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CHANGES IN LEXICAL AND READING PROFICIENCY THROUGH ENGLISH INPUT FROM VIDEO GAMES

Benjamin Thanyawatpokin
Himeji Dokkyo University

ABSTRACT

In recent years, video games have slowly been gaining more traction as a learning tool in the academic world. Evidence has been shown that video games can be used as tools to support language acquisition. However, studies which focus on single-player games and their use outside of a classroom environment are still sparse. This paper investigates single-player video games and their effect on University student reading and vocabulary comprehension in a mixed-method study. The participants in the study included a treatment group of nine second-year university students and a control group of ten second-year university students. All the students were volunteers from the same program and came from the same university. Data taken included vocabulary size and word recognition tests followed by a reading rate and reading comprehension test. In addition to this data, qualitative data in the form of interviews were included to support the findings of the reading and vocabulary tests. Over two months, data taken from subjects suggests reading rate, reading comprehension, and word recognition speeds showed a statistically significant rise. On the other hand, vocabulary size scores showed the treatment group had lower vocabulary sizes. In addition, the diaries show evidence that repeated incidental encounters with the same word and phrase may have played a part in the above-mentioned benefits. Motivation to play the game was also upheld throughout the two months according to the qualitative data. The data suggest that certain dimensions of reading and vocabulary comprehension such as word recognition speed and

reading speed can be developed by using video games as a learning support tool.

INTRODUCTION

In recent years recreational video games have increasingly become widespread among students of all levels. However, the popularity of these video games and the benefits they can bestow upon the players that play them has not gone without notice from the academic community. Researchers such as Squire (2011) and Gee (2007) have taken note of the benefits that video games offer players. These researchers have provided the theoretical groundwork for video games as potential learning device. In the realm of EFL education studies, video games have been found to be a viable form of second language input (e.g., deHaan, 2013; Ranalli, 2008). However, much of the research in the field of video games being used for EFL have revolved around the interaction between players, whether that be online (e.g. Peterson, 2012; Suh, Kim, and Kim, 2012) or in-person (e.g. Ranalli, 2008). However, many of the studies have looked at very broad aspects of vocabulary, reading, and listening. The current study attempts to fill a gap in the field by first focusing a slightly larger sample size of students focused on one video game, measuring reading comprehension, WPM reading speed, and word recognition rates in addition to including qualitative data which will garner insight into how each student experienced the video game for the two months they played it. The reason for investigating these areas is to shed more light upon the benefits of playing video games in a foreign language and possibly gain a more complete picture of how student lexicons and reading comprehension skills change.

LITERATURE REVIEW

Incidental Vocabulary Acquisition

Measuring how well video games benefit lexical and reading skill requires understanding how certain aspects of English can change due to incidental acquisition. This first section will seek to introduce some concepts in that area.

Incidental learning refers to a non-deliberate approach to learning vocabulary in which learners expose themselves to comprehensible texts that, consciously or unconsciously, spur them to recognize and learn new words (Nation, 2014). This

also usually implies gaining large amounts of L2 input in the form of reading for pleasure (Krashen, 1981). Much of the rationale for incidental vocabulary learning comes from Krashen's claim that a sufficient amount of input in L2 is enough to learn many aspects of the language. In other words, by simply reading through a passage in a foreign language, one can (with enough exposure) pick up vocabulary from the context. Recently, researchers have ideas that differ considerably from Krashen's. Hunt and Beglar (2005) proposed incidental vocabulary acquisition would have to be "reinforced through review or large amounts of additional reading" (p.40) due to vocabulary gains being "often partial and probably acquired incrementally." Grabe (2009) suggests words learned in passing, "may not even be noticed in a conscious way", but that, "some minimal possible meaning may be assigned to it in order to continue the effort to understand the text" (p.273). While in the above quotation, Grabe seems to suggest that it is difficult if not impractical to learn new words through incidental learning, Nation (2014) suggests vocabulary learning is taking place but in ways different from traditional ways of understanding vocabulary.

The Involvement Load Hypothesis also lends support to the viability of incidental vocabulary learning (Hulstijn & Laufer, 2001). According to this notion, learners who have a high degree of involvement with words during learning acquire words better than words that do not require as much effort to process (or involvement). In this context, the word "involvement" refers to three specific constructs, *need*, *search*, and *evaluation*. The first construct, "need" refers to motivation to learn a word and the next two constructs "search" and "evaluation" refer to not only the search to find the meaning of a word but also the evaluation of a word in context with other words; how does a word fit into a given context, what does it specifically mean when paired with certain words, and what are the connotations of the word in context. Hulstijn and Laufer (2001) also confirmed the findings of this hypothesis in a study, in which EFL learners were asked to complete one of three activities with varying amounts of involvement to learn 10 low-frequency target words. Vocabulary words were retained longer and had significantly higher rates of comprehension when they were found in contexts where the participants had high involvement with the word. A study done by Webb (2008) also produced results that echoed those in the above-mentioned study. This study showed that contexts that gave more hints to the meaning of a word (the words "illness" and "beds" in a sentence about hospitals) proved to be more effective in stimulating learning of vocabulary. Results of the study found higher scores on tests related to recalling meaning, $F(1,49) = 9.96$, $p < .01$, and recognition of meaning, $F(1,49) = 15.59$, $p < .001$. It could be said that contexts with higher information produced what Hulstijn and

Laufer (2001) would call more involvement and thus, higher gains in comprehension.

