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Vocabulary acquisition: Gaming as an extramural incidental learning activity for L2-English learners

by Iwarin Suprapas

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Vocabulary acquisition: Gaming as an extramural incidental learning activity for L2-English learners

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Abstract

This research aims to investigate how much vocabulary could be learnt from gaming. It explored the relationship between independent variables from player/learners- or game-oriented perspectives and vocabulary gains. Twenty-five gamers participated in the study. Their nonwords gains were tested at the level of the form-meaning link in both productive and receptive mastery, before, immediately, and one week after completing a quest in a single-player open-world adventure role playing (RPG) game called *The Elder Scrolls V: Skyrim Special Edition*. The results showed vocabulary could be learnt from gaming at the form-meaning link level in both productive and receptive mastery. Discussion viewed from the game-oriented perspective suggested the game chosen had an environment that suits incidental vocabulary learning. It complied with all five learning conditions and was supported by repetition and the words' saliency while having the characteristics to increase the player quality of attention. From the player/learners' perspective, quantitative data analyses indicated significant relationships between variables from the player/learners' perspective to positively affect gaming. Positive correlations were found between participants' gaming habits and engagement and vocabulary gains. On the other hand, gender and proficiency were non-significant. This implies that there is a possibility that English learners of any gender and proficiency could learn vocabulary incidentally from gaming; therefore, gaming should be encouraged. Future research could explore vocabulary in more depths or investigate and compare different game genres.

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Table of Contents

List of Appendixes

List of Tables

List Of Tables (Appendices)

List of Figures

List of Figures (Appendices)

1. Introduction

"Vocabulary is a complex construct" (González-Fernández & Schmitt, 2020, p.481) and a crucial element in any second language (L2) learning (Nation, 2013a, 2013b; Schmitt, 2008). Therefore, language instructors should devote considerable time to vocabulary teaching and learning (Webb & Nation, 2017). However, in English as a Foreign language (EFL) countries (Kachru et al., 2009), classroom time is limited; thus, lacking the necessary amount of input for vocabulary learning (Webb & Nation, 2017). Consequently, several studies have paid more attention to different Extramural English (EE) activities to which the learners are committed in their free time. These activities serve as potential resources for enhancing the exposure to the language and potentially improving vocabulary knowledge outside of the classroom (see, e.g., Peters, 2018). One of these resources is gaming. Even though several studies were investigating the relationships between gaming and vocabulary knowledge (Sundqvist, 2009, 2013, 2019; Sundqvist & Sylvén, 2014; Sundqvist & Wikström, 2015; Sylvén & Sundqvist, 2012), there are still voids left to be filled.

Previous research did not directly examine incidental vocabulary learning through gaming. If any, the only games explored were courseware, which differs significantly from extramural gaming (Reinhardt, 2017). Furthermore, González-Fernández and Schmitt (2020) mentioned the downside of using different test batteries in vocabulary research. They noticed that various tests with different conceptualisations or testing the same word knowledge with varying test formats could "partly" lead to incomparable results across various studies (p.484). This research, taking all the above gaps into account, aims to identify the link between incidental vocabulary learning and commercial off-the-shelf (COTS) games at the level of the form meaning link in both productive and receptive mastery by adapting Gonzalez-Fernandez and Schmitt's (2020) test batteries as the material.

This paper is divided into six chapters, presenting the introduction, literature review, methodology, reporting, discussing the results, and summarising the study.

2. Background

This chapter will review existing literature related to vocabulary learning and gaming. Firstly, vocabulary and its significance will be discussed, followed by approaches, input and learning conditions for vocabulary learning. Then vocabulary learning situations in EFL countries will be explained, leading to the need for Extramural English (EE) activities and gaming as one of the pastime activities, respectively. This chapter ends with a summary of the research gaps and research questions.

2.1. Vocabulary and its significance in language learning

Vocabulary is "a collection or list of words with brief explanations, definitions, or translations of their meanings, either in the form of a stand-alone list or book" (OED Online, 2021b). It is considered one of the most crucial elements in any language, as emphasised by Wilkins (1972), "without vocabulary nothing can be conveyed" (p. 111). Different words have different values, depending on the learners' and users' needs, goals, and purposes. It is also indicated by how frequent they appear in each language (Webb & Nation, 2017). The more frequent a word appears, the greater value it has in terms of usefulness, especially for communication purposes.

According to Schmitt and Schmitt, (2014), word frequencies are categorised into three categories: high-, mid-, and low-frequency words. However, it is much harder to identify the most frequent word families belonging to technical and academic word categories. Chuang and Nation (2003) found that, in medicine-related fields, the technical terms frequently used consist of both high- and low-frequency words, such as blood (1K), bone (1K), trachea (11K) and vertebrae (9K). As for vocabulary used in gaming, Rodgers & Heidt (2020) lexically profiled ten commercial-off-the-shelf (COTS) games and found that vocabulary used in gaming ranged from 1k to almost 14k word families. Therefore, even though the most frequent words are usually deemed most important, different frequency bands matter differently for different skills and tasks. This will be elaborated more in the following section.

2.1.1. Importance of Vocabulary

Vocabulary plays crucial roles in any language learning. Researchers suggest vocabulary size, also known as the form-meaning aspect of a word, has positive correlations with most language skills' performance, e.g., reading, listening, and writing (Albrechtsen et al., 2008; Laufer & Goldstein, 2004; van Zeeland & Schmitt, 2013). This means the more vocabulary the learners know, the better they will be able to perform such skills. Therefore, it is conclusive that an extensive vocabulary size is needed.

Different vocabulary sizes are needed for different skills and communicative tasks. For example, to comprehend written text (98% coverage), Nation (2006) suggested learners need 8000-9000 word families, and to understand spoken text (95% coverage), 2000-3000 word families are required (van Zeeland & Schmitt, 2013). Also, a large quantity of words is crucial for daily communicative tasks. Research suggests 2000-3000 word families are needed to converse in daily life conversations (van Zeeland & Schmitt, 2013) and watch television (Rodgers & Webb, 2011; Webb & Rodgers, 2009), while 4000 word families are needed to understand academic lectures (Dang & Webb, 2014). On the other hand, a much larger vocabulary size is needed for other tasks, e.g., 8000-9000 word families will be required for reading various topics of authentic texts (Hu & Nation, 2000) such as newspapers or novels (Nation, 2006). Moreover, Rodgers & Heidt (2020) found that different games demand different vocabulary. For example, they found that, to comprehend gaming instructions and the storyline, and complete quests in *The Elder Scrolls V: Skyrim Special Edition*, players need to know 5000- and 9000-word families to reach 95% and 98% coverage respectively. Considering all these findings, it is of utmost importance for any second language learner to know large amounts of vocabulary, which requires tremendous time to teach and learn (Webb & Nation, 2017).

2.2. Vocabulary learning: deliberate vs incidental

Two approaches have long been identified as a way to learn a language and its aspects, including vocabulary. The two approaches are deliberate and incidental learning (Webb & Nation, 2017). Since this study will focus on gaming as a pastime activity, the literature will mostly focus on incidental vocabulary learning. At the same time, it is also necessary to know briefly about deliberate learning to understand the different approaches used in ESL and EFL countries.

According to Webb and Nation (2017), deliberate learning is when the attention is explicitly given to the language feature, e.g., syntax, morphemes or phonemes. Therefore, learning in the classroom where the teacher explains each feature explicitly or using a dictionary would be classified as deliberate learning.

On the other hand, Ellis (1999) defines incidental learning as a secondary outcome when completing a task. This means that, instead of the word features, the focus of the task is to understand or comprehend the input or to accomplish a particular task, and while doing so vocabulary will be acquired (Webb & Nation, 2017). Some examples of incidental vocabulary learning are learning through conversing in daily lives, or through Extramural Activities (Peters, 2018), such as listening to music, watching series and playing computer games.

It is important to note that, even though there is a clear distinction of the definition between deliberate and incidental learning, in real life, these two approaches may overlap or scaffold each other (Schmitt, 2010). Pellicer-Sánchez (2017) mentioned the “semi-incidental acquisition approach" in her discussion of the acquisition of collocations through reading (p.396). She suggested the target items could be "manipulated," for example, by "highlighting, or glossing," making the target items more noticeable (p. 396). Pujadas and Muñoz (2019) also supported the argument by recommending a more explicit method. They suggested that, with audio-visual inputs, the words could be pre-taught and followed up by a productive exercise to enhance learning. This would stimulate learning explicitly through a meaning-oriented activity and would also be applicable to other extramural activities that involved words appearing in text formats along with audio-visual inputs, such as gaming.

2.2.1. Incidental vocabulary learning input and factors

Input is crucial for any aspect of learning, including vocabulary. Nation (2007) has defined five conditions an input needs in order to be suitable for vocabulary learning: familiarity, engageablility, comprehensibility, quantity, and containment of contextual clues. Many extramural activities comply with all conditions, especially audio-visual inputs, such as TV series, because of its "lexical richness, repeated encounters with low-frequency words, and visual image support" (Pujadas and Muñoz, 2019, p. 479). Similarly, as an audio-visual input, games which Zichermann and Cunningham (2011) had described as consisting of, e.g., reinforcement and feedback, surprise,

levels, challenges and missions, fantasy, and clear goals, could potentially also create similar incidental learning environment with possibly more engagement than watching TV series. After defining engagement, this comment will be elaborated on in the next paragraph.

Engagement is defined more generally in any learning environment as an act of relying on self-agency, or one's power to control the action and the course of the outcome, in which the learners participate actively (Roskos et al., 2012). Therefore, not only that the input should be engaging, but the learners should also get a chance to engage "actively" as well. This highlights a more engaging environment in the act of gaming when compared to other activities such as TV series.

Originally, engagement was used predominantly in relation to deliberate learning in a language classroom where the learner is participating in a language-focused learning task, such as reading with question prompts (Zhou & Yadav, 2017), or reading ebooks (Roskos et al., 2012; Xu et al., 2021; Zhou & Yadav, 2017) in which the learners could participate and interact with the ebooks. Roskos et al (2012) had established the protocols used to identify engagement in learning through ebooks which allow the learners to "interact" with the readings by e.g., operating the control buttons (Roskos et al., 2012). The protocol was later used in later studies. Xu et al. (2021) investigated whether children's interactions with hotspots (an embedded space that displays a picture and the name of the object which is activated after a click) increased their engagement with reading and how such interactions were related to their learning from the story. Their results suggested that these interactions could facilitate learning.

As previously discussed, in order to incidentally learn vocabulary, learners could also engage in extramural activities such as watching TV series (Muñoz et al., 2021; Pujadas & Muñoz, 2019, 2020) or gaming, since they can also partake in the activity by playing the game. However, previous research found interactivity to interfere with vocabulary recall (Dehaan et al., 2010). DeHann et al. (2010), with Japanese students, conducted research on the effect of interactivity with a music video game on second language vocabulary recall. They divided the participants into two groups, players and watchers, then asked the participants to memorise and recall song lyrics that appeared in the game. They found that the players recalled significantly less vocabulary than the watchers. They speculated that the phenomenon was caused by the extraneous cognitive load

induced by the game's interactivity. However, not much research on engagement or interactivity with other games or in different vocabulary depths has been done.

In addition to an interactivity overload, the input provided should consider minimising vocabulary learning interferences, including semantically related clusters and synformy.

Semantic clusters are semantically and syntactically related words (Gairns and Redman, 1986 as cited in Tinkham, 1977). For example, eye and hand are both nouns that describe body parts; they are semantically and syntactically related. Research advised against presenting vocabulary in semantic clusters since they might lead to confusion (Tinkham, 1993; Erten & Tekin, 2008; Karabulut & Dollar, 2016).

Synformy, as Laufer (1998) described as words with similar forms, could also cause interferences, both in productive and receptive mastery. For example, price and prize both have a consonant cluster starting with pr- and another consonant cluster at the end. Thus, similar spellings could lead to confusion, hindering the vocabulary learning process (Hashimoto & Egbert, 2019; Hiebert et al., 2019; Laufer, 1997; Schmitt, 2008).

In addition to the quality of input, with or without interferences, specific conditions must be met to facilitate learning. According to Webb and Nation (2017), the two conditions are repetition and the quality of attention (p. 61).

2.2.1.1. Repetition

Substantial research deems repetition important for both incidental and deliberate learning. The more one encounter target items, the more one learn. Working with L1-Japanese L2-English learners, Webb (2007) investigated incidental vocabulary learning through reading. Using nonwords, he found that repeated encounters significantly increased scores in both productive and receptive tests at the level of the form-meaning link and other vocabulary depths. The trend was also found consistent in other studies that follow (Chen & Truscott, 2010; Vidal, 2011). However, the number of encounters required to master a particular word is not set in stone. For incidental learning, different researchers found different numbers to be necessary for various tasks. Researchers found two to three encounters to implement the most significant increase in reading activities (Vidal, 2011) at the level of his orthography recall and recognition section (Chen & Truscott, 2010). Pellicer-Sánchez (2016) found eight encounter results in the highest scores on

form-meaning recognition tests, while others found that between 7 to 10 repetitions facilitate form-meaning recognition (Chen & Truscott, 2010) and recall most (see, e.g., Horst et al., 1998; Webb, 2007). As for this study, due to limited time, the participants will not be able to go through the treatment twice. However, the target words will still be repeated, and the participant will encounter the words multiple times during the treatment.

a. Saliency in repetition

When repeating a vocabulary in a context, saliency is one of the key factors affecting incidental learning from repetition (Brown, 1993). Saliency is how important the word is in a particular text (Brown, 1993). In Chen and Truscott's (2010) study on repetition and incidental learning through reading, he noticed saliency playing an exceptionally prominent role. The participants scored exceptionally on the word *troubadour*, a non-lexicalised (NL) word, while almost "no learning occurred" with other NL words (p.708). As they have discussed, this points to the importance of the word troubadour in one of the readings in which the protagonist was labelled as a troubadour, giving it more context, background, and role than other target words. Textual reading which involves context was the method in Chen and Truscott's study. Since context is also involved when playing video games, despite being an audio-visual context, it is also important that saliency be taken into account while researching incidental learning through gaming.

2.2.2. Quality of attention

Quality of attention has a strong effect on learning, perhaps stronger than repetition (Laufer & Rozovski-Roitblat, 2015). The quality of attention is subdivided into four conditions: noticing, retrieval, varied encounters and use, and elaboration.

Webb and Nation (2017) described noticing as attention the learners pay to a word. For incidental learning, they mentioned noticing could occur when the learners are guessing from a particular context. Many methodologies can facilitate noticing, including decontextualisation which looks at a word in isolation without context.

