are made differently. For example, setting Chinese as a learning aim requires involving traditional Chinese elements that can help the learners develop a better understanding of the target language.

### **Interactional Framework**

Long (1983) modified the Interaction Hypothesis and outlined the significance of interaction with respect to mutual comprehension, which conforms to the basic principle of communication. Numerous studies have outlined multiple aspects of interaction involving ‘environmental interaction’ (Lightbrown & Spada, 2013) ‘intrapersonal interaction’ and ‘interpersonal interaction’ (Chapelle, 2005; Vygotsky, 1978). Such works collectively postulate that languages are developed and acquired through interactions with the physical world. To some extent, the learning environment provides the settings of language learning process, which can be interpreted as three steps: negotiating meaning, obtaining enhanced input and directing attention to linguistic form (Chapelle, 2005). Hence, the significance of exposure to a target language environment is not only justified but necessary. When entering a new language environment, learners will experience an uncomfortable period when negotiating with the settings. At first, they confront intrapersonal interaction, which refers to the process where, through their internal thought processes and cognition, they explore meaningful sense based on physical interaction. This is followed by the comprehension stage, which contributes to the initial formation of the language system. With all the basic linguistic elements input and installed, learners develop the ability to transfer their cognitive information into linguistic forms for output. For example, the second stage of language acquisition demonstrates the gradual processes of “Preproduction, Early production, Speech Emergence, Intermediate Fluency, [and] Advanced Fluency” (Herrell & Jordan, 2016, p. 3). This highlights similarities with interaction theory. The Preproduction stage is akin to the intrapersonal stage, during which, the negotiation occurs between the environment and cognition formation. Likewise, the Early Production stage corresponds to comprehension stage, which illustrates the cognitive development acquired through the full



emergence to the physical environment. Lastly, Speech Emergence can be associated with output, which describes the meaningful communication achieved through interactions with the environment.

In addition, conversational interaction, a form of interpersonal interaction, is observed to be an essential influencing factor in language learning. What distinguishes conversational interaction from the environmental interaction is feedback. Sachs and her colleague (1981) studied the language development of a child they called Jim, whose language learning experience indicates that environmental interactions, including television as an input source, are not sufficient to provide qualified language acquisition or learning atmospheres. That is why this approach is problematic when communication with real world is not included. However, when learners are placed in a normal environment where conversational interaction takes place, language develops more quickly. The key factor is feedback, especially corrective feedback. When one simply consumes language without interacting, they may believe they understand it; however, when they engage with native speakers, they get immediate feedback and any issues in their understanding are highlighted immediately.

Lightbrown and Spada (2013) outlines seven types of corrective feedbacks applied in classroom practice that can assist students' language learning: "explicit correction, recasts, clarification requests, metalinguistic feedback, elicitation, repetition" (p. 140). Not every piece of corrective feedback will be noticed and modified by students, but the long-term accumulation will keep the students on the right track. Furthermore, corrective feedback is not limited to classrooms; rather, it appears universally in all conversations. Other studies demonstrate the value of technology, noting that it creates corrective feedbacks through interactions between

learners and computers or devices, such as CALLs and MALLs (Colpaert, 2004; Girard, Ecalle, & Magnan, 2013; Ma & Kelly, 2006).

Reinforcement hidden behind conversational interaction has been found to stimulate language learning positively (Peterson, 2012). Behaviorism theory defines the role of reinforcement as “things or actions that strengthen a desired response by making the learners feel better about themselves” (Beatty, 2013, p. 94). Thus, positive reinforcement is awarded when the expected performance encourages more meaningful interaction. Positive reinforcement varies in forms, ranging from prizes to a smile or nod. However, it does not necessarily mean negative reinforcement can effectively discourage effective interaction. Skinner (1957) suggests the positive evidence is also observed when improper behaviour is treated with negative reinforcement. For instance, corrective feedback mentioned above is to some extent negative reinforcement. The mistakes are emphasized or repeated to guide the students to adopt the accurate language. However, it is not always appropriate to point out every error every time directly. Thus, errors should be analyzed and categorized to provide clarity that allows educators to develop proper teaching strategies to cope with errors and less emphasis on the integration. The next aspect of reinforcement is punishment. In some cases, it is not easy to distinguish negative reinforcement and punishment, and debate has drawn on both sides of punishment. Starting from the interaction perspective, what matters is whether the punishment could result in the positive effect on conversational interaction.