In summation, this section sought to explain that incidental acquisition is something that has been said to take quite some time along with a considerable amount of exposure to the language. In the next section, it will be explained that video games stand to offer enough exposure to language that it is possible incidental learning can occur.

Extensive Reading

Extensive Reading is not something often associated with video game studies. However, video games have been shown to present opportunities for large amounts of English input as shown by deHaan (2013). It can be said that students who have the motivation to play a game for a long period of time will receive a considerable amount of English input. However, this does depend on the type of game. The video game used in this study was a role-playing game which is a game genre inherently linked with making players read a large amount of text to complete challenges. Due to this, it is imperative that current methodology and theories surrounding extensive reading also be introduced.

It has been posited many times before that L2 learning is possible to some degree with sufficient input (Krashen, 1981). Consistent with this, Extensive Reading (ER) may seem to be an extremely attractive option for any L2 learner. Day and Bamford (2002) first created a criteria for what kind of text could be used pedagogically as ER. They listed criteria such as the text being easy for the reader, it being rewarding, and the reading being geared more towards pleasure than any assignment given out by the teacher. This kind of criteria is very similar to what Squire (2011) stated as his theory of interest-driven learning, which is described below.

In the classroom, ER has gained much traction, especially here in Japan. However, Grabe (2009) states that, for reasons such as lack of resources, a focus away from fluency development, and the importance of exams, Extensive Reading as a pedagogical approach to learning at a tertiary level has suffered in popularity. However, Grabe (2009) also states that there is evidence that extensive reading that is applied under certain principles over a longer time frame can lead to many important benefits.

Nation (2014) also noted that extensive reading studies done with native speakers used unsimplified texts while simplified texts were used for non-native learners. It was reported that learners who read unsimplified texts did not make as many gains in reading fluency as those who read simplified texts. This could possibly be used to justify the above-mentioned goal of having 5% or less words that are unknown to the reader in any text they encounter to encourage fluency.

What Is A "Video Game"?

Before discussing the current state of video game research, it is important to first define what a "video game" is. Most researchers seem to agree on common criteria for games, which is that they are, "a system in which players engage in an artificial conflict, defined by rules, that results in a quantifiable outcome," (Salen & Zimmerman, 2004: 80). Nevertheless, all video games cannot be grouped under just one such heading. There are many different definitions and categories when it comes to the topic of video games. The type of game to be used in this research is often referred to as, "Commercial off-the-shelf games". Let us consider this in turn below.

Commercial Off-The-Shelf Games (COTS)

According to general game-based literature, games that are not specifically created for the purpose of L2 teaching or learning are called *commercial off-the-shelf* (COTS) games (Cornillie, Thorne, & Desmet, 2012). These are the games most people would be acquainted with since they are sold to the general public and are used for recreation by people around the world. An example of these games would readily appear in any electronics store.

Video Games as L2 Input

Research on video games in an EFL context is still a relatively new field. Most research done on video games usually call to mind the way learners have changed over the years and their reliance on different methods of gaining knowledge; otherwise known as the "digital native" (Prensky, 2005). He stated that these "digital natives" are more accustomed to technology and thus, more responsive to learning from multimedia.

There are many different ways in which video games promote learning. A list, adapted from Gee (2007) but slightly adapted for length, is presented below:

Video games allow players to change the virtual world they inhabit. Players must interact and solve problems to continue the game.

A sense of identity is shared with the character on screen, which stimulates investment in the goal or objective.

Manipulation of the virtual world is allowed which promotes investment and interaction in the game world.

Meaning and concepts introduced in video games are clearly shown to the player through experiences they have in the game world.

Squire (2005) also emphasized the importance of interaction in video games and how, "their ability to grant players *agency* within the narrative fiction of the game-world and its rules...account for players' actions in creating the experience." This is accomplished through interactivity with the game world, which forms the backbone of how learning takes place and interest in the activity formed.

Player investment in the video game is paramount to how much they stand to gain. Squire (2011) calls this "interest-driven learning". Learners must be engaged in the material they have at hand for them to effectively take away any knowledge. Squire (2011) also stated, "Although this principle is not new, many digital media researchers believe that it is increasingly relevant to the future of education, given the explosion of digital media" (p.47).

Studies on Video Games and English L2 acquisition

The following section will evaluate past studies done on video games supporting second-language acquisition.