Decontextualisation is when a word appears on its own without context or neighbouring words. According to Webb and Nation (2017), looking at a word in isolation could promote deliberate noticing. These circumstances usually occur in a dictionary or vocabulary exercises. In

a game's user interface, items are usually presented alone without context, mostly accompanied by a visual input. Therefore, it can be inferred that learners will be able to notice these words when they appear on an interface.

Moreover, pictures are also found to facilitate vocabulary learning (Andrä et al., 2020; Carpenter & Geller, 2020; Carpenter & Olson, 2012; Ehret & Hollett, 2014; Kaplan-Rakowski et al., 2021; Mayer et al., 2015; Verhallen & Bus, 2010; Xu et al., 2021). It can also be used to "reinforce and elaborate the use of a word in a context" (Webb & Nation, 2017, p.73). However, Webb and Nation also mentioned its disadvantage as these pictures could divert attention from what needs to be learnt.

Vocabulary is a complex construct (González-Fernández & Schmitt, 2020) and as discussed, the learning process requires suitable input and learning conditions. Thus, a considerable amount of time should be dedicated to vocabulary learning (Webb & Nation, 2017). However, these inputs and learning conditions will vary in different educational settings in the world. The next section will discuss vocabulary learning situation in English as a second language (ESL) and English as a foreign language (EFL) countries.

2.3. Vocabulary learning in ESL and EFL countries

According to Kachru's (1985) Three-circle Model, English speaking countries are divided into three tiers, the inner-, outer- and expanding- circle. This depends on how English is used and the different varieties of Englishes in each circle (Holmes, 2013). English speakers in English as a second language (ESL) and English as a foreign language (EFL) countries use English for different purposes (Holmes, 2013), leading to varying teaching methods, including for vocabulary instruction, depending on the purposes, the quantity of input, and the significance of English in the user's lives. In EFL countries, English is not used outside educational or working contexts; therefore, there will only be few chances learners will encounter or be obligated to produce the language in their daily lives (Kachru et al., 2009). Some examples of EFL countries include Spain, Sweden, Thailand, and China.

As previously mentioned, English usage in EFL countries is scarce. Even though it is mandatory to teach and learn English in educational settings, the learning time provided in the national curriculum alone could not and will not be able to compensate for the amount of input

learners will be able to encounter in ESL countries. For example, in Thailand, English classroom time is limited to only an average of five hours per week in every public school for students at all levels (Ministry of Education, 2018). It is clear that a five-hour learning time is not enough to cover English teaching and learning thoroughly. As a result, some language aspects were neglected, including vocabulary. Hence, more attention should be given to activities in which the learners engage outside educational settings in Thailand and other EFL countries to promote incidental vocabulary learning and compensate for the lack of input and insufficient classroom time. These activities are known as Extramural English (EE) activities, which will be discussed in the following section.

2.4. Extramural English (EE)

English is also learnable outside the classroom, primarily through digital mediums. English provided through these activities is known as Extramural English (EE) (Sundqvist, 2009). Recently, there has been a wave of interest in EE activities as reflected in numerous publications (Leona et al., 2021; Peters, 2018; Sundqvist & Sylvén, 2014). These EE activities, including TV series (Pujadas & Muñoz, 2019), internet (Peters, 2018), songs (Pavia et al., 2019), and gaming (Sundqvist, 2019), are effective inputs to learning English outside the classroom. Different research proves EE to be quality input that positively correlates with second language learning in different aspects. Sundqvist (2009) found positive correlations between oral proficiency and engagement with EE activities, while similar correlations were also found in Sylvén & Sundqvist's (2012) study for reading and listening comprehension. Leona et al.'s (2021) results also indicated that EE activities could increase learners' motivation.

Above all, many studies concluded that EE activities could promote incidental vocabulary learning (Peters, 2018; Pujadas & Muñoz, 2019; Sundqvist, 2009). Reading has long been one of the most researched topics. Webb (2007) and Chen and Truscott (2010) had found incidental learning beneficial for vocabulary learning, both with nonwords and low-frequency words, respectively, at all vocabulary depths, especially when reinforced with repetition (due to limited space, see Nation, 2001 for further details on vocabulary depths). Several studies also reported TV series to be beneficial for vocabulary learning (Muñoz et al., 2021; Peters, 2018; Pujadas & Muñoz, 2019, 2020). Pujadas and Muñoz (2019) investigated the relationship between extensive TV

viewing with subtitles and vocabulary gain in the level of form-meaning link. Results showed that vocabulary could be learnt from watching TV series and could be enhanced by incorporating explicit pre-teaching. Although aspects such as reading have been explored in more detail, the effect of other EE activities such as listening to music or gaming is under researched. Therefore, the present study will concentrate on gaming and its associated research.

2.4.1. Gaming and Second Language Learning

Gaming, one of many EE activities, has just sparked an interest among researchers in the last decade, even though it has remained one of the favourite past-time activities since the creation of Atari Pong Game in 1970s (Lowood, 2009), and continues to gain more popularity. People from every age and race are spending much more time gaming (Facebook Gaming, 2021). According to e Marketer (2021, as cited in Clement, 2021), the number of digital gamers had risen sharply from 166.4 million players to 174.7 million players in the United States. The trend is further predicted to reach 182.6 million players in 2025 (Clement, 2021). As a result, game developers have been continuing to distribute different arrays of games in various genres and titles (Reinhardt, 2017). Before delving into gaming research, it is necessary to define "gaming" as used in this study and understand the complexity of gaming genres.

2.4.2. Gaming and COTS games: Definition, genres & the SSI Model

Gaming is defined more generally as "the action of engaging in games or entertainments; merrymaking; sport" (OED Online, 2021a). However, it has a narrower definition in computer-technology areas. In this research, gaming will be used only in a computer-related sense as in the act of playing digital video games or known as Commercial-off-the-shelf (COTS) games, including computer games, console games, and mobile games. Thus, henceforth, people who play games as a hobby will be referred to as gamers.

Games can be classified into different categories, mainly basing on the types of interactions occurring in each game, the game content, or how the game is played (Apperley, 2006; deHaan, 2005). Some examples of content-based game genres are action, simulation, role-playing games (RPG), and strategy (Apperley, 2006). Games could also be categorised based on the number of players, including, single player (1 player), multiplayer (> 1) and massively multiplayer online

(MMO: uncountable across online platforms). Each genre is further divided into sub-genres, e.g., real-time strategy or shooting as part of an action category. The genres can also be merged as game developers develop new games, such as an action-based adventure MMORPG game. Moreover, with the proliferation of new games and the advance of technology, there are more genres to come, for example, sandbox and indie games. Thus, identifying the game genre is more delicate than ever before.

Sundqvist (2013) categorised gaming using the Scale of Social Interaction (SSI Model) for vocabulary research purposes. She divided games into three tiers according to the number of interactions between players while playing: single-player where the player plays alone, multiplayer with a group of friends, and mass multiplayer online (MMO) which has possible encounters with other international players online.

Gaming is a popular activity that students can choose to do voluntarily in their free time. Consequently, it can serve as a meaningful and authentic resource for incidental second language learning (Reinhardt, 2017) while boosting learning motivations (Leona et al., 2021; Sundqvist & Olin-Scheller, 2013). Above all, gaming has a potential to facilitate vocabulary learning, as stressed by Sundqvist (Sundqvist, 2009, 2013, 2019) and her colleagues (Sundqvist & Olin-Scheller, 2013; Sundqvist & Sylvén, 2014; Sundqvist & Wikström, 2015; Sylvén & Sundqvist, 2012). However, the extent of this relationship is not yet clear.

2.4.3. Relationship between gaming and vocabulary learning

Gaming is beneficial for vocabulary acquisition because of its communicative, repetitive and task-based nature (Sylvén & Sundqvist, 2012). The language most commonly used in games is English, both in the user's interface (UI) and for communication among gamers (Stenberg, 2011 cited in Sylvén & Sundqvist, 2012; Waters, 2007 cited in Sylvén & Sundqvist, 2012). Hence this makes games "authentic, consequential, and widely applicable L2 learning resources" (Reinhardt & Thorne, 2016, p. 416). Moreover, in-game languages are also repetitive to an extent (Marsh & Tainio, 2009). Marsh and Tainio (2009) found repetitions of language features or utterances in "salient and meaningful" quests or in-game events in their study. Consequently, these repetitions could provide players more chances to notice and "learn" those language features. Also, in different game genres, as identified by Apperley (2006), players need to know different words in order to

identify specific items and commands and "communicate" with non-playing characters (NPC). The knowledge will be necessary in order to obtain information and complete quests or objectives.

DeHaan (2005) found that learners acquired sports-related vocabulary from playing a baseball video game. In his study, he interviewed, observed, tested and asked an American L2-Japanese learner to do a self-report on reading and listening to investigate whether those skills could be enhanced by playing Jiikyoo Pawafiru Puro Yakkyu 6 (Announcing Powerful Pro Baseball 6), a Japanese baseball game. The results showed that reading and listening skills could be facilitated by gaming. In terms of vocabulary, the participant reported that the more time he spent playing, the more he could comprehend language that appeared in the game. However, it was also reported that the participant had difficulties in dividing his attention between the content and gameplay since in this particular game, the dialogue and announcements occur at the same time the player had to "play" baseball.

Moreover, studies found that learners could learn and practice using English through interactions with NPCs while gaming, resulting in greater confidence in communicating in real life (Rankin et al., 2006; Reinders & Wattana, 2014). In 2014, Reinders and Wattana investigated the relationship between 90 Thai learners' willingness to communicate and digital gameplay. The participants were asked to complete a modified quest, specifically for communication purposes. Then, a questionnaire was distributed to record the willingness to communicate on the scale before and after the treatment. The 'willingness to communicate' score improved significantly after the treatment, with participants reported to be "more confident, less anxious, and more competent" (Reinders & Wattana, 2014, p. 101).

Based on the studies previously reviewed, gaming might have some potential to be an invaluable resource for second language learning. However, not much research is done regarding gaming in general. Also, since many variables play different roles between gaming and language learning, it can be researched from different perspectives which will be discussed in the following section.

2.4.4. Researching gaming: CALL and the three perspectives

Gaming can be considered a subset of Computer Assisted Language Learning (CALL), which uses computers either as a tutor or tool to assist learning (Levy, 1997). As a tutor, the

program used is developed for teaching and learning, facilitating learning even without the tutor present. In other words, a tutor programme would be designed to teach. On the other hand, as a tool, it acts as a material for tutors to use in classroom settings. Gaming can be used as both a tutor and a tool depending on the developer's intention and the game's specifications. However, commercial off the shelf games could only be defined as a tool, as it is not designed to teach but can be at the teacher's disposal.

According to Reinhardt (2017), three perspectives could be taken into account while researching the relationship between gaming and L2 learning. They are the game-, player/learner-, and pedagogically-oriented perspectives. In the following section, only the game- and player/learners-oriented perspectives will be discussed in detail since they will be the focus of this study.

The game-oriented perspective has been researched in the field of second language acquisition (SLA) to create games with an environment that suits deliberate L2 learning (gamification) both for game developers and second language teachers to use in classrooms (Reinhardt, 2017). This results in various language learning support applications, known as courseware, such as *Duolingo*, *Rosetta Stone*, *Vocabox Experience* (Weissheimer et al., 2019) or other tailored applications (see e.g., Tamtama et al., 2020). Despite being proven by research that gamified lessons would directly benefit L2 learning, the games designs and purposes are different COTS games that the players chose to play in their free time. Therefore, these types of research may lack ecological validity, as Reinhardt (2017) had commented. Non has focused on incidental learning from COTS games and whether they have a suitable environment for incidental vocabulary learning according to Nation's (2007) conditions.

Player/learners-oriented perspective research explores the relationship between gaming and language learning affected by the players' biographical data, e.g., gender, proficiency, and habits (Reinhardt, 2017).

Gender has been deemed as an impactful variable for vocabulary and gaming research. In the past, gaming was predominantly male-oriented; however, there is more balance between male and female gamers in the 21st century (Clement, 2021). However, this also reflects in the biographical data obtained in different studies. For example, from Sylvén and Sundqvist's (2012) report on her participants, male participants engage more in gaming than female participants. They

also found that those male participants have higher vocabulary knowledge than female participants.

Research following this doctrine found positive correlations between gaming and language proficiency, with gamers having higher language command (Sundqvist, 2009; Sylvén & Sundqvist, 2012) and larger vocabulary size than non-gamers (Sundqvist, 2019; Sundqvist & Wikström, 2015). Gender is also a prominent variable. It is found that male participants outperformed female participants since they spend more time playing in a wider variety of games (see, e.g., Sylvén & Sundqvist, 2012). Despite much evidence which proves that gaming positively correlates with learners' vocabulary size and gain, Peters (2018) did not find a significant relationship between gaming and vocabulary learning. She speculated that the different findings varied because her participants' age differed from that of Sylvén & Sundqvist's (2012) and Sundqvist & Wikström's (2015) participants. It is worth noting that these studies only used correlations to find out the relationship between gaming and vocabulary size. None has attempted to examine vocabulary learning through gaming empirically. Consequently, a problematic issue could arise from examining correlations only. This would be discussed in detail as a Sundqvist's (2019) limitation in the following sections.

Sundqvist (2019) conducted the most recent research involving different types of commercial off-the-shelf games in receptive and productive knowledge with learners with varying gaming habits. Situated in Sweden, the study itself is rigorous, being a large-scale, quantitative-dominant, mixed-method, longitudinal study in Sweden. There were 1069 participants, who were divided into four groups according to their gaming habits (differ in how often they play games each week). There were non-gamers (not playing at all), low-frequent gamers (play less than 3 hours per week), moderate gamers (play 3-9 hours per week, and frequent gamers (play more than 9 hours per week). To investigate the extent of the relationship between time spent playing COTS games, type-of-game-preference groups, and L2 English vocabulary test measures, two adaptations of two standardised vocabulary tests were used: the productive levels test (PLT) and the vocabulary levels test (VLT). On average, gamers scored higher than non-gamers, and her results further showed positive correlations between the amount of time played and vocabulary knowledge. Frequent learners are reported to have higher language proficiency and vocabulary knowledge, as demonstrated from Vocabulary Level Tests scores and the usage of more infrequent

vocabulary in their essay samples (see also, Sundqvist & Wikström, 2015). Sundqvist also found that different types of games benefit gamers differently. Using her gaming categorisation (Sundqvist, 2013), she reported that games with a larger SSI scale benefit learners more, suggesting MMO games and Multiplayer games have higher potential than single-player games. After examining the data using multiple regression analysis, it is found that game genre, as classified by the SSI model, was not a predictor of vocabulary knowledge. However, the amount of time played is still significant to L2 vocabulary, thus being a better predictor. Therefore, the time spent playing is more significant than the type of games learners choose to play.