Interaction, a vital feature in gamification, is incorporated into digital games to imitate the verisimilitude background for players to involve. ‘Background’, ‘interaction modes,’ and ‘traits’ offered by the gamification taxonomy support the theoretical foundation of interaction theory (Gilabert, 2007). Royle (2008) argues that the backstory or narrative provides a believable and

authentic setting for the learners to involve. Interaction modes in this stage primarily focus on the communicative and conversational interaction, which are the nature of the games built based on communication and collaboration. In addition, with the robust development of social media, distinctive interactive features are designed and implemented. McGonigal (2011) observes that VGs that carry online spaces provide the opportunity for global players to test and develop their skills through communication, cooperation, and coordination. Wongso, Rosmansyah, and Bandung (2014) argue that chatting features, discussions, and divisions of learning contents should be considered to strengthen the social interaction.

## Chapter V: Meta-data Analysis

### Overview of the selected research

**Journal distribution.** Nine studies were selected for the current study: three were published in 2014; three were published in 2015; one was published in 2016, and two were published in 2017. They were collectively distributed in six journals (see Table 1).

Table 1:

*Overview of Journal Distribution*

Journal Name	Amounts
Educational Technology Research and Development	3
Educational Technology & Society	2
Journal of Educational Computing Research	1
CALICO Journal	1
ReCALL	1
Technology, Pedagogy and Education	1
<b>Total</b>	<b>9</b>

Two of the journals—*CALICO* and *ReCALL*—are international journals that focus on educational technology applied in language learning. The remaining four journals—*Educational Technology Research and Development*, *Educational Technology & Society*, *Journal of Educational Computing Research*, and *Technology, Pedagogy and Education*—focus on the application of technology in education in general with language learning as a subarea. Hence, all these six journals are highly associated to the research topic.

**Content.** Seven of selected articles used comparative experiment designs involving control groups and experimental groups. In addition, a classical pre-test/ training/post-test process was conducted. Furthermore, three of the studies also utilized a delay-test to compare the short-term and long-term learning effectiveness by integrating gaming in language education. Although there are no comparative results in the remaining two articles, they are either rich in language

diversities or participant numbers, which could provide different insights. However, in order to ensure the accuracy, the two types of research are analyzed separately. Table 2 illustrates the brief summary of the seven comparative articles; Table 3 illustrates a brief summary of the remaining two studies. Furthermore, these studies are also diverse in gameplay duration, ranging from a single session of 50 minutes (Wu et al. 2014) to one-semester long continuous tracking playing (Newgarden & Zheng, 2016).

Multiple instruments were used in these studies. For example, well-designed tests or quizzes were used to assess the language performance. Likewise, authorized or self-designed questionnaires were used to measure students' affective factors, and observations and interviews were used to evaluate the interaction.

Table 2:

*Overview of the Final Selected Studies (Part 1)*

<b>Authors</b>	<b>Game Name</b>	<b>Features</b>	<b>Participants</b>	<b>First Language</b>	<b>Research Concentration</b>	<b>Framework</b>
Young & Wang (2014)	Self-designed Game	ASR Application (SG)	Elementary Students	Mandarin	Vocabulary Acquisition and Pronunciation; Affective factors	Scaffolding
Wu, Chen & Huang, (2014)	Self-designed Game	Computer Board Game (SG)	High School students	Mandarin	Communicative speaking transferability, motivation	Digital Learning Platform
Proske, Roscoe & McNamara , (2014)	Self-designed Game	Computer-based instructional	University students	German	Motivation and writing strategies	ARCS
Hung & Young, (2015)	Connecting English world (Self-designed Game)	Handheld Device Game (SG)	Elementary Students	Mandarin	Vocabulary acquisition and interaction	Interaction pattern
Hung , Young & Lin (2015)	Crossword Fan-Tan Game (Revised Game)	Tablet PCs (SG)	Elementary students	Mandarin	Vocabulary acquisition and interaction	Cooperative structure

Huang & Huang, (2015)	Self-designed Game	Handheld Sensor - based (SG)	University students	Mandarin	Vocabulary acquisition and motivation	Scaffolding
Franciosi, (2017)	Energy City	Online Simulation (SG)	University students	Japanese	Transferability from Vocabulary to writing	Transferability