A study done by Sylven and Sundqvist (2012) explored the question of whether or not video games are conducive to L2 learning. They gathered data from 86 fifth grade students studying English in an EFL environment at Swedish primary schools. Each student was told to write down their exposure to certain activities such as reading books, newspapers, television, music, or playing video games over a certain period of time. Tests were then taken by the students that measured their English reading, listening, and vocabulary comprehension. The researchers split the students up into three different groups based on the frequency of video game playing (non-gamers, moderate gamers, and frequent gamers). It was found that English proficiency scores of frequent gamers were

significantly higher than those who were not in vocabulary ($p<.007$), reading ($p<.021$), and listening ($p<.022$). The study, however, did not control for the type of video games the participants played and did not attempt to determine what kind of games and what kind of English input they were getting from the video games. In addition, mainly being a survey study meant the study did not attempt to stage an intervention on the students to see if it was actually the video games that were causing the students to be more proficient at English.

Ranalli (2008) chose to use a real-life simulation game called "The Sims" to investigate if nine intermediate-level ESL learners from various countries were able to improve their vocabulary knowledge through game play. Results of the research found an increase of 14% in vocabulary knowledge when comparing pre- and post-tests. Change in vocabulary was also found to be statistically significant at $p<0.002$. One of the main points Ranalli stresses in his conclusion is "commercially produced computer simulation games can, with theoretical guidance, be adapted for use by ESL students" (p.453). However, gameplay sessions were used in which students were allowed to play the game while being observed by the researcher. The study did not account for student interaction between the students and did not pair qualitative measurements with the data.

The next study explored the effectiveness of massive-multiplayer online role-playing game (MMORPG)-based instruction in elementary English education in Korea (Suh, Kim, & Kim, 2010). 302 fifth and sixth grade students from five schools participated in the study. The students played with each other online. Results from English comprehension tests showed students who played the game had overall higher English comprehension scores that were calculated with a multivariate analysis of variance (MANOVA) revealed statistically different scores between the control and treatment groups ($p<.01$). When analyzing the individual skill subsets, speaking was the only subset found not to have a statistically significant difference ($p<.07$). The study concluded that MMORPG's were "useful for improving the English abilities of students who study English as a foreign language" (p.376). It is important to note, however, that the study used video games pedagogically. Students did not use the video game in a naturalistic context and possible interaction between teachers and students was not factored in. Squire (2011) and Gee (2007) have said using video games in this way is not favorable in that the "fun" aspect is absent and motivation to play could be damaged.

Vahdat and Behbahani (2013) studied the effect of video games when compared to more traditional pedagogical methods. Their study revolved around

vocabulary acquisition in 40 students who played video games to support learning done in classes. These students were compared to a similar group of students who did not play video games but received text-based activities created by the researchers. It was found that the students who played video games displayed scores higher than the control group that were statistically significant. The study, however, did not mention what aspect of vocabulary the students were learning. Research has stated that vocabulary in itself is a very complex system and there are different levels of knowing a word (e.g. Nation, 2014).

The study most similar to the current research, deHaan (2013) investigated using various video games to improve Japanese learner English ability. Six different video games were played by six different students; one student to one game. Each game genre was different, ranging from puzzle games to rhythm games and role-playing games. The video games were played outside of the classroom for four weeks and differences in achievement were tracked before and after they were given to the students. Results showed that some participants lost motivation while playing their game (i.e difficulty level was too high, language was hard to understand, gameplay became repetitive and thus, boring, or lack of time). However, students who played role-playing games, such as the one presented in this study, mentioned that they felt they learned English while playing the games. Students remarked they had fun while learning English through gameplay. English comprehension scores showed improvements in vocabulary and grammar scores, as well. Qualitative surveys also reflected the participants felt the game was beneficial to their English studies, citing the large amount of L2 input found in each game regardless of genre. It should be noted that this study appears to have been done as a more comprehensive evaluation of several different types of video games. In fact, the bulk of the data was qualitative and the quantitative data seemed to be used to support claims made in the qualitative segment. As such, data in grammar and vocabulary test scores was gathered, however no statistical analysis was undertaken. All video games have different amounts of text, require different skills to complete, and have different situational goals and problems. The researcher himself stated that the generalizability of the study was a point of limitation. Lastly, data for this study was taken over a period of four weeks. Research has stated that the minimum to observe changes in ability requires eight weeks (Squire, 2011).

RESEARCH QUESTIONS

Up to now, studies conducted on single-player games have focused on many aspects of vocabulary, reading, and listening ability. However, no study before has focused on changes in reading speed, word recognition speed, and vocabulary size after being exposed to video games. Due to a low number of students that were involved in the study, qualitative data in the form of interviews was also taken to support the above mentioned quantitative data. It should also be noted that video games were not implemented in a classroom, but were given to the students to play freely outside of the classroom.

Research questions for this study are as follows:

1. Can English video games foster gains in reading rate comprehension?
2. Can playing English video games increase vocabulary size?
3. Can playing English video games increase word recognition speed?

METHODOLOGY

Participants

Two groups of students volunteered for this study. One group of 2nd year undergraduate students (four male, five female) from a university in Japan participated. This group played a video game for two months. Nine participants spoke Japanese as a first language. The control group of ten students did not undergo a two-month period of playing video games but were given graded readers during the same time period the treatment group received the video game. No limits were imposed on the reading of graded readers. Once one was finished, the student simply gave the graded reader back and received a new book to read. Both groups come from the same major and had the same English class load as determined by the university.