However, since this study only examined vocabulary knowledge using standardised tests, which includes actual words, the study could not determine whether the vocabulary gain is from gaming or contaminated with knowledge acquired from other EE activities the learners also take part in. No study has explored learning which actually occurs through gaming.

2.5. Conclusion, research gaps and research questions

Previous literature has found EE activities to be beneficial for vocabulary learning, especially in language settings where input is scarce. However, not much research was done on gaming, and if any, no study has investigated incidental learning which occurs through playing games. Attempting to take a new leap forward in vocabulary learning and gaming study and fill in previous voids, this research aims to determine whether vocabulary is incidentally learned through commercial off-the-shelf (COTS) games, which is the type of games learners choose to play as a hobby. In line with previous research, the vocabulary size of participants will be tested at the receptive level, and the knowledge of the form-meaning link of new target items will be assessed both receptively and productively. This study will investigate the issue using both the game- and player/learner-oriented approach. The study addresses these research questions:

1. How much vocabulary can be learnt from playing a single-player adventure simulation computer game at the level of the form-meaning link in both productive and receptive mastery?

2. To what extent is there a relationship between the participants' gender, gaming habits, and L2 English vocabulary size and learning gains? How does it compare to previous findings?

3. Methodology

This chapter will review and discuss the methodological approach, data collection, and the procedures used in this study to examine all three research questions introduced in the previous chapter. Firstly, the quantitative approach will be discussed, followed by data collection and procedures, including the participants, target nonwords, material, instruments, procedures, analysis and ethics.

3.1. Quantitative Approach

The quantitative approach, closely related to numerical data and statistics, was chosen for this study. Since this research aims to examine how much vocabulary learning occurs from playing games and investigate the relationship between vocabulary learning and participants' habits, the quantitative approach which offers a "structured and regulated" method to "achieve the macro perspective" (Dörnyei, 2007, p. 29) is crucial to enlighten the notion. The quantitative approach uses numbers and statistics; therefore, the analysis of the relationship between dependent and independent variables could be visualised, allowing the researcher to see the trend and generalise the findings (Dörnyei, 2007). However, it is important to note that the results from the quantitative approach could not identify causation. Nevertheless, the advantages of quantitative far outweigh the disadvantages for this research.

3.2. Data Collection and procedures

3.2.1. Participants

Twenty-five L2-English speakers from EFL countries who play games as a hobby participated in the study. Eighteen of them were male and seven were female. Their age ranged from 20 - 36 years old (M = 25.36, SD = 4.405) and were from a range of L1 backgrounds (60% Thai, 40% Chinese, Spanish, Polish, Gujarati, Greek, Malay, and Hindi). All participants had prior English knowledge and knew an average of 10,132 word families (SD = 569.495, min = 2400, max = 13,600). The average vocabulary size was ideal since it allows learners to comprehend gaming instructions, the storyline, and complete quests in The Elder Scrolls V: Skyrim Special Edition with 98% coverage (Rodgers and Heidt, 2020). The majority were frequent gamers who

play games more than five hours per week (60%), while others were less frequent gamers (40%). They reported being players of multiple game genres, ranging from adventure, auto-chess, RPGs to sandbox and simulations. They all believed that games are useful language and vocabulary learning resources, and all self-reported that they had learnt vocabulary through gaming.

3.2.2. Material

The Elder Scrolls V: Skyrim Special Edition (henceforth Skyrim) is chosen as the material in this study. It is a single-player adventure simulation game developed by Bethesda Game Studios and launched in 2016 through Steam. The game is rich in lores and stories with a world, culture, history and races of its own. In this game, the players role-play as a "dragonborn" to fight dragons and save Skyrim from peril by completing main and complementary side quests while proceeding in the game. Despite not being able to interact with other players while playing, placing the game at the end of the SSI scale, this game allows in-game interactions with different non-playable characters (NPC) as the story progresses. The player could also make choices while completing quests, leading to different outcomes and paths in the main storyline. Despite showing the least potential for vocabulary learning according to Sundqvist's SSI framework (2013) and results (2019), their regression analysis did not find a significant effect of the genre either (2019); therefore, it is still valid to use this game type in a study. On the other hand, adventure and simulation games are rich resources that could facilitate language learning (Baltra, 1990). Baltra reported that this game genre involves the integration of goal-oriented tasks which require meaningful language use. Miller and Hegelheimer (2006) also suggest that simulation games are effective resources for vocabulary learning activities.

Also, Skyrim comes with a modifying program, *Creation Kit Skyrim*, which allows users to modify in-game contents legally, such as modifying characters, quests, and items, both visually and namely. Therefore, the researcher could tailor item names to suit research purposes. By doing so, the researcher could replace item names with the target nonwords introduced previously.

In this study, the participants had to complete the introductory quest *Unbound* which asks the player to escape from *Helgen Keep* after being captured as a prisoner. The quest will also explain how to play the game while introducing the user's interface. As discussed in the literature, games can be classified into different genres; therefore, even though all participants reported

playing games as a hobby, there is no guarantee that these learners know how to play an open-world, first-person game similar to Skyrim. Choosing this quest will facilitate and accommodate every participant.

In addition to completing the in-game quest, , the researcher had instructed the participants to find as much golden coin-shaped money as possible as a side quest in the supplementary instruction sheet (See Appendix X). This was done to highlight intentional learning by ensuring they interact with as many items as possible and distract them from intentionally remembering the target nonwords.

Moreover, the quest does not consume a lot of time (approximately 30 minutes to complete). Most importantly, in open-world games, players' decisions and interactions will affect the gameplay and stories. However, this is not the case with the introductory quest. Not many options can be made, making it easier to control the variables and target nonwords encounters.

3.2.3. Target non-words

Twenty nonwords were used as the target items in this study. The nonsense words are all nouns with at least five while not exceeding seven characters, and were randomised from *ARC nonword Database* <http://www.cogsci.mq.edu.au/research/resources/nwdb/> (See Figure 1 for the word list and short definitions). All words are lexicalised in English, and they followed the phono-syntactic rules to make sure they resemble authentic English words. The target nonwords were divided into three categories: quest-related items, equipment, and miscellaneous. See more information, including occurrences and in-game pictures, in Appendix B.

Figure 1
Target nonwords categories, meaning and definitions

Category	Nonword	Word	Definitions adapted from (OED)
Quest-related items	Kavs	Coins	A piece of metal (gold, silver, copper, etc.) of definite weight and value, usually a circular disc; a piece of money
	Thwist	Potion	A liquid, usually taken orally
	Sprunt	Chest	A box used for the safe custody of articles of value
	Blawked	Spider	One or other of the arachnids possing the power of spinning webs in which their prey is caught
	Quares	Bear	Any of the large, heavily built mammals which typically have small rounded ears, a long snout, thick shaggy fur, stocky legs and a plantigrade gait
Equipment	Phloob	Warhammer	any of various types of heavy hammer, typically with a spiked or pointed head, used as a weapon
	Cheigh	Sword	weapon adapted for cutting and thrusting, consisting of a handle or *hilt* with a cross-guard, and a straight or curved blade with either one or two sharp edges and a sharp point
	Swilge	Bow	A weapon for shooting arrows
	Dwined	Greatsword	A big two-handed sword
	Relp	Shield	Defensive armour carried in the hand or attached by a strap to the left arm of a soldier, as a protection from the weapons of the enemy
	Snarm	Arrow	A long, thin shaft, typically made of wood, with a sharp point at the front shot from a bow as a weapon or for sport
	Slodge	dagger	A short stout edged and pointed weapon, like a small sword, used for thrusting and stabbing.
	Bepth	Helmet	A defensive cover for the head
	Thests	Gauntlets	Glove worn as a part of armour
	Claits	Boots	A covering for the foot and lower part of the leg extending above the ankle
Miscellaneous	Smoch	Basket	A vessel of wickerwork, made of plaited osiers, cane, rushes, bast, or other materials
	Prauced	Broom	An implement for sweeping
	Sweered	Lockpick	An item used to pick a locked door
	Rhogged	Bucket	The vessels in which water is carried,
	Scact	Door	A movable barrier of wood or other material, consisting either of one piece, or of several pieces framed together, usually turning on hinges or sliding in a groove, and serving to close or open a passage into a building, room, etc

Typically, when assessing vocabulary knowledge or vocabulary gain, the words used in each test were authentic English vocabulary. However, there are cases that researchers did not use authentic words to test vocabulary gain. Webb (2007) used nonsense words to explore the relationship between repetition and vocabulary learning. Despite being criticised later by Chen and Truscott (2010) for the lack of ecological validity, these words might not mirror English vocabulary learning (see e.g., Horst, Cobb, & Meara, 1998) his methodology is valid for various reasons. First, non-existing knowledge for the target words was guaranteed; thus, attributing the knowledge gained entirely to the treatment (Webb, 2007). This rigidly controlled environment ensures no learning interferences, allowing researchers to get accurate results only from the treatment. Webb further illustrates that using nonwords could create a learning environment similar to incidental learning from graded readers. Therefore, the participants have enough vocabulary coverage, stimulating the learning of new words.

As for this study, the advantages of replacing in-game words with nonsense words echoed the benefits in Webb's (2007) study discussed in the previous paragraph. All target words will be unknown to the participants. Hence, the results acquired from this research would be accurate and attributed only to the treatment given. Also, this could be considered the best approach, given the participants' proficiency (10,132 word families). If actual words were to be used, it would have been difficult to identify sufficient unknown real words across all participants in the treatment. It is important to note that corpus-based research involving gaming is scarce. So far, a gaming corpus is yet to be established, and there is not yet a corporal study on gaming to determine saliency. Therefore, there is no research to support whether the vocabulary chosen in the study is salient or not. Also, words used to communicate could be similar across different games and genres (Bawa, 2018). The learners could have had prior knowledge of the terms despite no previous experience playing a particular game or game genre. Finally, incidental learning can be stimulated since they have enough vocabulary to achieve 98% coverage in the chosen game (Rodgers and Heidt, 2020).

Apart from advantages resonated from Webb's (2007) study, additional possible advantages are applicable in this research. Firstly, a control group would not be needed for this study which would be more convenient during the pandemic. Moreover, during Covid-19, it is almost impossible for a group of people to meet; therefore, the exams were distributed online. Using fake words will also ensure that the participants could not acquire the word knowledge by

looking them up in a dictionary or online gaming wikis, threads, or walkthrough guides (e.g., on Steam threads, FANDOM, or Reddit). Thus, this study would highly benefit from using nonwords to test vocabulary learning from gaming.

These words will then be modified and replace authentic words in *The Elder Scrolls V: Skyrim Special Edition*, the game chosen as the material.

3.2.4. Instruments

3.2.4.1. Questionnaire

A structured online questionnaire was used to collect the participants' biographical data and gaming habits used as the independent variables from the player/learner's perspective in this study.

Questionnaires are instruments used widely to collect "survey information", which often provides numerical data (Wilson & McLean, 1994 as cited in Cohen et al., 2011). They can be distributed both physically and electronically, with or without the researchers' presence (Cohen et al., 2011). The structural and straightforward nature of a questionnaire makes it easier for both the participants' comprehension and completion and the researchers' analysis (Cohen et al., 2011). However, some researchers view the data gathered from questionnaires as 'unsophisticated' and 'limited' (Cohen et al., 2011, p. 317; Dörnyei, 2003, pp. 10-14). Also, as stated by Cohen et al., the issue would be hard to resolve since it will impact the participants' motivations to fill in the form if the questionnaire is too wordy or demanding.

An online questionnaire was used in this research for two main reasons: suitability and practicality. Firstly, as mentioned previously, questionnaires often provide numerical data (Cohen et al., 2011). Since this study uses a quantitative approach, numerical data would be suitable. Secondly, questionnaires are practical since they can be distributed online (Cohen et al., 2011). In this study, most participants do not reside in Sheffield. Using this instrument, the participants could access the questionnaires from anywhere at any time, allowing more participants to participate. Also, questionnaires, especially structured, require less time for participants to comprehend and complete. Consequently, participants will be less likely to drop out.

For this study, a structured-dominant, semi-structured questionnaire format was used. The questionnaire is divided into four sections: biographical data (age, gender, educational level, nationality, native language), gaming habits (frequency and genres played), vocabulary size (VST: discussed in the next section), and prior information to the game chosen. All participants were asked the same question in the same order with no translation into any other languages. As previously mentioned, the questionnaire is heavily structured with some options to provide answers that were not listed in the choices given, such as the game genre they played. See the complete questionnaire in Appendix C for further elaboration.

3.2.4.2. Vocabulary Tests

Four tests were used to assess vocabulary size and vocabulary gains following the questionnaire. They were the Vocabulary Size Test, pretest, immediate posttest, and delayed posttest. Similarly, all tests were distributed online using a Quiz-mode in Google Form.

a. Testing vocabulary size: Vocabulary Size Test (VST)

Tests used to measure and give learners placements are also known as standardised vocabulary tests. These standardised tests intend to measure learners' receptive vocabulary size (Nation & Beglar, 2007; Schmitt et al., 2001). Many tests of different versions are available, for example, Vocabulary Level Test (VLT) (Schmitt et al., 2001), Vocabulary Size Test (VST) (Nation & Beglar, 2007) and the picture vocabulary size test (Nation & Anthony, 2016). This section will be dedicated to the Vocabulary Size Test since it is chosen as a tool for this research.

Vocabulary Size Test (VST) developed by Nation and Beglar (2007) was designed to measure the learners' receptive vocabulary size up to the most frequent 14,000 word families. It measures written form, the form-meaning connection at the recognition level (Nation, 2012). Suitable for both native and non-native learners, both monolingual and bilingual versions are available for distribution.

VST is the most suitable standardised test for this study. Firstly, the targeted participants are L2-English learners. It was suggested that educated L1-English speakers would have known 15,000-20,000 most frequent word families (D'Anna et al., 1991; Goulden et al., 1990). It was found that L2 learners acquire vocabulary slower than native speakers (Nurweni & Read, 1999;

Webb & Chang, 2012); therefore, the participants would not be likely to know more than 15,000 most frequent words families. Thus, there is no need to test word frequencies higher than 15k, making VST the best choice. Also, testing only up to 14k level would reduce the exam time, making the test more time-efficient. Moreover, an official online version of this test is also available on lextutor.com. Thus, this increases the practicality of this test in terms of administration.

i Specifications

According to Nation and Beglar (2007), the items chosen were intended for testing single word units; therefore, no multi-word units were selected, including proper nouns, transparent compounds, marginal words and abbreviations. They sampled 140 words from fourteen 1000 BNC word lists (Nation, 2006), with ten for each level from each 1000 word level. The test words are then put in a "simple non-defining context" (p.11). Therefore, the test also measures concept knowledge to a minor degree since the words were put into a single non-defining context.