Table 3:

*Overview of the Final Selected Studies (Part 2)*

Authors	Game Name	Features	Participants	First Language	Research Concentration
Bytheway (2015)	World of Warcraft	(MMORPGs) VG	University students in New Zealand	German, Hokkien, Russian, Vietnamese and Mandarin	Vocabulary learning strategies and interaction
Newgarden & Zheng (2016)	World of Warcraft	(MMORPGs) VG	University students in the US	Turkish, Arabic, Spanish, Mandarin, English	Skilled linguistic; Speaking proficiency and Interaction

**Participants.** A total of 579 participants were involved in the studies. Three of the studies were conducted in elementary education: these collectively included 112 of the participants (Hung & Young, 2015; Hung, Young, & Lin, 2015, Young & Wang). One study was conducted within the context of secondary education and involved 96 participants (Wu et al., 2014). The remaining five studies focused on university education and collectively had 371 students (Bytheway, 2015; Franciosi, 2017; Huang & Huang, 2015; Newgarden & Zheng, 2016; Proske, Roscoe & McNamara, 2014). Five studies were conducted in Taiwan, where Mandarin is the first language. The other four studies were conducted in Germany, United States and New Zealand with the students whose first languages were Turkish, Arabic, Spanish, Mandarin, Japanese, German, Hokkien, Russian and Vietnamese.

A total of 497 students enroll in the comparative experiment research: 183 students in the experimental groups and 314 students in the controlled groups. The numbers in experimental and control groups are different because several studies designed more than one controlled group to manipulate the variables to investigate the effectiveness of the digital gamed-based learning. For example, Proske, Roscoe and McNamara (2014) designed three experimental conditions—question-based, model-based, and writing-based conditions—and one experimental condition—a game-based condition—to compare the different learning outcomes. Wu et al. (2014) designed two controlled groups—an ordinary instruction group, and a board-game learning group—and one experimental group—a digital board game learning group—to determine the differences in a gradual pattern.

**Game Categories.** Divided by their purposes, the nine games could be divided into two groups: seven serious games that focus on educational purpose, and two serious games that were initially designed for entertainment. Moreover, five games were self-designed and two were modified games. From their designing and implementing process, the theoretical foundations that gamification and language learning share—Cognition Hypothesis, Motivation Theory and Interaction framework—could be observed as well. In addition, most of the research that addresses serious games was conducted in classroom settings, so certain pedagogical frameworks were observed as well (Shown in Table 2). Two studies explored the same video game: *World of Warcraft*, a MMORPG. Both assessed how social interaction could enhance language learning. However, they found that the learning effectiveness was difficult to evaluate.

## **Research Questions**

**Effectiveness in language achievement.** The current study's first research question was designed to investigate the benefits of digital games with respect to the outcome of in additional

language learning and education. The recent meta-analysis studies apply coding and statistical techniques to calculate the overall effectiveness of language learning by synthesizing data from different research. However, even when the coding rules were illustrated, there is still no clear answer with regard to which aspect of digital game integration proved most effective at improving language learning. In order to ensure the data is reliable, only the data from the comparative studies is used. The results are presented in Table 4.

*Table 4:*

*Summary of Learning Outcomes*

<b>Learning Outcomes</b>	<b>Positive Evidence</b>	<b>Neutral Evidence</b>	<b>Negative Evidence</b>
Vocabulary	“low-achievement students in the EG had a better learning performance than those in the CG” (Hung, Young & Lin, 2015, p.42 )	“the handheld sensor-based vocabulary game designed with the scaffolding strategy was not helpful for students to retain the memory of their learned vocabulary” (Huang & Huang, 2015, p.701)	“but the learners with only drill practice memorized the vocabulary better than the learners with game-based practice from a long-term perspective” (Young & Wang, 2014, p.246)
Speaking	“learners with game-based practice achieved better speaking improvement than those with only drill practice during the experiment” (Young & Wang, 2014, p.246)		
	“the instruction set at digital learning playground yielded a higher learning performance compared to the ordinary instruction and the board game blended learning” (Wu, Chen & Huang, p. 221)		
Writing	“the more the students completed the game-based lessons, the more likely they were to use key words in the writing task.....Mastery of vocabulary in Quizlet had no apparent influence on targeted word use in this study.” (Franciosi, 2017, p.130)	“There were no statistically significant differences between game-based and conventional forms of practice.” (Proske, Roscoe & McNamara, 2014, p.494)	