Data Collection

Data was collected from the participants twice during the duration of the study. The first set of data was collected in November 2014 (pre-treatment) and

January 2015 (post-treatment). The second set of data was collected in April 2015 (pre-treatment) and June 2015 (post-treatment). The implementations used to measure reading and vocabulary data are described below in more detail. In addition to the quantitative data, qualitative data in the form of interview questions before and after the study were used to gauge participant reactions. Qualitative data was taken to support the test data due to the low number of treatment group participants. A period of two months for the treatment in this study was selected based on findings from Squire (2011) who stated at least eight weeks of treatment were needed to observe any significant changes in multimedia-based studies.

Instruments

Video Game and System

The video game chosen for this study was Pokemon Y. It was played on the handheld Nintendo 2DS gaming system. In the game, the player creates a character and ventures across a fictional world while catching creatures called "Pokemon". The goal of this game is to embark upon an adventure and become the strongest Pokemon "trainer" in the world by defeating and challenging other "trainers".

The vocabulary level of Pokemon Y was analyzed to determine suitability for use with the students. Due to a comprehensive script not being given out to third parties by the parent company, a short two-hour long play session was conducted in which all messages and dialogue that appeared on screen were recorded and put into a small file, which was analyzed with Compleat Lexical Tutor. Table 1 displays this data. Overall, the data for each frequency band (words which appear more or less commonly in normal English interaction) is quite average for a text being used by EFL students. However, it is important to note the high number of off-list words (6.57%). This means the text used words that are not normally found in any type of conversation and were most likely created for the game. This could have been due to the high amount of Pokemon or location names in the game.

Table 1
Linguistic characteristics of a two-hour gameplay sample of Pokemon Y.

	Types	Tokens	Cumulative %	Total Words
1k	471	2742	82.00	
2k	91	201	88.01	
3k	46	78	90.34	
4k	11	33	91.33	
5k	14	21	91.96	
6k-25k	29	49	93.43	
Off-List	50	220	100.00	
				3346

Reading Rate and Comprehension Tests

To measure reading speed and reading comprehension, two passages from Nation and Malarcher's (2007) book *Reading for Speed and Fluency Level 4* were chosen. From this book, the passages entitled, "Fighting the Flu" and, "The Segway" were chosen. In addition, both texts were linguistically similar; each had approximately 400 words and utilized vocabulary that was deemed to be in the beginner-intermediate range. This data shows that the text chosen is a graded text, which would be suitable for testing reading speed in EFL students. Comprehension questions based on the passages that were included in the book were also given to the participants to complete.

Vocabulary Size Test - x_lex

A test designed by Meara (2005) called x_lex was chosen to measure vocabulary size. X_Lex is a fully validated computer test that was designed to run on computers and features a simple "Yes/No" method of vocabulary testing. This is shown below in Figure 2. Words included in the test are selected from five frequency bands (1k - 5k). Frequency bands are made of up words that appear more commonly in the English language. For example "the" is the most common word due to it being present in almost every English sentence. This would result in it being included in the 1k frequency band. Results are divided

into two categories: raw score and corrected score. The raw score simply shows how many words the participant claimed to know. However, the test contains imaginary words that do not exist and thus, if a participant claims to know the meaning of an imaginary word it affects the score. Vocabulary knowledge is suspect when the participant claims to know a lot of imaginary words, which lowers the corrected score and gives a better picture of the real vocabulary size of the subject.

Figure 1. Sample screen of *x_lex*.



Word Recognition Speed - *q_lex*

Word recognition skill is closely related to reading comprehension. To assess changes in this skill, *q_lex* was utilized. This is also a test developed by Meara (2005) to measure word recognition speed. This test displays a string of seemingly nonsensical letters on screen. In fact, there is one English word hidden amongst the line of letters. For example, in **fodguestqborp**, the target word is "guest". A time limit for recognition of each word is used; this is based on the average reaction time of English L1 speakers. The goal of the test is for the participant to stop the timer before it runs out and correctly answer what word was included in the string of letters. *Q_lex* assesses subjects' sensitivity to the presence of real words among a string of letters. Below, a screen shot is shown of what the subject sees while he or she is taking the test.

Figure 2. Sample screen of q_lex.



Interview Questions

As stated above, qualitative data in the form of interview questions was also taken to supplement the quantitative data. This was done because the number of treatment group participants was low in comparison to other studies done in the past. The interview questions before and after the game playing period are included in Appendix 1 and 2.

Procedure

Data collection took place over the course of two months. On the first day data collection began, participants were asked to take part in a brief interview, take the x_lex and q_lex tests, and their reading rate and comprehension were also tested. After this was completed, the treatment group was given the video game "Pokemon Y" and a Nintendo 2DS. They were asked to play the game in their free time over the course of two months while filling out short entries in a video game diary. Subjects were allowed to freely choose when and how long they would play the game. Control group participants also underwent the tests, however they were not interviewed and were given graded readers instead of video games. Each time they finished a book, they contacted the researcher to receive a new one. After two months, treatment group participants were

interviewed again detailing their experiences with the game. The same quantitative measurements from the pre-task were also taken.