As for the format, a four-multiple-choices format was chosen. Nation and Beglar (2007) mentioned that, by doing so, the test is applicable for learners of different language backgrounds. Moreover, multiple choice items are considered efficient and reliable (Nation & Beglar, 2007). Despite more recent research had disagreed (see, e.g., Gyllstad et al., 2015), multiple-choice test formats are still practical, which is suitable for this research given the number of items which appeared on the test (Nation & Beglar, 2007) Thus, the learners will take less time completing the test, and it could still provide objective numeric results. Therefore, through this rigid and controlled test format, the learners will be able to demonstrate their knowledge of each item. Among the four choices, there is one correct answer and three distractors which, in most cases, are the meanings of words from around the same 1000 word frequency level as the correct answer. It is also important to note that VST does not provide an *I don't know* option. Nation and Beglar clarified that such an option would discourage test-takers from making informed guessing which is crucial since these guesses draw on one's subconscious knowledge. All versions of this test have been piloted in several ways, leading to confidence in its practicality, validity, and washback (Beglar, 2010).

ii Interpreting the Scores

According to Nation and Beglar (2007), each word represents 100 word families. Therefore, when measuring the vocabulary size, the number of correct answers need to be multiplied by 100. For example, if a test taker scores 132 out of 140, it means that that test-taker knows the most frequent 13,200 word families.

However, it is important to interpret the scores with caution. Firstly, since the *I don't know* option is not available, score inflation might occur because of pure guesses. Even though the test-takers used informed guesses, it could hardly indicate how much vocabulary depth the test-takers actually know. Moreover, since VST aims to measure the learners' receptive vocabulary size, the scores cannot be interpreted as an indication of the test-takers' productive mastery, e.g., using those words in writing or speaking. However, these scores can roughly indicate how well a learner can read since vocabulary knowledge is considered the most important element that affects reading skills (Klare, 1974).

b. Assessing vocabulary gain from experimental design: Vocabulary test batteries

Different vocabulary tests have been developed and used to measure the participants' knowledge in different experimental design research. Since these tests aim to quantify the learners' knowledge after the treatment, it is safe to categorise these tests as achievement tests. There are many formats to choose from, but they are also of different names and test different word knowledge. Certainly, a variety of tests can be utilised to suits each research. However, the inconsistency and the different formats could lead to the results of the various studies being difficult to interpret and compare. Gonzalez-Fernandez and Schmitt (2020) addressed their concern towards this issue and recommended consistent use of the same type of test to yield more comparable results.

Therefore, in this study, Gonzalez-Fernandez and Schmitt's (2020) latest test format is chosen as a template to measure the participants' word knowledge acquired from the treatment. This format is chosen since it is a current adaptation of the most common formats employed in the field to test specific word-knowledge aspects. Their test not only tests from meaning links but also other depths such as collocations or associations. Hence, if this research is replicated, future

researchers would have an abundant test format resource to choose from and the results will be comparable.

i Test specifications: Form-recall & Meaning-recognition

Since this study will only focus on the form-meaning link on both productive and receptive mastery, the form-recall and meaning-recognition formats were adapted from Gonzalez-Fernandez and Schmitt's (2020) test batteries. The overall tests were designed so that the preceding sections do not give out the answer to the following one. Therefore, the form-recall was given before the meaning recognition test (Webb, 2007; Chen and Truscott, 2010; González-Fernández and Schmitt, 2020) following numerous previous studies (Chen & Truscott, 2010; Schmitt, 1998; Webb, 2005, 2007). In each sensitivity, ten distractors were added to each section so that the participants will focus on the nonwords. The distractors were chosen from Bawa's (2018) list of gaming vocabulary, then crossed compared with words which appeared during the quest. A brief questionnaire was used at the beginning of each test to minimise any deliberate memorisation from each test to the treatment. All the measurements used to assess vocabulary gained from the treatment were online through Google Form for practicality. See full tests in Appendix X.

b.i.1. Form-recall

According to Gonzalez-Fernandez and Schmitt (2020), the form-recall section uses a fill-in-the-blank format. Here, the participants have to recall the form, given an English meaning adapted from Oxford English Dictionary (OED Online). However, instead of being given the L1 meaning (González-Fernández & Schmitt, 2020; Laufer & Goldstein, 2004), participants were presented with a context in English setting the situation and meaning of the target words. In addition, the first letter of the target was presented in the sentence to prevent the participants from providing other possible answers.

Example:

Write the appropriate word in the space to complete the sentences. The word begins with the letter given.

1. A p_____ is a large, heavy hammer with a long handle and usually spikes. It is used as a weapon.
   Answer: _____

Similar to Gonzalez-Fernandez and Schmitt, dichotomous scoring (correct = 1, incorrect = 0) was adopted, and lenient marking was used. Therefore, the answers were considered correct if the participants provided accurate or recognisable spellings (e.g., *ploob* for *phloob, snorm* for *snarm*). Since the response could not be left blank, it would be marked as incorrect if the participants provided "-" or unrecognisable answers. The total maximum score is 20.

b.i.2. Meaning recognition

As for the meaning recognition test, a multiple-choice format, one of the most widely used for recognition sensitivity (e.g., Laufer and Goldstein 2004), is used. Similar to Gonzalez-Fernandez and Schmitt's study, "the target [non-]words were presented in a short, non-informative sentence" (2020: Appendix 3, p.3). Here, the participants were asked to choose the correct answer from four options with three authentic-word distractors. The distractors were other words that appeared on the test or quest, in the same word category or physically related to the target nonword (see example below). In this section, the "I don't know" option was also included to prevent guessing (Zhang 2013). For the marking, only if the appropriate answer was chosen will the item be marked as correct. The maximum score is 20.

Example:

Choose the correct meaning of the word in [square brackets]. If you do not know the answer, please choose "I don't know".

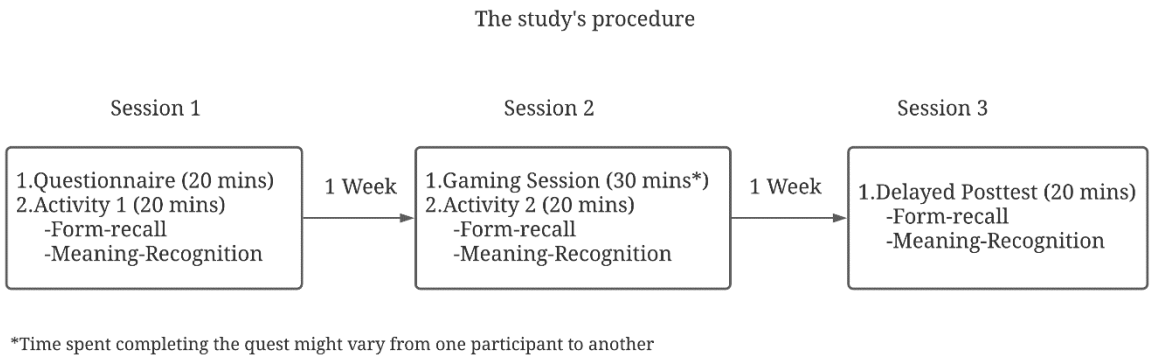
1. He is carrying a [phloob].

   a. Warhammer
   b. Sword
   c. Mace
   d. Broom
   e. I don’t know

3.3. Procedures

Figure 2 illustrates the study's procedure. Before the session, the participants were asked to read an information sheet and agreed to participate before any activity began. Then, within three weeks, participants completed a total of three sessions. All sessions took no longer than 3 hours, deviating by how much time they spent playing the game. All three sessions incorporated Activity 1, 2 and 3, which serves as the pretest, immediate posttest, and delayed posttest in disguise to avoid formality and stress. This could prevent participants from noticing the forms and realise the target nonwords. All instructions were given through email with detailed guidelines, and all activities were accessed through Google Forms.

Figure 2
The study's procedure



3.4. Analysis

Quantitative data was analysed using descriptive and inferential statistics. Descriptive statistics were used to report the general information regarding the participant's biodata, habits, and test scores, demonstrating how much the nonwords are learnt. Then inferential statistics were used to explore the relationship between different variables in this study. To answer both research questions, T-Tests, analysis of variances (ANOVA) and correlations were used to examine the relationship between independent variables and vocabulary gains.

3.5. Ethics

This research follows the University of Sheffield's ethical guidelines. Information sheets and electronic consent forms were distributed and collected from all participants through Google Form. They were also informed of the right to withdraw at any time. The participants will also get a copy of their signed consent form and information sheet to keep (See the forms in Appendix X). If there is any need to refer to a participant in the paper, pseudonyms will be used to ensure anonymity.

4. Results

An analysis of research data gathered through the questionnaires and test batteries is presented in the chapter addressing the research questions raised in chapter 1. Quantitative results from the data collected were statistically analyzed and explained. This chapter will be divided into three main sections, addressing each research question 1, 2 and 3, respectively. However, before reporting and discussing the results, it is important to keep in mind the number of participants. There are only 25 participants in this study; therefore, the data collected and the analysis must be interpreted with caution.

4.1. Research Question 1: How much vocabulary can be learnt?

Research question 1 examines how much vocabulary was learnt from playing Skyrim on the knowledge of the form-meaning link in both productive and receptive mastery. For this question, the data was collected through the test batteries: the pre-test, immediate post-test, and the delayed post-test. Descriptive statistics are used to report the scores. Paired-Sample tests were used to compare the pre-test and immediate post-test to investigate if there were any significant learning. Also, regression was used to examine the attrition between the immediate and delayed post-test scores.

4.1.1. Descriptive frequencies

Table 1 shows the descriptive statistics for the pre-test, immediate and delayed post-tests. The total score for each test is 40, with 20 each for the form-recall and meaning-recognition formats. The participants scored an average of 3.32 (SD = 4.86) on the pre-test, scoring 0 on all form recall questions and 3.32 (SD = 4.31) on average in the meaning recognition section. For the immediate post-test, the average score was 18.92 (SD = 12.33). On average, the participants scored 7.08 (SD = 7.06) on the form-recall questions and 11.84 (SD = 5.9) on the meaning-recognition part. The mean score dropped slightly in the delayed posttest. They scored 18.10 (SD = 12.45) on average, with 6.52 (SD = 7.22) on the form recall and 11.57 (SD = 5.91) on the meaning recognition part. The immediate post-test scores increased from the pre-test while decreased in the delayed post-test.

Table 1:
Descriptive frequencies of the pretest, immediate posttest, and delayed posttests at the level of form-meaning link in both productive and receptive mastery

Activities	M	SD
Pre-test	3.32	(4.86)
Immediate Posttest	18.92	(12.33)
Form-recall	7.08	(7.06)
Meaning-recognition	11.84	(5.90)
Delayed Posttest	18.1	(12.45)
Form-recall	6.52	(7.22)
Meaning-recognition	11.57	(5.91)

4.1.2. Pretest, immediate posttest and delayed posttests

To answer if there was any significant learning, a repeated Measures ANOVA with a Greenhouse-Geisser correction was used to compare the overall scores between the pre-test and immediate post-test (results in Table 2). The results from a Greenhouse-Geisser correction indicated that the average scores differed statistically significantly between different tests ($F(1.296, 25.913) = 26.646$, $P < 0.0005$). Post hoc analysis with a Bonferroni adjustment revealed that immediate posttest scores had significantly increased from the pretest scores ($p < 0.001$). On average, immediate post-test scores were 16.52 points higher than pre-test scores (95% CI [9.175, 23.873]). Therefore, the participants gained significant vocabulary knowledge from gaming.

However, there was no significant difference between the immediate and delayed posttest scores ($p = 0.346$). On average, delayed post-test scores were 2.10 points lower than the immediate post-test scores (95% CI [-5149, 1.229]). Therefore, it can be inferred that the participants can still retain vocabulary knowledge gained from gaming within the period of one week.

Table 2

Pairwise comparisons between pretest, immediate posttest and delayed posttest scores

Pairwise Comparisons

Measure: Pretest, immediate posttest and delayed posttest scores

(I) time	(J) time	Mean Difference (I-J)	Std. Error	Sig.[b]	95% Confidence Interval for Difference[b]	
					Lower Bound	Upper Bound
1	2	-16.524*	2.813	.000	-23.873	-9.175
	3	-14.429*	2.948	.000	-22.132	-6.726
2	1	16.524*	2.813	.000	9.175	23.873
	3	2.095	1.272	.346	-1.229	5.419
3	1	14.429*	2.948	.000	6.726	22.132
	2	-2.095	1.272	.346	-5.419	1.229

Based on estimated marginal means

*. The mean difference is significant at the .05 level.

b. Adjustment for multiple comparisons: Bonferroni.

4.1.2.1. Form-recall and meaning-recognition: pre vs post test

In addition, the scores were also significantly different in each section from the pre-test and the immediate post-test. For the form-recall section, participants scored an average of 5.72 points higher than in the pre-tests ($t24 = 4.207$, $p < 0.001$, 95% CI [2.914, 8.256]). The average score was also significantly different in the meaning recognition part ($t24 = 5.806$, $p < 0.001$). On average, the meaning-recognition scores were 8.520 points higher in the immediate post-test than the pre-test (95% CI [5.491, 11.549]). From the results, it is clear that vocabulary knowledge was gained in both sensitivities after the treatment.

a. Target nonwords learnt in the immediate posttest

When we look closer at each item, all items were marked correct at least once for all participants. The participants scored highest from the word *thwist* (*potion*) in the form recall part

and *kavs* (*coins*) in the meaning recognition format for the immediate posttest. While the non-word participants scored the least were *sprunt* (*chest*) and scact (*door*) in the form-recall and *smoch* (*basket*) in the meaning-recognition part (See Figure 3 for form-recall section and Figure 4 for meaning-recognition section. From the scores, it can be inferred that learning has occurred with every target word on both productive and receptive mastery.