In terms of learning outcomes, recent studies primarily focused on three aspects: vocabulary, speaking, and writing. Young and Wang (2014), Hung et al. (2015), and Huang and Huang (2015) demonstrate that educational games are not effective in long-term vocabulary retention. Young



and Wang (2014) even observed negative effect in vocabulary retention directed by digital game-based learning. However, Hung et al. (2015) found that low-achievement students who were involved in the digital game-based learning groups gained better learning outcomes than those involved in conventional learning. With respect to writing, Proske et al. (2014) argue that game-based learning did not have significant influence on writing strategies. Franciosi (2017) also found that game-based lessons offered slight advantage with regard to increasing the transferability of mastered vocabulary into writing. With respect to speaking, digital games, involving multimodalities, could provide vocal affordance on language learning. Young and Wang (2014) found digital games were effective at improving vocabulary pronunciation, which was perceived as a linguistic component. Furthermore, Wu et al. (2014) suggest that digital-game learning led increased transferability of learning knowledge into daily communicative speaking. The data derived from Bytheway (2015) and Newgarden and Zheng (2016) heavily focus on interviews and observations. Bytheway (2015) provided 15 strategies in vocabulary learning including reading in game-information, noticing repetition of words, interacting with players and so forth. Newgarden and Zheng (2016) concentrated on the transferability of game skilled language into communicative skills and argued that WoW, a MMORPGs, was effective to facilitate the development of second language proficiency by incorporating meaningful leaning materials into the authentic and interactive environment that were created.

**Effectiveness in motivation.** The current study's second research question was designed to examine how the utilization of digital games improves learning motivation with regard to additional language learning and education. Table 5 was constructed in order to arrange the findings in an organized and clear pattern. Overall, empirical data showed that digital games played a positive effect on stimulating students' motivation to learn. These affective factors

could be interpreted as decreasing anxiety; increasing enjoyment, curiosity, interest and so forth.

The interview data also indicated that low-achieving students felt more motivated to learn than high-achieving students by engaging in the same learning environment.

*Table 5:*

*Summary of Motivation*

<b>Authors</b>	<b>Design and findings</b>	<b>Evidence</b>
Wu, Chen & Huang (2014)	Assess the affective factors from four dimensions: interest/enjoyment, effort, pressure/tension, and value. The study indicates that digital game learning is most effective at decreasing anxiety.	“The results show students perceived less stressed learning with digital learning playground while language learning with papered board game playing caused higher anxiety(p. 222)”
Proske, Roscoe & McNamara (2014)	Introduced Instructional Materials Motivational Survey to assess the ARCS motivation. (Attention, Relevance, Confidence, and Satisfaction)	Game-based learning was most effective at facilitating Attention and Satisfaction, which were related to curiosity, interest, and positive attitude. (interpreted from the bar graph Figure 5, p.493)
Young & Wang	Introduced a modified questionnaire to measure the motivation and attitude of the learners. Learners reported by receiving affirmative feedback, and completed different level of tasks, and felt motivated to learn. In addition, speaking with a computer also decreased their anxiety.	“Furthermore, learners from the E.G. gave affirmative feedback on participating in the speaking game. They acquired the English vocabulary by completing the different levels of the speaking activity and showed strong motivation to practice speaking in order to experience achievement in the speaking barrier game” (p.246) “The learners pointed out that speaking English with the computers was easier than practicing with a real person.” (p.247)
Hung & Young (2015)	Learning with digital games on a mobile-device increased learning motivation slightly compared to controlled groups because of the enjoyment.	“Overall, the students using tablets had a better enjoyment than students using the conventional approach” (p.555)
Huang & Huang (2015)	Introduced a modified questionnaire to measure the motivation	Mobile device motivated low-achieving students but without significant difference to motivate moderated and high achieving students.

**Effectiveness in interaction.** The current study’s final research question was designed to determine how the uses of digital games provide interactions that improve second language learning and education. Based on the empirical data from observations and interviews,

interactions could be observed in game-based language settings (Hung & Young, 2015; Hung et al., 2015; Young & Wang, 2014). Details could be found in Table 6. All the evidence shows the positive influence that game-based learning had with regard to stimulating interactions in different forms. In addition, Hung and Young (2015) and Hung et al. (2015) introduced an interaction framework to evaluate and compare the interaction rate between experimental and controlled groups. Frameworks like the IBIS model were used to provide detailed description and scientific justification for the observational data. Analysis of the interaction demonstrates that the experimental groups saw positive results.