RESULTS

Results of Reading Rate and Reading Comprehension Exercises

Reading rate is presented in both time the subjects needed to read the passage in seconds, and the number of words per minute (WPM) achieved by the time spent reading the passages. In addition, statistical information comparing reading speed means and WPM means of the two groups is presented in Tables 2 and 3.

Table 2

Subjects' reading rate change in pre and post activities of the treatment group.

	Fighting the Flu (pre)		The Segway (post)		Difference (sec)	WPM Change
	Reading Rate (sec)	wpm	Reading Rate (sec)	wpm		
S1	181.1	133.22	163.1	145.70	18.0	12.48
S2	196.1	122.98	161.5	147.11	34.6	24.13
S3	176.3	136.83	166.5	142.71	9.8	5.88
S4	92.0	262.12	85.4	278.16	6.6	16.04
S5	116.4	207.31	114.3	207.87	2.1	0.56
S6	132.1	182.60	105.2	225.83	26.9	43.23
S7	234.2	102.98	185.1	128.34	49.1	25.34
S8	199.6	120.85	165.4	143.65	34.2	22.80
S9	197.3	122.23	155.2	153.10	42.1	30.87

Table 3

Comparison of treatment and control group mean reading speed (sec).

	Pre	SD	Post	SD	Difference
Treatment	169.1	46.1	144.6*	34.0	24.8*
Control	209.4	54.6	211.4**	51.8	4.0**

*significant at $p < .01$ according to Wilcoxon Signed-Rank Test

**not significant at $p > .05$ according to Wilcoxon Signed-Rank Test

From this data, the treatment group is showing statistically significant gains in reading rate. A Mann-Whitney test indicated the treatment group had achieved a faster mean reading rate than the group that did not play video games, $U=21$, $p=.05$. This data was shown to have a medium effect size with $r=.45$.

The next set of data presents the reading comprehension scores gathered from the participants. Scores were out of a maximum of 8 points. The scores are shown in Table 4. Treatment and control group means are compared in Table 5.

Table 4.

Reading comprehension change in pre and post activities (Max 8 points).

	(Pre) Fighting the Flu	(Post) The Segway	Difference
S1	6	7	1
S2	6	8	2
S3	5	7	2
S4	6	6	0
S5	6	7	1
S6	6	8	2
S7	6	8	2
S8	5	7	2
S9	4	7	3

Table 5

Comparison of mean reading comprehension scores.

	Pre	SD	Post	SD	Difference
Treatment	5.56	0.73	7.22*	0.67	1.67*
Control	5.90	1.37	6.30**	1.83	0.4**

*significant at $p<.01$ according to Wilcoxon Signed-Rank Test

**not significant at $p>.05$ according to Wilcoxon Signed-Rank Test

From this data, gains can be observed in reading comprehension. Also, subject 4 did not exhibit reading comprehension gains and the quiz scores stayed at six points out of eight. Subject 9 displayed the highest gains in reading comprehension with a 3-point rise. A Mann-Whitney test indicated the treatment group had achieved higher gains in reading comprehension score after two months, $U=17$, $p=.017$, $r=.55$.

Results of *x_lex*

The scores on the *x_lex* instrument aid in discerning the vocabulary size of the participants before and after they played video games. The pre and post *x_lex* scores are summarized in Table 6. The maximum score for this set of data is 5000. The scores presented in this table are taken from the adjusted *x_lex* scores. The score is adjusted according to how many words the subject incorrectly identified as real.

Table 6
*Vocabulary size according to adjusted *x_lex* score (out of 5000)*

	Adjusted Scores		
	Pre	Post	Difference
S1	3550	2550	-1000
S2	3950	2400	-1550
S3	2150	2400	250
S4	3400	2250	-1150
S5	3700	3400	-300
S6	4300	4550	250
S7	3750	3050	-700
S8	3250	2100	-1150
S9	4150	3350	-800

As seen in Table 6, *x_lex* test scores fell quite dramatically over the course of two months. Only two participants, subject 3 and subject 6, experienced very slight gains in vocabulary size. Many of the subjects' scores fell 1000 or more points. No subject experienced a gain higher than 250 points.

Table 7
*Comparison of mean *x_lex* scores.*

	Pre	SD	Post	SD	Difference
Treatment	3578	635	2894	781	-684*
Control	3095	1017	3160	1070	65**

*significant at $p < .01$ according to Wilcoxon Signed-Rank Test

**not significant at $p > .05$ according to Wilcoxon Signed-Rank Test

As mentioned above, the x_{lex} scores of the subjects as a whole in the treatment group fell considerably. The data presented in Table 7 shows that this drop in scores from pre to post-test phase was, in fact, statistically significant. The control group's score remained moderately the same between the two phases, which explains the lack of statistical significance in that area. In addition, a Mann-Whitney test was used to calculate the statistical difference between the treatment and control groups. This test indicates the treatment group's score dropped a significant amount when compared to the control group, $U=24$, $p=.086$, $r=.51$.