Figure 3

Form-recall scorings for each target nonword

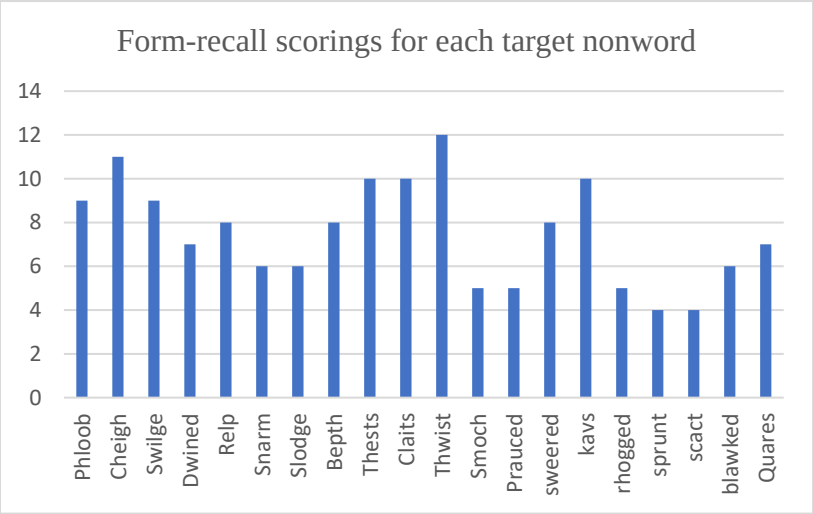
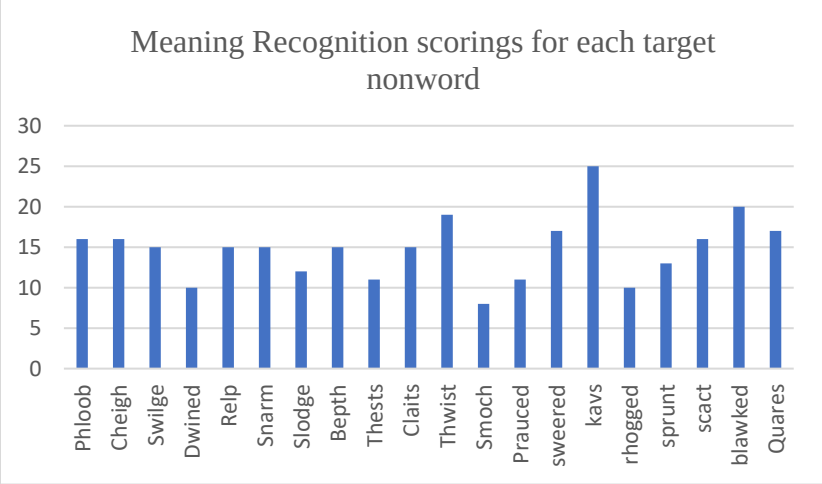


Figure 4

Meaning-recognition scorings for each target nonword



4.2. From a player/learner's perspective: The relationship between the participants' gender, gaming habits, engagement, and L2 English vocabulary size and learning gains

Research question 2 examines vocabulary from both player-learner's and gaming perspectives by investigating all variables that could have affected vocabulary gain. The issue was inspected from both the learner's biographical data and their gaming engagement, and the game itself. It investigates the extent of the relationships between the participants' gender, vocabulary size (VST score), gaming habits, prior game genre engagement and in-game engagement gathered from the questionnaire. Another independent variable is the words' category in which they have appeared in the game. For this research question, independent-sample t-tests were used as a mean to analyse the data since the participants were divided into two groups for each independent variable (gender: male and female & gaming habits: frequent and less frequent gamers). Correlations was used to examine the relationship between vocabulary size and test scores, and the amount of engagement and test scores. The results will be reported by addressing each independent variable, focusing on the immediate posttest to assess the gains.

4.2.1. Gender and scores t-test

An independent-samples t-test was conducted to compare vocabulary battery test scores between male and female participants (see Table 3). The results show no significant effect for gender (t(23) = -.710, p = .485). Here, men (M = 20, SD = 11.84) scored, on average, 3.86 points higher than women (M = 16.14, SD = 14.09). Therefore, being a male or female gamer does not affect vocabulary learning from gaming.

Table 3
Gender and immediate posttest scores

Group Statistics

	Gender	N	Mean	Std. Deviation	Std. Error Mean
Activity_2_L	Male	18	20.00	11.837	2.790
	Female	7	16.14	14.088	5.325

Table 4

Independent Sample Tests results between male and female participants

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
									95% Confidence Interval of the Difference	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
Immediate Posttest	Equal variances assumed	.088	.770	.695	23	.494	3.857	5.552	-7.627	15.342
	Equal variances not assumed			.642	9.494	.536	3.857	6.011	-9.635	17.349

4.2.2. Language proficiency and test scores

Pearson's correlations were used to find the relationship between the participants' language proficiency and test scores (see Table 4). Pearson/Spearman's correlations found insignificant and weak positive correlations between the two variables ($r = 0.18$, $p = 0.38$). Therefore, the learners' vocabulary size does not determine the amount of learning that occurred.

Table 5
Correlations between immediate posttest scores and participants' vocabulary size

		Immediate posttest scores	Vocabulary Size
Immediate posttest scores	Pearson Correlation	1	.184
	Sig. (2-tailed)		.378
	N	25	25
Vocabulary Size	Pearson Correlation	.184	1
	Sig. (2-tailed)	.378	
	N	25	25

4.2.3. Gaming Habit and score t-test

Another independent-samples t-test was conducted to compare vocabulary battery test scores between frequent and less frequent gamers. The results in Table 5 and 6 show significant effect from the two types of gamers ($t(22.90) = 2.43$, $p = .023$). Frequent gamers ($M = 21.67$, $SD = 12.43$) has significantly higher scores than less frequent gamers ($M = 11.40$, $SD = 7.59$). Frequent gamers gained more vocabulary than less frequent gamers.

Table 6

Descriptive statistics of the participants' immediate posttest scores according to their gamer type

Group Statistics

	Gamer type	N	Mean	Std. Deviation	Std. Error Mean
Immediate Posttest scores	Frequent gamers	15	23.13	12.727	3.286
	Less Frequent gamers	10	12.60	8.909	2.817

Table 7

Independent Sample Tests results between frequent and less frequent gamers

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
									Lower	Upper
Immediate Posttest scores	Equal variances assumed	3.149	.089	2.266	23	.033	10.533	4.649	.917	20.150
	Equal variances not assumed			2.433	22.899	.023	10.533	4.329	1.577	19.490

4.2.4. Engagement and vocabulary gain

Pearson's correlations were used to find the relationship between the participants' in-game engagement and test scores. Here, the engagement is evaluated by the number of coins the participants had to find as a part of the instructions other than completing the quest. Then, the participants had to self-report the number of coins in the questionnaire section before the second activity. For this variable, Pearson's correlations found significant moderate positive correlations between the two variables ($r = 0.67$, $p < 0.001$). Therefore, participants who engaged more in the game had higher scores. Furthermore, results from ANOVA's linear regression analysis found the number of coins could predict vocabulary, $R^2 = .45$, $F(1, 23) = 18.509$, $p < .001$. The more coins participants found, the more scores they will be able to get.

Table 8

Descriptive statistics of the participants' immediate posttest scores and number of coins

Descriptive Statistics

	Mean	Std. Deviation	N
Immediate posttest scores	18.92	12.329	25
Coins	61.76	43.200	25

Table 9

Correlations between immediate posttest scores and number of coins

Correlations

		Immediate posttest scores	Number of coins
Immediate posttest scores	Pearson Correlation	1	.668**
	Sig. (2-tailed)		.000
	N	25	25
Number of coins	Pearson Correlation	.668**	1
	Sig. (2-tailed)	.000	
	N	25	25

**. Correlation is significant at the 0.01 level (2-tailed).

Table 10

Model summary of a linear output between immediate posttest scores and number of coins

Model Summary[b]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics				
					R Square Change	F Change	df1	df2	Sig. F Change
1	.668[a]	.446	.422	9.374	.446	18.509	1	23	.000

Note: a. Predictors: (Constant), Number of coins, b. Dependent Variable: Immediate posttest scores

Table 11

Results from ANOVA concerning a linear output between immediate posttest scores and number of coins

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	1626.573	1	1626.573	18.509	.000[b]
	Residual	2021.267	23	87.881		
	Total	3647.840	24			

a. Dependent Variable: Immediate posttest scores

b. Predictors: (Constant), Number of coins

4.2.5. Participants biographical data and Vocabulary size

In addition, participants' biographical data including gender and gaming habits were also used to investigate the relationship with the participants' vocabulary size. No significant relationship was found between gender ($t(23) = -.884$, $p = .386$), despite women ($M = 10942.86$, $SD = 703.683$) attaining larger vocabulary size than men ($M = 9816.67$, $SD = 739.645$). Moreover, there was no significant effect of the gamer type either, ($t(23) = -1.594$, $p = .124$). Here, it is found that less frequent gamers ($M = 11210$, $SD = 527.984$) has larger vocabulary size than more frequent gamers ($M = 9413.33$, $SD = 845.541$).

5. Discussion

This section analyses the previous chapter's key results, referencing the research questions raised in light of the previous literature discussed. This chapter will be divided into three main parts echoing the research questions investigated. The first section will provide an in-depth analysis of vocabulary learning through gaming, looking at the results of the pretest, immediate posttest and delayed posttest scores. Then, different in-game-environment variables viewed from the game-oriented perspective, potentially affecting vocabulary gains, were discussed. Following the first section, the second section analyses independent variables from both the player/learners' perspective and in-game engagement in relation to the vocabulary gains. The third second will compare the relationship between participants' biographical data and vocabulary knowledge with findings from previous studies.

5.1. Can vocabulary be learnt from playing COTS games? How much?

There has long been a belief that vocabulary can be learnt through gaming and that games can be a potential meaningful resource for vocabulary learning (Reinders & Wattana, 2014; Reinhardt, 2017; Reinhardt & Thorne, 2016; Sundqvist, 2009, 2013, 2019; Sundqvist & Wikström, 2015). All participants also supported this belief, as reported in the questionnaire. To confirm whether the hypothesis was true, the first research question investigates whether vocabulary can be learnt from playing COTS games at the level of the form-meaning link in both productive and receptive mastery. The discussion will focus on the overall immediate posttest results then discuss each mastery and individual item. It is important to note that, since this research is the first which studies learning through gaming, no comparable analysis is available. Hence, the findings will be compared and contrasted to studies involving incidental learning through reading and TV series with captions since words in the games appeared in a text format accompanied by audio-visual contextual clues.

From the test results, it can be concluded that vocabulary can be learnt from playing games. Paired-Samples T-Test found that the participants' scores significantly increased in the immediate posttest. Therefore, learning occurred from playing Skyrim. It is fascinating to see the participants acquiring an average of 47.3% (35.4% on form-recall and 59.2% on meaning recognition) in the immediate posttest. The average score is considered to be high despite getting the treatment only once. The results are comparable with vocabulary gains from Webb's

(2007) incidental learning from reading with one encounter on both sensitivities and is considered much higher than the relative gains of B1 learners from extensive TV series viewing with captions (Muñoz et al., 2021; Pujadas & Muñoz, 2019). Therefore, it can be inferred that learning from video games could potentially be as beneficial as learning from readings and, perhaps, more beneficial than watching TV series extensively.

5.2. The form-meaning link in productive and receptive mastery

Vocabulary knowledge at the level of the form-meaning link can be learnt from playing computer games. T-tests showed significant differences from the pretest in each test format. As previously Moreover, participants scored significantly higher in the meaning-recognition than in the form-recall section. The results support González-Fernández and Schmitt's (2020) order of vocabulary knowledge components' acquisition. The form-meaning link meaning recognition is acquired before form-meaning link form recall. Unfortunately, this study could not explore other vocabulary knowledge components due to limited time and space. Therefore, the topic is still open for investigation in the future.

5.3. Attrition/retainment

In addition to vocabulary gain, this study also examines the retainment of vocabulary gains from playing computer games in the period of one week. Paired Samples T-Test reveals a non-significant decrease from the immediate posttest. Therefore, vocabulary knowledge gained through gaming can be retained within the period of one week. However, it is essential to note that, usually, the period of testing attrition would ideally be in two weeks' time. However, this study reduced the time to only one week due to time constraints. Therefore, this could interfere with the results. Further research should be done to investigate this matter.

5.4. Target nonwords and its categories

Another notable aspect of learning is the learning of each target nonword itself. From the results, all target nonwords had been marked as correct at least once in both immediate and delayed posttests. Therefore, it can be inferred that English words with similar characteristics could also potentially be learnt with these nonwords. However, the amount of learning occurs differently with different words. Therefore, the following section will discuss different learning

conditions which could be detected in the treatment and were speculated to scaffold and facilitate learning through gaming in this study.

5.5. Game's perspective: A COTS game as an input for vocabulary learning and learning conditions

Following the previous discussion which discussed how much vocabulary was learnt, this section will explore variables investigated from a game-oriented perspective. Although substantial research had investigated whether EE activities, such as readings or TV series (Muñoz et al., 2021; Pujadas & Muñoz, 2019, 2020), have a suitable environment for incidental vocabulary learning, no research had been done with COTS games. According to Nation (2007), input has to comply with five conditions with two main learning factors to facilitate vocabulary learning (reviewed in section 1.2.1). This section will discuss aspects that could have affected the learning gains: repetition, saliency, quality of attention and lexicalization, respectively.

5.5.1. Repetition

Research suggests repetition is one of the key conditions to vocabulary learning (Chen & Truscott, 2010; Webb, 2007; Webb & Nation, 2017). However, due to time constraints, the participants only received the treatment once. These findings resonate with previous studies that found that the first few encounters benefit the acquisition of form (Chen & Truscott, 2010; Webb, 2007). Also, the gains align with Webb's (2007) results considering his group of participants, which had one encounter with the target items in both form-recall and meaning-recognition sections. Therefore, it is plausible that, with more repetitions, learners will be able to acquire more vocabulary through gaming.

Despite receiving the treatment once, it is essential to note that all words appear more than once during the treatment, and the number of appearances varies from word to word. However, there is no significant relationship between the number of appearances and the scores in both form-recall and meaning-recognition mastery. The results suggest similar conclusions with Laufer and Rozovski-Roitblat's (2015) discussions. The importance of how the learners engage with the words may override repetition. Moreover, there is a possibility that the quality of attention and saliency might be more important than repetition when learning vocabulary

incidentally through gaming. In the next section, saliency, which I speculated to be the most critical factor, will be discussed.

5.5.2. Saliency

Saliency was generally defined as how important a word is in a context in a task, such as in written texts (e.g., Chen & Truscott, 2010). Since the target nonwords are decontextualised, saliency in this study would refer to how important it is to the task completion, which is completing the quest given. Since the words were already grouped into three categories (quest-related nouns, equipment, and miscellaneous), these groups could be evaluated accordingly. Quest-relates items would be considered most salient in this treatment since the participants were asked to interact directly with these items (*kavs*, *thwist*, *blawked*). The second most salient group would be the equipment. Participants could interact, collect, wear, discard and switch between different weapons (e.g., *phloob*) and apparel (*bepth*). Miscellaneous is the least salient group since nouns belonging to the group are not required for the quest (e.g., *smoch*, *prauced*), but the participants could still interact with them.