Two studies focused on digital gaming also show significant improvement with regard to interaction. Bytheway (2015) reports that among the 15 vocabulary learning strategies, the two most frequent learning strategies mentioned were player interaction and playing in English. These results illustrate the importance of interaction in informal learning settings. Newgarden and Zheng (2016) conducted an innovative experiment to install commercial gaming directly into language learning. Both linguistic skill and overall language proficiency were observed to be improved by communication and cooperation in such a natural game setting. After observation and analysis of the dialogues, social interactions were also found to improve language performance, which was identical with the Interactional framework mentioned in the literature part.

*Table 6:*

*Summary of Interaction*

<b>Authors</b>	<b>Findings</b>	<b>Evidence</b>
Young & Wang (2014)	Observation: interaction and collaboration were more frequent and comfortable. Interview: students mentioned that more interaction occurred by using game-based language learning.	Young and Wang (2014) note that “some of the high-achievement learners in the E.G. shared their experience of completing the game based activity with the low-achievement ones, and some of the high-achievement learners in E.G. even accompanied the others especially the low-

		achievement learners to practice speaking in the game-based activity” (p. 247). Also, “Two out of five students had mentioned there might be more pair-work conversation practice than their usual classes”(p. 223)
Hung & Young (2015)	Observation: more communication, collaboration and negotiation were found in game-based learning groups	“The most important key point is that the design of WiCFG makes the group members have the equal right and duty to offer their idea. In the class I can observe that the low-achievement members in the experimental group engage in the activity more actively than those in the control group” (p. 44).
Hung, Young & Lin (2015)	<p>Interview: High-achieving students reported game-based learning was more effective in group negotiation and collaboration. Low-achieving students reported suffering less isolation and gained more opportunities to cooperate with the team members.</p> <p>Observation: teachers reported that game-based learning environment provided a safe and encouraging learning environment for students to cooperate.</p>	<p>“This is a totally different way to learn English. It’s so great to use this computer [tablet PC] in the activity. I was able to negotiate with my group members and control the collaborating progress during this activity” (Transcription, p. 558).</p> <p>“When completing one word, I felt fulfilled. I concentrated all my attention on the game because everybody needs me immediately” (Transcription, p. 558).</p> <p>“I think the most important point is the design of the CEWG makes the group members have equal rights and duties in offering their ideas. In the class, I can observe the members in the experimental group engage in the activity more actively than those in the control group” (Transcription, p. 558).</p>

## Chapter VI: Discussion and Conclusion

### Discussion

As a collection and synthesis of recent empirical studies on digital games and additional language learning, this meta-analysis shows positive evidence on the effectiveness that digital games facilitating additional language learning. These positive results correspond to previous studies (Chiu, Kao, & Reynolds, 2012; Girard, Ecalle, & Magnan, 2013; Grgurović, Chapelle, & Shelley, 2013) and assert benefits in language learning achievement, motivation, and interaction.

More studies are exploring the effectiveness of educational games other than video games. That is to say, recent studies are spending more effort on game-based language learning than game-enhanced learning. Given the nature of the game mechanics and additional language learning theories, numerous educational games are designed to provide affordance to the language learning effectiveness (Roscoe, Brandon, Snow and McNamara, 2013

). commented that the objective of educational games is to support formal learning by leveraging game features and interactions. The biggest challenge is to tailor the gaming mechanics into knowledge-driven games while maintaining the attracting factors of the game (Chen, Hwang, & Chen, 2013).

Compared to traditional learning method, game-based learning offers slight advantages with regard to improving learning outcomes. Young and Wang (2014) and Huang and Huang (2015) even showed negative results by arguing that students in game-based learning group lagged behind in long-term vocabulary retention than the conventional groups, underscoring the potential benefits in vocabulary retention. However, the advanced technology such as ASR in games is beneficial with regard to practical skills like pronunciation and the vocabulary transferability. Pertaining to motivation and other affective factors, game-based learning shows

moderate benefits. Overall, students reported that they felt more engaged when engaging in educational games. However, individual differences seem to be a challenge. Several articles divided the students into academic achieving groups. Students who are perceived as high achievers will complete games in a shorter time and may consequently be more likely to lose interest. Hence, both structures (including tasks, complexities and levels) and corpora should be taken into consideration to avoid ceiling effort (Chang et al. 2012). Interactions have proven to be the most significant advantage of the game-based learning. Through cooperation, communication, negotiation, and collaboration, students at different levels could benefit from the process. Among the devices, wireless tablets were the most effective at providing students with a flexible learning environment.