Results of q_{lex}

In the next set of data, data for word recognition speed is presented. Test items that were only answered correctly in only either the pre or post-test were excluded from this set of data. In attempting to accurately measure the word recognition latency of a dynamic system such as vocabulary, focusing on the change in previously known words suggests a more global view of how word latency changed over two months. The results are reported below in Table 8.

Table 8
Latency of words answered correctly in pre and post-tests (sec).

	Pre	Post	Difference
S1	1.32	0.99	0.33
S2	1.08	0.90	0.18
S3	1.60	0.95	0.65
S4	0.85	0.75	0.10
S5	1.12	1.08	0.04
S6	1.07	0.96	0.11
S7	1.20	0.88	0.32
S8	0.88	0.74	0.14
S9	1.30	0.93	0.37

Table 9
Comparison of latency of known words (sec)

	Pre	SD	Post	SD	Difference
Treatment	1.16	0.23	0.91	0.11	0.25*
Control	1.01	0.19	1.01	0.14	0**

*significant at $p < .01$ according to Wilcoxon Signed-Rank Test

**not significant at $p > .05$ according to Wilcoxon Signed-Rank Test

When latency of words that were answered correctly in both the pre- and post-test are compared, the treatment group showed a statistically significant rise in score. The control group did not exhibit any change in scores. In addition, a Mann-Whitney test was used to determine that the treatment group did, in fact, gain faster word recognition scores, $U=1$, $p=.0003$, $r=.83$.

Survey and Video Game Diary Responses

This next section will summarize the responses for the pre task interviews, video game diaries, and post task surveys. Firstly, the amount of hours each subject played the game will be summarized in Table 10:

Table 10
Summary of total hours played

	Hrs. Played
S1	26.10
S2	43.01
S3	24.40
S4	19.29
S5	31.07
S6	24.22
S7	14.41
S8	28.12
S9	20.42
<i>M</i>	25.67

A quick summary of data gathered from interviews follows in bullet-point format:

- The inclusion of graphics and animations in the video game seemed to promote comprehension of the text. This can suggest a shift towards more visual-based formats as being desirable by students. Subjects stated that when they first read an explanation for an item or event, they often did not understand the more complex vocabulary words if they were not also looking at the screen. Upon looking at what was shown on screen, they were able to understand the general gist of what it was the game was trying to tell them.
- Repetition of messages and dialogue seemed to have caused incidental learning. Most of the subjects stated that many contexts such as battles or system dialogue messages such as, "Do you want to save now?" were repeated quite often. Thus, they were able to slowly realize what the game was trying to tell or ask them.
- Video games may have a lower level, more colloquial use of language. However, explanations and descriptions were still difficult even for more advanced learners of English.
- In some cases, such as subjects 8 and 9, even though the subjects understood the type of English being used in the video game was conversational and less formal English, they still struggled with understanding the meanings of certain phrases throughout gameplay.
- Subject 7 stated she was unable to play the game for several weeks. She stated that it was because of this period away from the game that she was unable to immerse herself in the game again and thus, played much less than other participants.
- Many of the subjects stated they were motivated to continue playing the game throughout the two months. Interview responses suggested that even though they felt they did not understand the English at times, they were still motivated to continue playing the game.
- Some subjects felt a loss of motivation if they were unable to understand certain phrases. Subject 9 suggested she lost some motivation due to not being able to understand some phrases even though, "the game was made for children."

DISCUSSION

RQ1: Can English video games foster gains in reading rate and reading comprehension?

As shown above, the reading rate of the students showed a significant gain in test scores after two months. It is possible the students became more accustomed to seeing and parsing English text through large amounts of input taken in. Reading rate results such as these have been echoed in research using extensive reading such as Iwahori (2008). These two studies showed reading rates could rise when EFL students were exposed to extensive reading programs. The current study did not frame the experience of using video games as English exposure to mimic extensive reading practices, however in retrospect there are a few similarities. Namely, that students were allowed to freely play the game at their leisure over the course of two months, and that video games were something they initially found interesting bears a resemblance to the principles that guide many extensive reading courses (Day and Bamford, 2002). Expanding upon the similarities to the findings of studies done in extensive reading, Nishino (2007) also found that Japanese students who read through a text (in her case *Harry Potter*) normally showed gains in WPM reading speed. Because the students in this study did something very similar, this strongly demonstrates that video games can improve the reading rate if some extensive reading principles are applied to video games in extra-curricular language learning activities. WPM as a measurement for benefits from video games has not, to the knowledge of this researcher, been used in any studies beforehand so comparing the data found in this study to other video game for EFL-related studies is currently not possible.