The participants scored highest from the word *thwist* (*potion*) in the form recall part while all participants were correct in recognising the meaning of *kavs* (*coins*) in the meaning recognition format for the immediate posttest. These two items were explicitly mentioned in the quest (*thwist*: in-game quest, *kavs*: extra instructed quest from the researcher). The results resemble Chen and Truscott's observation in their research. They found that the word *troubadour,* as which the protagonist was defined, was learnt most among other nonlexicalised words. Similarly, saliency could also explain the learning of the words *kavs* and *thwist*.

On the other hand, participants scored lowest on the nonwords *sprunt* (*chest*) and *scact* (*door*) in the form-recall and *smoch* (*basket*) in the meaning-recognition part. *Scact* and *smoch* were considered to be miscellaneous. These items could be found on the map. However, the participants did not need to interact with the items to advance to another room. The non-saliency of these words could potentially be one explanation of the number of vocabulary gains.

Another intriguing observation was concerning the word *sprunt* (*chest*). At the start of the quest, the participants would be asked to open containers to find weapons and apparel, which chests appeared multiple times on the map. Since *sprunt* was almost explicitly mentioned in the command (*Find some equipment. Press E to open containers.*) and the

participants interacted with the item at least once, the word could have been learnt better than less salient words. However, the word was reported to be learnt the least. One possible explanation would be because of the learning burdens this word bears. As Webb and Nation (2017) mentioned, learning burdens could stem from interactions between words that were presented at the same time. In this case, the words presented were mostly in lexical sets which are semantically related and, unintentionally, with similar forms.

Firstly, sprunt and other target nonwords were semantically related. *Sprunt* (*chest*) is a container, similar to other items chosen, such as *smoch* (*basket*) and *rhogged* (*bucket*). Therefore, they are somewhat semantically related. This can be considered an interference, thus hindering the learning process (Erten & Tekin, 2008; Karabulut & Kesli Dollar, 2016; Nation, 2000; Tinkham, 1993).

Moreover, *sprunt* was similar to other target nonwords in terms of form. As suggest by previous research, *Synformy* or words with similar forms (Laufer, 1988) could also cause interferences, both in productive and receptive mastery; thus, hindering the learning process (Hashimoto & Egbert, 2019; Hiebert et al., 2019; Laufer, 1997; Schmitt, 2008). In this study, the words were randomised, both in terms of forms and allocations to the authentic words. Five out od all target words has similar forms: two beginning consonant cluster starting with an s and two ending consonant clusters (*sprunt, smoch, scact, snarm, slodge*). The similarities could plausibly increase a tremendous amount of learning burdens to those words, as seen from the answers in both sections that the participants got them mixed up.

5.5.3. Quality of attention and learning environment

Other than saliency, the quality of attention is considered to me a more impactful factor than repetition for learning vocabulary through gaming. As mentioned by (Laufer & Rozovski-Roitblat, 2015), quality of attention has, perhaps, a more substantial effect on learning than repetition. From the results, the insignificance of repetition and vocabulary gain could suggest the same. Gaming has an environment that could possibly enhance the incidental learning conditions, especially the quality of attention to the target words, similar to other audiovisual input such as TV series (Pujadas & Muñoz, 2019). Before the discussion, it is essential to note that, since this research uses nonwords in a game, participants will not be able to retrieve any prior vocabulary knowledge, nor the words could appear differently in different encounters

because the words are decontextualised. Therefore, noticing and elaboration will be the only applicable conditions.

a. Noticing

As mentioned previously, in Skyrim, the words were decontextualised while being supported by various visual cues. These two conditions support both noticing and elaboration, which, according to (Webb & Nation, 2017), would increase the quality of attention to the target words. In the game's UI, the word will appear on the screen when the player's character stands in front of the item or as a label under the item's picture in the player's inventory (see Figure 5 and 6). Target words that appear on their own without context would be easier to notice (Webb & Nation, 2017). Pairing the target word with its picture makes the form and meaning link explicit, thus, enhancing the learning environment and learning gains, as also supported by previous empirical research (Carpenter & Geller, 2020; Carpenter & Olson, 2012; Kaplan-Rakowski et al., 2021).

Figure 5
Item on the map

Figure 6
Item's caption in the inventory

b. Elaboration and gaming as a multisensory enrichment

Pictures were found to facilitate vocabulary learning and elaborate the use of words in different contexts (Andrä et al., 2020; Carpenter & Geller, 2020; Carpenter & Olson, 2012; Ehret & Hollett, 2014; Herodotou, 2018; Kaplan-Rakowski et al., 2021; Mayer et al., 2015; Muñoz et al., 2021; Roskos et al., 2012; Verhallen & Bus, 2010; Zhou & Yadav, 2017). Gaming provides clear visual inputs which could also elaborate the target words. However, gaming does not offer only visual inputs, but also sounds and a chance for learners to interact with and "use" the target items. Therefore, gaming could be considered a multisensory enrichment that facilitates learning. Multisensory enrichment is the complementary information that involves different senses, such as seeing and hearing (Mayer et al., 2015). Interactive activities from electronic computing devices are also considered multisensory enrichments, enhancing the outcome of learning (see Ehret & Hollett, 2014; Herodotou, 2018 for further details). In Skyrim, players can interact with the items and use them to complete the quest which do not happen when watching TV series. This results in more audio-visual inputs and interactions. For example, when players equip items, such as when a *phloob* (*warhammer*), as the chosen weapon, they will see the character holding a *phloob*, which looks like a giant hammer, with two hands, and they can attack the enemies using that weapon. The players would also hear the sound when equipping the weapon, e.g., unsheathing the *cheigh* (*sword*) or swinging the *phloob* (see Appendix H for further explanation and illustrations).

Moreover, there are multiple chances for players to “use” and contemplate the usefulness of each item, unlike in TV series where learners could only get audiovisual inputs. They can collect, loot and discard items they found on the map. For example, different types of weapons have varying attack damage; therefore, learners will be able to assess and use them to fit their playing style. This could potentially help elaborate the meaning of the nonword on a deeper level since players has direct interactions and can incorporate motor skills (Mayer et al., 2015; Xu et al., 2021). Participants will not only see what it physical form is, but also how much damage they deal, how useful it is for the quest, or whether this weapon suits their play style.

On the other hand, multisensory enrichment could hinder the learning gains for some gamers. Dehaan et al. (2010) had found extraneous cognitive load induced by the interactivity of the game to interfere with the process of vocabulary learning. In this study, some participants

explicitly expressed their concern regarding their learning gains through an email. They had mentioned that the game was too hard to play, and that their “cognitive energy was consumed by how to play the game rather than picking up new words in the game.” This also indicated that a game genre might not be suitable for every learner. The effectiveness of vocabulary learning from gaming would vary greatly according to their preferences and game genres they had played.

5.5.4. Target nonwords

As previously mentioned, the learning gains were comparable with Webb's (2007) study, which involves incidental learning through reading. Webb also used nonwords as the target items in his research, which is also the case in this study. Similarly, the nonwords randomised for this study has no more than two syllables. They consist of not more than seven characters with not more than two beginning and ending consonants. Hence, the words are considered relatively easy to spell. Therefore, it can be speculated that the characteristics of the nonwords could explain what Chen and Truscott (2010) would criticise as "inflated" learning in this study.

As previously discussed, a substantial amount of vocabulary can be learnt through gaming. Future research could explore more about these variables discussed since these are still speculations. There are a lot of areas to be explored.

5.6. Participants, their habits, engagement and vocabulary gain

This section will move away from gaming and explore vocabulary gains from the player/learners' perspective. Several studies in the past had identified positive correlations between the participant's biographical data, gaming habits and vocabulary knowledge. But no research has been done to investigate these player/learner variables and vocabulary test scores gained from gaming. Therefore, this section will focus on independent variables involving the participants' gender, vocabulary size, gaming habit, and in-game engagement in relation to their immediate posttest scores.

5.6.1. Gender and scores t-test

Gender has long been a subject matter when researching vocabulary and gaming (Sundqvist, 2019; Sundqvist & Sylvén, 2014; Sundqvist & Wikström, 2015; Sylvén & Sundqvist, 2012). Male has been featured as more dominant and more engaging in the field of gaming; however, the number of female players was also increasing (Clement, 2021). The differences in the number of participants from the opposite sex still mirror this belief. In this study, the number of male participants is almost two times higher than that of female participants.

However, gender does not affect vocabulary learning. The results from Paired Samples T-tests shows no significant differences between male and female participants' scores. Therefore, gaming can possibly be an input suitable for people of any gender.

5.6.2. Language proficiency and score correlations

Previous research found positive correlations between the participants' language proficiency with vocabulary gain from extramural activities (e.g., Muñoz et al., 2021; Pujadas & Muñoz, 2019). However, an insignificant, weak positive correlation was found. This could stem from the small number of participants, and further research should be conducted. On the positive side, learning occurred more or less with all participants; therefore, it is plausible to infer that anyone of low or high proficiency can learn vocabulary through gaming.

5.6.3. Gaming Habit and score t-test

Although no significant effects were found from other variables, significant differences were found when comparing the average test scores between frequent and less frequent gamers. Therefore, gaming habits affect vocabulary learning from gaming, while more frequent gamers scored significantly higher than less frequent gamers. This could possibly be explained by how accustomed to gaming in general or this game style in particular. For example, deHaan's (2005) participant had no experience playing the game; therefore, he couldn't pay full attention to the words while "playing" baseball in the game. This might also explain the lower amount of learning from less frequent gamers in this study. However, as previously discussed, participants who had played the game before did not score significantly higher because they might have

chosen to ignore non-salient items. Therefore, gaming habits and familiarity with the game could be another area to explore.

5.6.4. Engagement (Nunber of coins)

Engagement, as discussed in previous research, could facilitate language learning. However, it was used to explain learners' behaviour in deliberate language learning activities or language-focused input and in-classroom activities. In this study, learners' engagement would be defined as in-game interactions with items and user interfaces, not a language task itself. The behaviours would resemble what Roskos et al. (2012) had defined as the operation of devices. The environment and the user interface in Skyrim are similar to that of a "hotspot" (Xu et al., 2021). When participants control the character using the WASD keys to approach the item, or click on the item in their inventory, a text and picture will be shown. Since the activity in which the participants had engaged did not have a purpose of learning the target language, this would be defined as an incidental activity engagement for incidental learning of the target items. Since there was no observation, engagement was represented by the number of coins participants collected during the quest. Coins could be found in multiple places and containers on the map; therefore, I think it is possible to assume that the more coins participants found and collected, the more they had engaged in this gameplay.

The results showed the number of coins to correlate positively with vocabulary gains, and the effect is still significant after analysing with linear regression from ANOVA. Therefore, it can be concluded that engagement is an impactful factor for vocabulary learning through gaming. It is also important to note that participants who had engaged more in the activity also learned less salient words. This presumption could be further elaborated in future research by using observation as one of the key methodologies.

5.6.5. Gender and gaming habits and vocabulary knowledge

To compare the relationship between the player/learners' variable to previous research, participants' biographical data including gender and gaming habits were analysed with participants' vocabulary size. Correlations did not find a significant relationship between gender and vocabulary size. Moreover, there was no significant effect of the gamer type either. These findings contrasts with numerous findings in the past (Sundqvist, 2019; Sundqvist &

Sylvén, 2014; Sylvén & Sundqvist, 2012). On a positive note, it can be inferred that neither being a male or female gamer nor one's gaming habit determine one's vocabulary size. Also, it is possible that other factors, such as educational levels or engagement in other EE activities, might have accumulated to the participants' vocabulary size in previous studies and this study.

5.7. Conclusion

This chapter has summarised the findings and discussed them in light of previous research. The full summary will be given in the next chapter following by implications, limitations and suggestions for future research.

6. Conclusion

In conclusion, this research aimed to investigate how much vocabulary could be learnt from gaming and whether independent variables from player/learners- or game-oriented perspectives impact vocabulary gains. The results had found that vocabulary could be learnt from gaming at the level of the form-meaning link in both productive and receptive mastery. At the same time, the discussion points out the possibility of several variables from a game-oriented perspective suggested a single-player open-world adventure RPG game has an environment that suits incidental vocabulary learning. It complies with all five learning conditions and is supported by repletion, the saliency of the words while having the characteristics to increase the player quality of attention.

Moreover, from the player/learners' perspective, quantitative data analyses indicated significant relationships between variables from the player/learners' perspective to positively affect gaming. Positive correlations were found between participants' gaming habits and engagement and vocabulary gains. On the other hand, gender and proficiency were non-significant. This implies that there is a possibility that English learners of any gender and proficiency could learn vocabulary incidentally from gaming. Unfortunately, these findings could yet be generalised beyond the specific participants involved in this study because the number of participants was too low.

6.1. Implications

Some implications could be grasped from the results of this study. L2-English speakers can learn vocabulary from playing games; therefore, gaming should be encouraged as a hobby. Moreover, since engagement is possibly one of the critical factors, I would suggest learners immerse themselves in the act of gaming, interact and pay attention to all language items, regardless of their importance to the quest. Moreover, players can choose games that suit their proficiency levels, so the learning environment will be enhanced since they have the right vocabulary size for lexical coverage. As a pedagogical implication, vocabulary learning could be reinforced by pre-teaching the target items or providing supplementary materials for learns who play a particular game, which could be done, for example, in gaming clubs.

6.2. Limitations and suggestions for further research

This research, being one of the firsts, has many methodological and analytical limitations. The number of participants itself was also limited; therefore, the finding could not be generalised. Only the quantitative questionnaire and test batteries were used. Therefore, the data gathered was limited and could only speculate why learning occurs. Further research could adopt a mixed-method approach by employing a systemic quantitative and qualitative observation to monitor the participants while gaming or follow-up with an interview.

Moreover, due to time constraints, the participants underwent the treatment only once, and only one quest in one particular game was chosen for this study. Hence, a game with a suitable learning environment for vocabulary learning could not be generalised with other game genres that are different from the game chosen in this study. A longitudinal study could be conducted, where participants advance through various quests in the game or where diverse groups of learners play different games or game genres.

The target items were limited. They were only restricted to nouns of items in the game. However, much more input in the game, such as dialogue, commands, and user's interfaces, could serve as a potential input. Target words could be improved in the mods if nonwords were still used, e.g., modifying dialogues or narrations and putting the words into context. Thus, participants could have a chance to learn words of different parts of speech, therefore investigating vocabulary knowledge learning in more depth in its form, meaning and use. Also vocabulary depths were not explored. For example, it might be possible that these interactive visual cues could potentially facilitate the learning of collocations (e.g., equip a Phloob, discard a Phloob, attack someone with a Phloob, etc.) depending on the actions they can choose to do with that particular item. Most importantly, the target nonwords lack ecological validity. Low-frequency words could be considered. Also, the discussions made in this research was mainly linked to other EE activities since existing literature was not sufficient. They were mere speculations and were not theorised.