Compared to game-enhanced learning, game-based learning is more suitable to be applied in formal learning environments that focus on academic language learning purpose. In terms of language performance, video games and serious games focus on different aspects. The linguistic components learned from video games are known as “extramural English” (Sundqvist, 2009) or “skilled linguistic action” (Newgarden & Zheng, 2016, p. 274). However, without instructional design, the learning process could not be controlled, and effectiveness could not be assessed. Although informal learning has proven to be highly connected to formal learning theoretically, no empirical research has been conducted to address the transferability. In terms of motivation, learners have the right to choose any video games to engage, and video games are designed to be entertaining. However, the serious games are limited in designs, content, and other factors. When it comes to interaction, most serious games are designed to be played in the classroom settings, so the interaction can only be observed within the classroom. Video games, in contrast, are developed for the gaming community, even when the games are not played online or in a SIM

environment (Ryu, 2013). Learners also have more social interaction with the global players. Though several other self-designed or modified MMO educational games have been tested, their effectiveness in additional language learning has not been identified clearly.

For the reason that no empirical research is designed to address the comparison of video game-enhanced learning and conventional classroom practice, this analysis will not address the field.

### **Limitations and Conclusion**

Overall, the descriptive data of the nine empirical studies demonstrate the effectiveness of digital games in additional language (English) learning, providing a relatively clear overview of which elements of learning this approach supports. In general, effectiveness in language acquisition seems to be the least significant and even saw a negative influence. However, digital games did prove beneficial to motivation, and were most beneficial with respect to interaction. This is critical as language performance is also highly associated with motivation and interaction. These findings support previous studies, which indicate that digital games have the potential to facilitate additional language learning.

In addition, this meta-analysis provides further insights and implications for future research. For example, it is important to determine why learning outcomes are not improved at an expected rate when motivation and interaction is increased. Moreover, it is critical to determine whether current assessments are capable of effectively measuring language performance and development and how these methods might be improved. Likewise, future research should explore whether instructions or pedagogies embodied in game-based/-enhanced learning processes can effectively support students' learning needs. Finally, future studies should seek to

evaluate learning gains and the degree to which they might be improved were digital games to be introduced as standard component of the curriculum for additional language learners.

Thus, the current study's findings should be interpreted with caution for a number of reasons. First, publication bias could be observed since data acquired from published studies are more likely to represent positive results. Hence, the findings of this study yield a representativeness of positive findings with less or no negative evidence illustrated. Second, search basis should be taken into consideration since word strings are limited and the inclusion criteria are self-defined. Hence, more reliable inclusion techniques are needed. Third, selection bias is also considered to influence the generalization due to demographic distribution (five of nine selected studies are located in Taiwan), research designs (more than one control group in some studies), sampling (small sample size and convenient sampling), experimental length (diverse practice duration) and biased finding (individual differences and heavy involvement of subjective data).

Though there are limitations to the current study, it remains clear that with the proliferation of technological devices, educators will have to adapt pedagogies that integrate these tools if they seek to engage with students using their language. Moreover, digital games, when integrated into language learning, can increase both motivation and interaction, two factors that are critical to successful language learning. Even if language competency does not improve at the same rate that motivation and interaction associated with digital gaming increases, any increase can prove beneficial. Thus, educators should consider ways in which they can integrate gaming into their pedagogy, specifically with respect to additional language learning.

Apart from the implications mentioned above, this study also addresses future implications for language learners, parents and gaming developers. Firstly, exposing to the nature of learning



theories and technologies, language learners could feel encouraged to seek for and engaged in more effective learning approaches like game-based/enhanced language learning. Subsequently, parents of young language learners could be able to realize potential learning values of digital games and provide appropriate guidance on their children's game consuming. Lastly, this study offers underlying learning theories and practice embodied in digital games to game companies and their developers so that the educational values of games should be improved from the design level to meet learning needs.

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