Contextual clues in the video game were also a possible source of the participants' gains in reading comprehension. Firstly, it was stated by Hulstijn and Laufer (2011) that incidental learning is a time consuming process that would take longer than more conventional learning styles. Data gathered on time played by the students shows that the students played the games for a considerable amount of time over the two months. In addition, the students also stated they enjoyed playing the game and were motivated to continue playing until completion. For some students, they even continued playing past completion. The responses demonstrate a commitment to giving quite a substantial amount of time to the game on the part of the students. This could have spurred some form of contextual learning of words or reading passages that were shown in the game. All subjects mentioned in the interviews that after seeing the dialogue or explanation on screen coupled with animations or visuals,

they were able to grasp the meaning of the text they read. This confirms qualitative findings made by deHaan (2013). In addition, increased comprehension of reading passages after playing video games is a finding which confirms the results of a study done by Suh et.al. (2010). Paran (1996) also theorized that beginning readers would have to rely upon contextual cues in order to gain meaning in many situations. While the students were not beginning readers, most were playing an English video game for the first time, which could suggest a few similarities.

RQ 2: Can playing English video games increase vocabulary size?

Vocabulary size dropped for students who underwent treatment when compared to the students in the control group who simply read graded readers for two months. The students in the treatment group were found to have vocabulary size scores that were significantly lower than those of the control group. This is not something that has been seen in any study before this one. Studies such as Ranalli (2008) and Vahdat and Behbahani (2013) have shown evidence for video games as being able to reinforce vocabulary acquisition to a certain degree. However, a drop in vocabulary size is something that has not been observed before.

One possible reason for this behavior could be the high amount of fake words used in the game that most subjects say they never saw anywhere else. The names of monsters, items, and locations were for the most part, unique to the game because they were made-up. Lexical analysis of the game text showed a percentage of made-up or off-list words that were quite considerable for a text included in media marketed towards children. Due to this, it is possible this led the participants to guess more often during the *x_lex* test because of the prolonged exposure to fake words. In fact, the Dynamic Systems Theory supposed that complex cognitive systems such as reading or vocabulary retention can react in dramatic or unusual ways when exposed to new types of stimuli (de Bot, Lowie, & Verspoor, 2007). Most participants noted they had never played video games made in English before and expressed a certain degree of surprise upon first playing the game. It may be suggested that the participants were becoming used to the concept of meeting new, unknown words with a context that can hint at their meaning. It is possible that the participants began reacting in unusual ways to seeing words they did not know in real life due to prolonged exposure to fake words in a virtual world.

RQ 3: Can playing English video games increase word recognition speed?

As described above, all participants also mentioned they felt they were able to read the text as a whole faster. The subjects attributed this to repeated contexts and sentences during the course of gameplay. As Waring and Nation (2004) mentioned, this repeated encounter with the same word or phrase could have slowly built up the participants' lexical knowledge. However, in this case the "knowledge" that was built up was the speed at which the participants were able to identify a word. This is seen in the significant rise in word recognition speed of the treatment group.

Hunt and Beglar (2005) also stated that lexical access can be developed through, "a variety of integrated tasks, such as reading, viewing accompanying videos, discussing the topic, and responding to the text through writing tasks" (p.40). Using these tasks lessens processing demands through repeated tasks that take advantage of familiar schema in a variety of contexts. Many of the subjects in this study commented that unknown words they encountered in context such as the name of a new character or item they did not know yet would show up repeatedly after being introduced to it during gameplay. In addition, they often had to talk to the character or use an item, which provided an opportunity to "interact" with the word. This slow build up of knowledge and improvement in word recognition could give evidence for the Involvement Load Hypothesis posited by Hulstijn and Laufer (2001). Responding to the situation at hand, having an animation of the item or character, and having the vocabulary term show up repeatedly during gameplay is something that can be said to have caused the higher vocabulary recognition speeds exhibited in the data. As with the other data involving reading speed, word recognition speeds being used as a form of measurement for benefits from video games is not something that has yet been demonstrated in other studies and thus, cannot currently be compared. Vocabulary gains have been reported by Ranalli (2008) and Vahdat and Behbahani (2013), however they did not report on whether or not their subjects were experienced faster word recognition rates, only general comprehension of the words.

Although the participants' recognition speed became faster throughout the two-month period, it still cannot be concluded with confidence that overall vocabulary proficiency (vocabulary used in production, automaticity of words, and the above-mentioned size of vocabulary) of the participants also developed. According to similar findings by Coulson and Meara (in press), improved *q_lex* scores indicate, "changes in lexical accessibility, which are weakly linked to

general proficiency" (p.14). In other words, *q_lex* scores give us insight into how fast a person can recognize words in a given context, but overarching change in general lexical ability is not an area where concrete conclusions can be drawn.

IMPLICATION FOR FURTHER STUDY

It should be noted that the point of the current study was not to look into how video games could impact the classroom, but rather how effective they would be at providing an environment where reading and vocabulary comprehension could benefit.. Ranalli (2008) stressed the importance of guidance when using video games for pedagogical purposes. A conscious effort was made not to impose rules on the gameplay (hours played, what monsters they battle, where to go, etc.) of participants of the current study. How these single player video games are taken to when introduced into the classroom has been studied before by Squire (2011), however it may be worth studying how they affect EFL learners.