Since this study aims to measure vocabulary learning from an ecologically valid gaming environment, too many variables were speculated to have an effect in vocabulary gains. However, the effect size or criticality could not be measured since the variables were intangible. More on each variable from a game-oriented perspective, such as repetition or saliency, could be explored by using a more rigidly controlled experimental design, focusing solely on saliency, repetition, or engagement and interactivity.

Even though this research is a preliminary study and a small step into the field, I truly hope this will shine light onto the path and hope other researchers join in researching gaming, which has the potential to be a meaningful learning input for vocabulary learning.

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Appendix A

Supplementary Information Sheet

Since *The Elder Scrolls V: Skyrim Special Edition* is not a free to play game, the researcher had to distribute a purchased game through a Steam account. Therefore, further information was sent to the participants after completing Session 1's activities (questionnaire and Activity 1). Moreover, if was not certain that all participants will know how to install the game and, especially, the mods which the researcher had created to embedded the target nonwords into the game. Hence a detailed Skyrim and Mod Installation Guide was written and distributed through email. To maintain the installation guide's format, please see the full guide starting from the next page or go to https://bit.ly/3ACHFi3 to access the guide on Google Docs.

Skyrim and Mod Installation Guide

If you know how to install and download the game, please skip to 5.

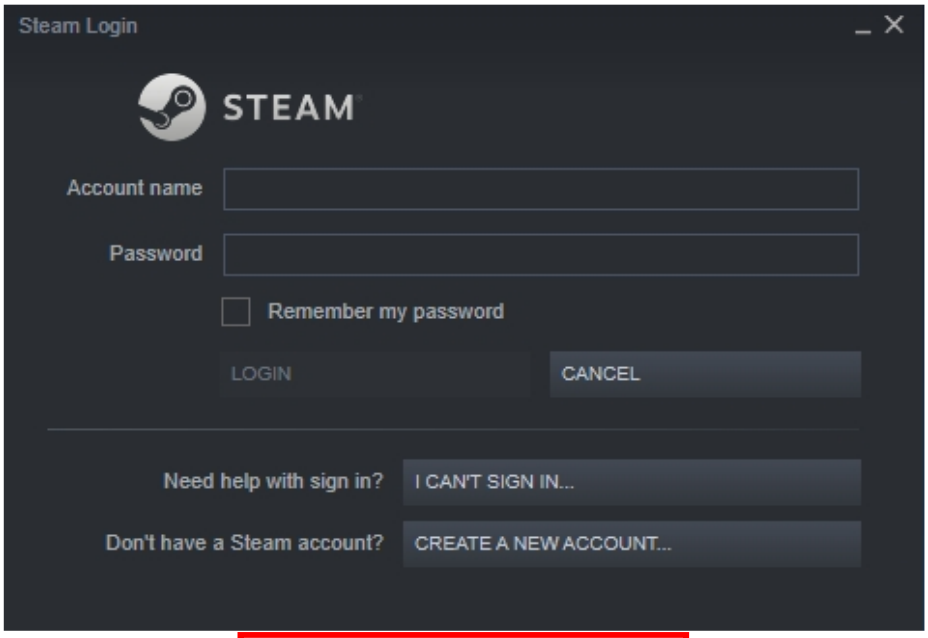
If you know how to install the game and the mod, click here for the mod link and carefully read the quest detail.

1. Download and Install Steam

Download -> https://cdn.akamai.steamstatic.com/client/installer/SteamSetup.exe

Steam Browser -> https://store.steampowered.com/

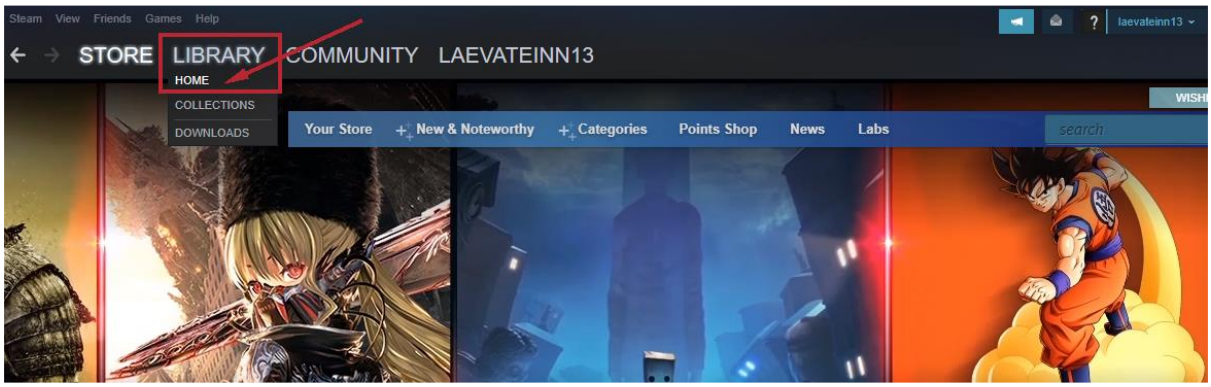
2. Open Steam and log in



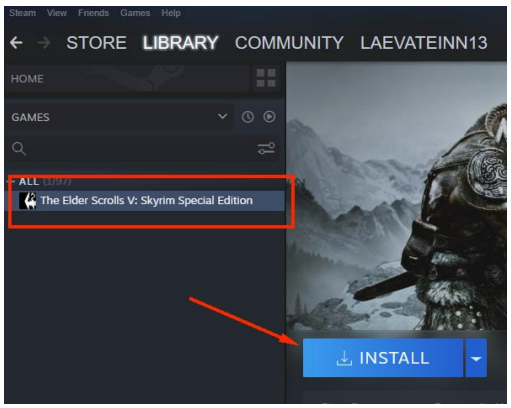
Account name: l[redacted]

Password: S[redacted]

3. Go to Library > Home



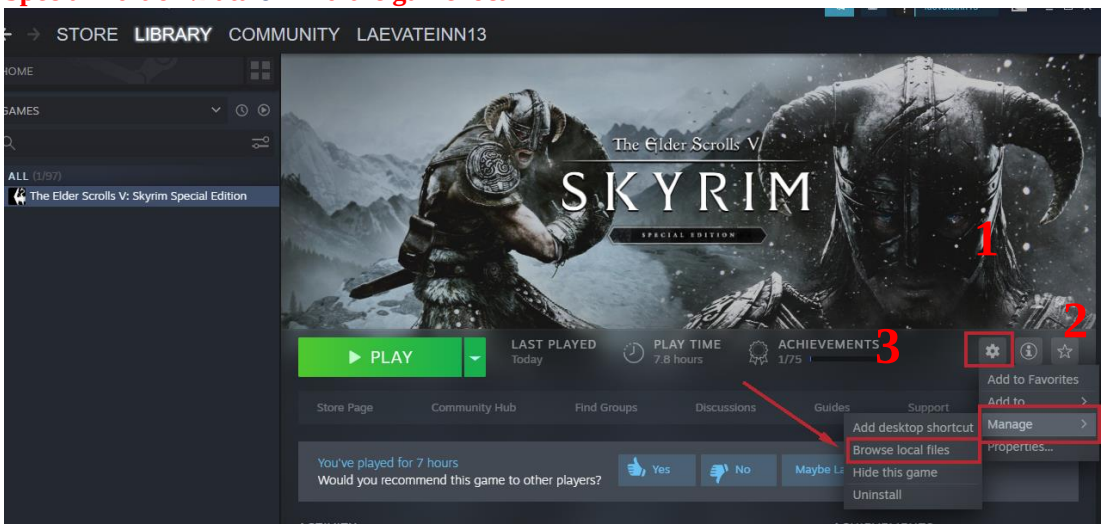
4. Select The Elder Scrolls V Skyrim Special Edition and Install

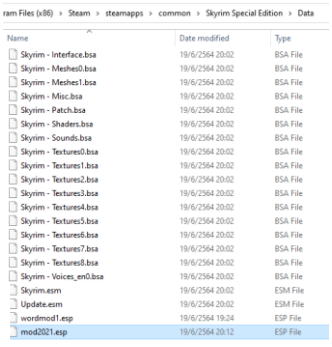


5. After the installation is completed > Download BOTH two mods

Mod download link: https://bit.ly/3xilVHk **and** https://bit.ly/3yhlaOD

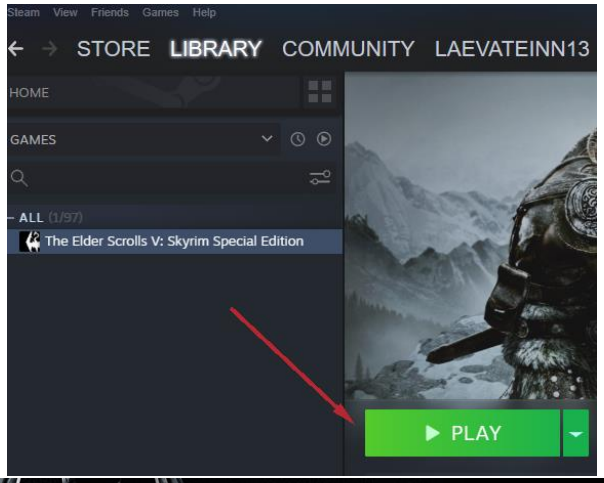
6. Move (mod2021.esp) to C:\Program Files (x86)\Steam\steamapps\common\Skyrim Special Edition\Data or find the game local