The *x_lex* scores reported are a point that could possibly be used in further video game-related research. The phenomenon of adjusted *x_lex* scores dropping over time has never been reported by any other study. However, the fact this drop was observed in the data merits more attention. Whether this was caused by the video game or an extraneous variable is something that should be examined more closely. Video games causing an unintended change in how players perceive words could be something that can be studied in more depth in the future.

Observations made in this study were done right after the participants' two-month game playing period. How the benefits associated with video games hold up after several months away from video games is another point that requires more investigation. A similar study taken a few weeks, or years after video games are played could shed light into just how powerful a stimulus video games are for speeding up reading and vocabulary recognition rates.

On the subject of qualitative data and student responses to playing the games, it would be interesting to investigate how the students reacted to playing the games over time. A purely qualitative study could be undertaken to determine how students change over time when exposed to English video games.

LIMITATIONS

One of the biggest limitations of the current study was the relatively small sample size that was taken. Having only nine participants in this study allows us a glimpse at the overall picture. To gain a more complete understanding of how video games affect a larger student body, optimal numbers for participants when gathering both statistical and interview data could be approximately 30 students to mirror a study done by Squire (2011). A larger and thus, much more difficult number to attain, could be to mirror a quantitative study done by Suh et al. (2010) which used 220 students over two months.

Interest-driven learning, which was introduced by Squire (2011), was a fundamental part of this study. This concept could be seen as both as a strength and a weakness of the study. Due to the researcher not wanting to impose any restrictions or limits on play time, it was decided to let the students play as much or as little as they wanted in their off time. This was done to preserve the low-pressure environment normally attributed to video games and entice the users to play as much of the game as possible. This caused an uncontrolled time variable present in the study, it could be seen as a possible confounding variable that could be eliminated in further, and more clinical, study.

As mentioned above, the entire script of the video game was not obtained due to licensing restrictions. This same limitation appeared in Horst's (2005) study of vocabulary learning by reading graded readers. Due to the fact that the linguistic data of the video game used in this study is still, at this point, incomplete, it is difficult to draw definitive conclusions on what kinds of words and word forms the participants learned while playing the video game.

Lastly, Waring and Nation (2004) mention identifying any one person's full reading comprehension skill requires the use of multiple tests; one test is simply not enough for such a complex construct. This study only presented a narrow spectrum of what could be considered part of a larger construct that is reading and vocabulary comprehension as a whole. In no way could it be said that overall reading comprehension and overall vocabulary comprehension showed benefits.

CONCLUSION

Video games are still a relatively new field in the established world of EFL. This paper has provided evidence for single player video games to benefit

language acquisition in students of English. These benefits encompass word recognition speed and reading speed and comprehension. While adding to research up to this point in terms of vocabulary acquisition, studies up to this point, which provide evidence for English ESL learners playing video games and achieving faster reading and vocabulary recognition rates are few, if none. The data presented also confirmed past data in many studies, which related to video games spurring higher rates of reading comprehension. It should be noted, that an increase in vocabulary size was not observed. On the contrary, vocabulary size scores in the group that played video games dropped significantly when compared to the control group. This phenomenon, which has not been reported in any other paper, is one that requires more research in the field of video game research. In learning more how video games can affect students in this day and age, it is hoped that the results and conclusions presented in this paper spur more discussion and research into the usage of video games as a learning tool.

ABOUT THE AUTHOR

Benjamin Thanyawatpokin is a teacher and researcher at Himeji Dokkyo University in Japan. He earned his M.Ed in Teaching English at Ritsumeikan University in 2015. He is currently publishing works in a variety of areas including CALL and the usage of plurilingualism in the classroom. His current research interests are video games and how they can be used to facilitate language acquisition.

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APPENDIX 1

Pre-Study Interview Questions

Name:

Age:

Major:

1. Currently, how do you study English?
2. Have you ever thought of using multimedia to learn English?
3. Are you interested in video games?
4. If you have interest in video games, what kinds of video games have you played before?
5. Do you still play games now? Why or why not?
6. Why did you decide to take part in this study?
7. Do you think playing video games in English will be beneficial for your studies?

APPENDIX 2

Post-Study Interview Questions

1. How often did you play? (About how many hours in a week?)
2. Were you able to finish the entire game?
 - If yes, did you continue to play after you finished? Why did you continue to play?
3. Did you find the game enjoyable? Would you continue playing it now if you still had the game?
4. How often were the images useful in understanding the text? Why?
5. How easy/difficult was the text to understand?
 - If you had difficulties in understanding the text, did you continue playing or stop and check the meaning?
6. What was reading the text like after playing for two months? Did you still have problems understanding the text?
7. What was the level of the text in the game? Was it difficult to read?
8. After this experience, do you have motivation to try other games in English? Do you know anything you would like to try?
9. As a learning style, what would you say was effective about using a Nintendo DS?
10. After finishing this study, do you feel motivated to continue with your English studies?
11. Was this experience different from other types of reading experiences? How so?
12. Are there any other comments?