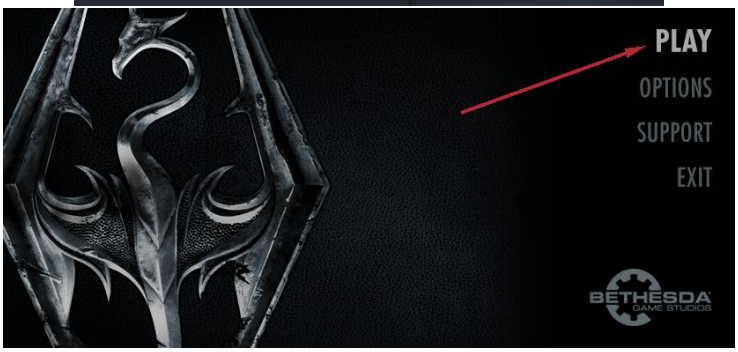




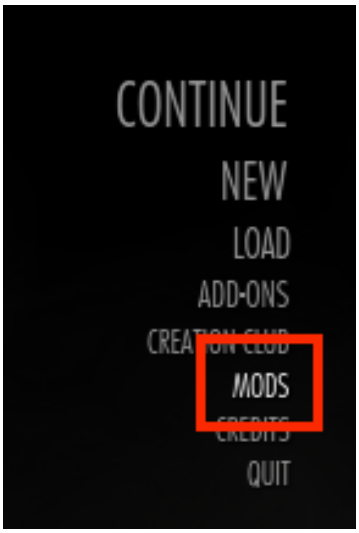
Install BOTH files

7. Start the game

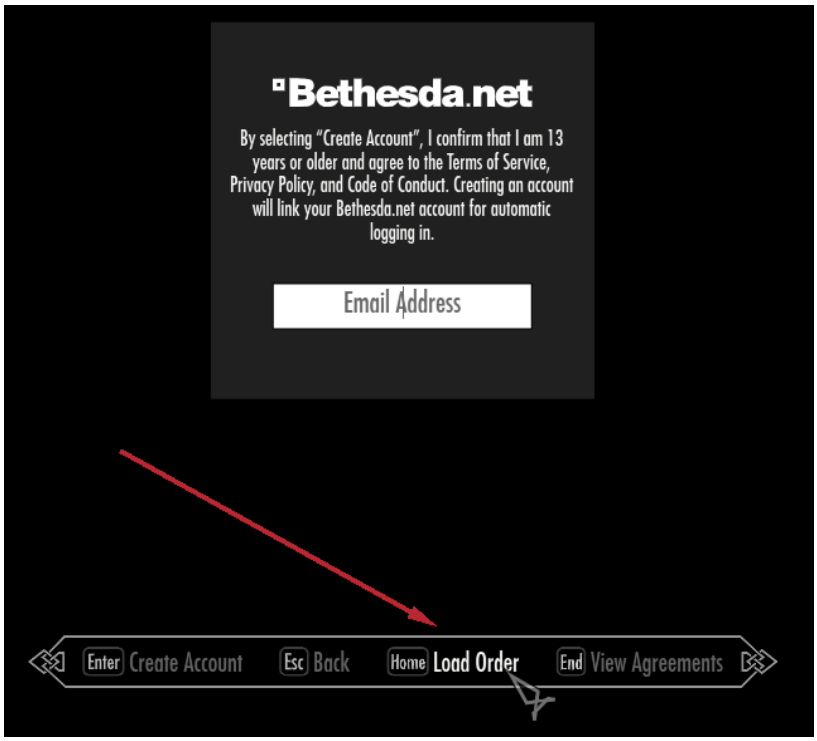


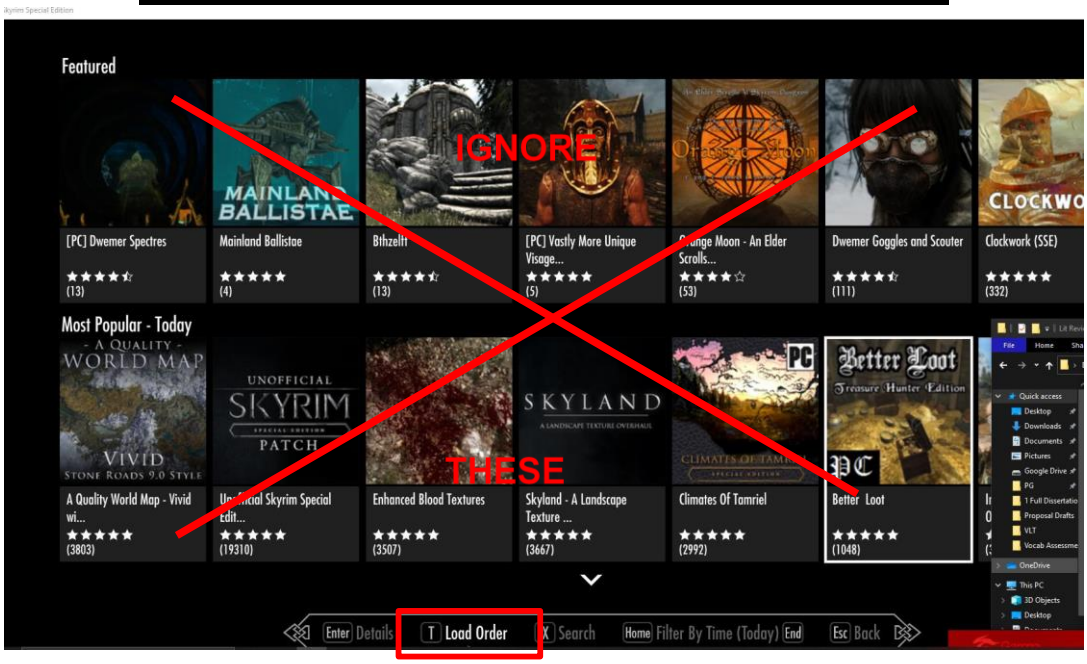


8. Enable Mod



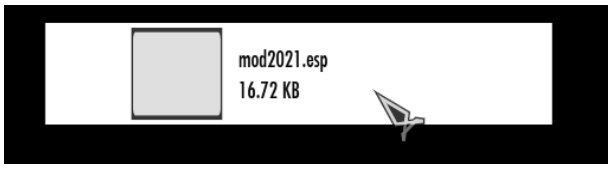
Select MODS





Click: Load Order

Select **Mod2021.esp and Modding2021.esp**



Not activated

Activated

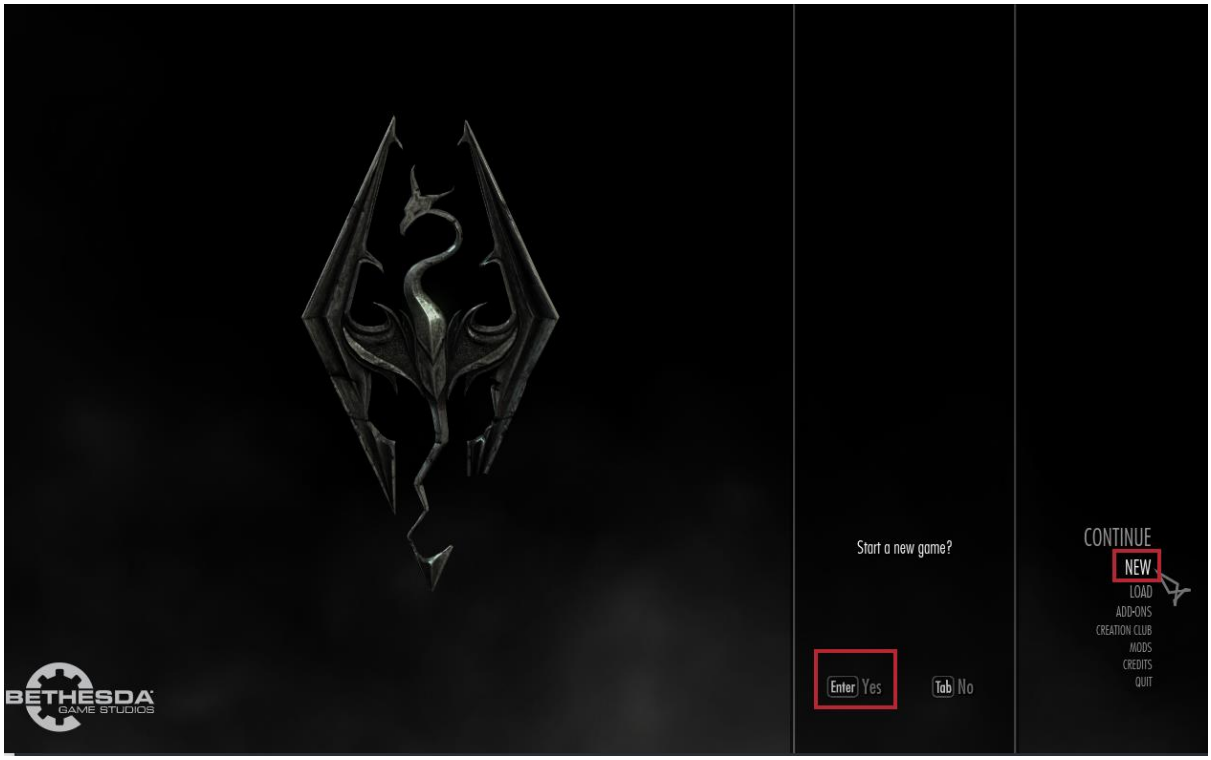
****ACTIVATE <u>BOTH</u> MODS****

****Make sure there is a tick in front of both mods****

8.1 If the mod is still not found, revisit 6 or contact isuprapas1@sheffield.ac.uk

9. Press ESC to go back.

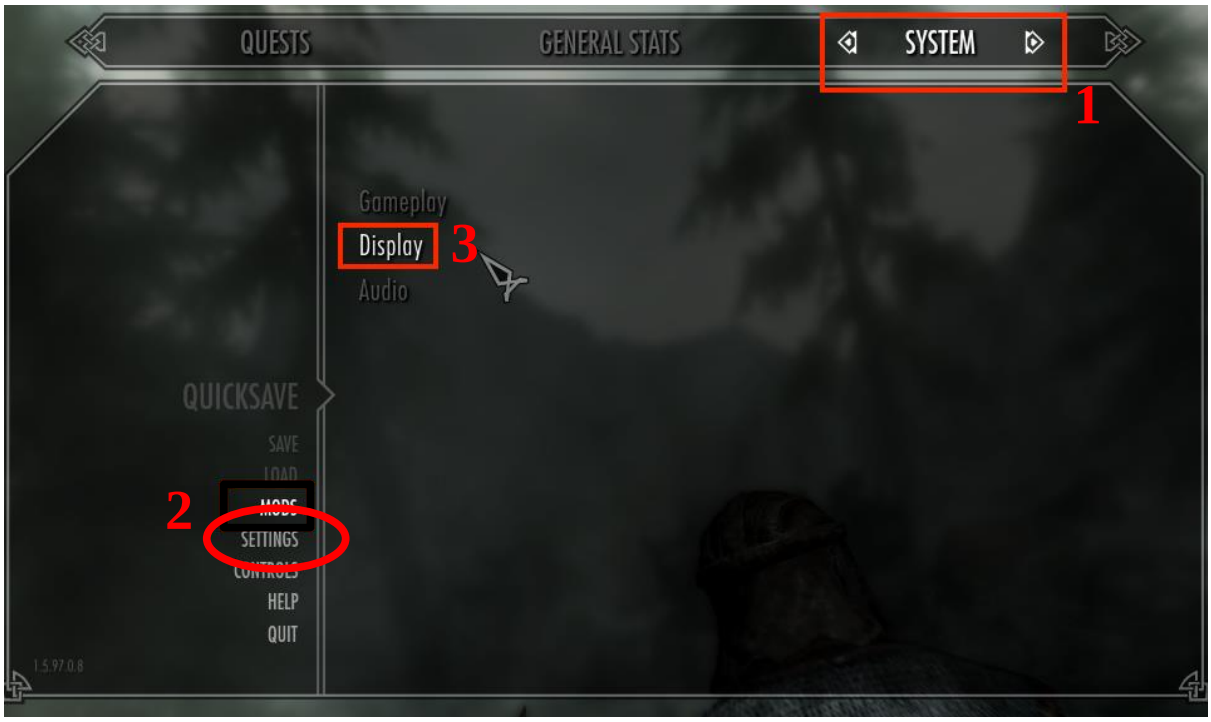
10 Click on NEW and Start the new game

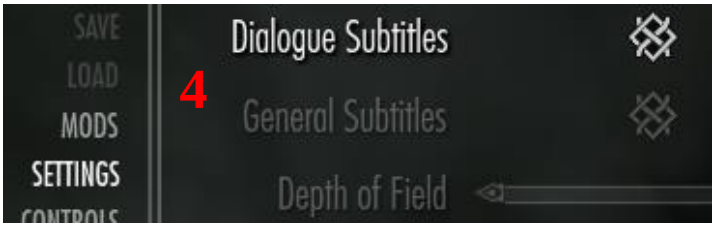


To enjoy the game to the fullest, there is one more step.

11. Enable the game Subtitles [MUST DO]

ESC -> SETTINGS -> Display -> Dialogue Subtitles & General Subtitles





Make sure there is a cross in the square box

Press ESC to continue the game

Quest Detail

**** Utmost important: Please read carefully****

After starting the game, complete the quest *Unbound*. You must escape from *Helgen Keep*. At one point, the quest will ask you to choose between Rolof and Hadvar. **Follow Hadvar** (the **brown-haired** guy with **brown leather clothing**) **into the Helgen keep**. He is the one who asked for your name before the character creation. He will keep you safe. DO NOT FOLLOW Rolof.

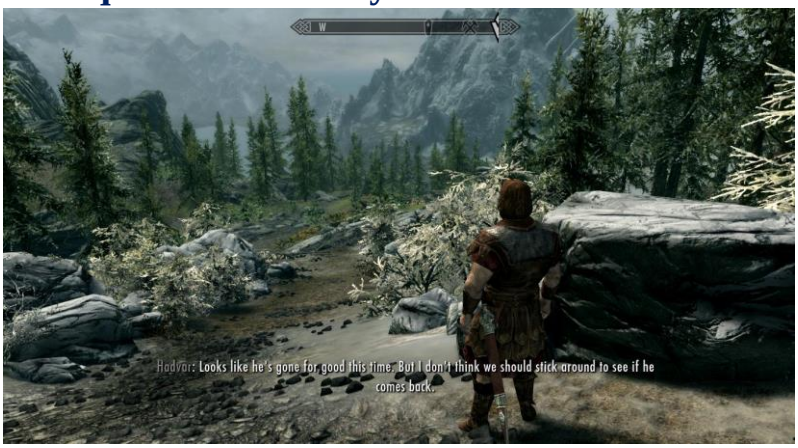
Hadvar

Money is essential (always). So, along the way, you will find some *golden coin-shaped money* here and there. Make sure to look for them on every piece of furniture and in every container you see.

Also, take note of how many coins you collected during your gameplay. You will get a chance to win a lucky draw for a free game at the end of the research! Press I → bottom right (Gold)

If you are lost, follow the quest marker found on the top of the screen.

****The quest ends when you come out of the cave.****



Note: PLEASE **DO NOT** PICKPOCKET Hadvar or burn him!!

You have 2 hours to play the game (which should not take you more than 40 minutes to complete the quest). Therefore, if you feel any **motion sickness**, feel free to **PAUSE** by pressing **ESC** and take a short break.

Reminder: 30 minutes after your session has started, you will receive a link via email for Activity 2 which should be completed immediately after you have complete the quest.

Enjoy!

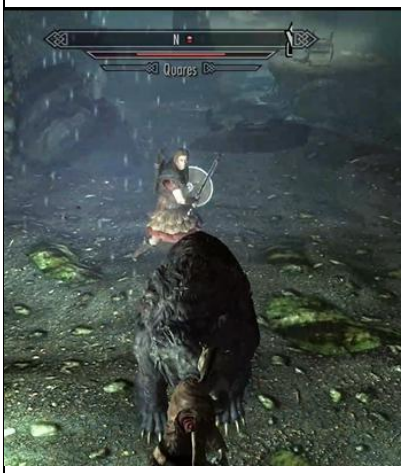
Appendix B

Target nonwords

Table A1

Target nonwords: Occurrences & Pictures

Category	**Nonword**	**Word**	**Occurrences**	**Picture**
Quest-related items	Kavs	Coins	11*	
	Thwist	Potion	5*	
	Sprunt	Chest	4	

	Blawked	Spider	9**	
	Quares	Bear	1**	
Equipment	Phloob	Warhammer	2	

	Cheigh	Sword	3	
	Swilge	Bow	3	
	Dwined	Greatsword	3	
	Relp	Shield	2	

	Snarm	Arrow	4	
	Slodge	Dagger	3	
	Bepth	Helmet	2	
	Thests	Gauntlets	12	

	Claits	Boots	13	
Miscellaneous	Smoch	Basket	12	
	Prauced	Broom	3	
	Sweered	Lockpick	3*	

	Rhogged	Bucket	7	
	Scact	Door	10	

Note: *more than 1 count in a single encounter

**players can see the target nonwords on the screen while fighting, and they also encounter the words again if they search the creatures' bodies after fighting to loot items

Players have multiple chances to reencounter these words when they go through their inventory (more illustrations in Appendix H).

Appendix C

Biodata and Gaming Habits Questionnaire

The full questionnaire is provided in this section. As stated in the methodology, the questionnaire was distributed online through Google Form. However, the form formats were disorganised when converted into PDF. Therefore, the questions were re-typed into word document formats for a more organised composition.

Biodata and Gaming Habits Questionnaire

Biographical Data

ID

You can also use an alias to ensure anonymity. Please do remember the name given since it will be your ID during the course of this project.

Answer: _____

Today's date

Answer: _____

Age

Answer: _____

Gender

Male Female Prefer not to say

Education level

Undergraduate (Bachelor's degree) Master's degree PhD Other

Nationality

Answer: _____

Native language

Answer: _____

Do you play games as a hobby?

☐Yes ☐No

How often do you play games on average per week in the past 3 months?

☐0 hours ☐less than 3 hours ☐3-5 hours ☐more than 5 hours

Gaming habits

Which game genres go you play?

Choose all that applies

☐Adventure ☐Sports

☐Auto-chess ☐Stealth

☐Battle Royale ☐Strategy

☐Multiplayer online battle arena (MOBA) ☐Survival

☐Open-world ☐Role-playing game (RPG)

☐Shooter ☐Other (please specify): _____

☐Simulation

Please give at least 1 example of the game you play

Answer: _____

Gaming and language learning beliefs

Gaming is a useful language learning resource.

Strongly Agree 1 2 3 4 5 Strongly Disagree

Gaming is a useful vocabulary learning resource.

Strongly Agree 1 2 3 4 5 Strongly Disagree

You have learnt vocabulary from gaming.

☐Yes ☐No

Vocabulary Size

Please complete the Vocabulary Size Test

1. *Click on this link: https://www.lextutor.ca/tests/vst/*

2. *Check if you are in the practice mode using the first two questions BEFORE starting the test*
3. *Choose the correct answer which demonstrates the meaning of the word*
4. *Click on the yellow button "SCORE mode = test" to get the results*

you can try clicking on the "SCORE mode = test" after finishing the first section

*** please double check whether you have answered all the questions before clicking***

*** BEWARE: if you click CANCEL after submitting, all your answers will be removed***

5. *Copy and paste the scores generated under the yellow box into the area below*

Note: It is normal that you will not know some of the words in the test. It is even hard for native speakers to recognize all the words presented. Therefore, you can take your best guess and move on quickly to the next questions!

Please paste the scores shown in the white box on the left-hand side of the screen here

Answer: _____

VOCAB SIZE (wds)

Answer: _____

About the game

Have you played "The Elder Scrolls V: Skyrim Special Edition" before?

☐Yes ☐No

Do you have "The Elder Scrolls V: Skyrim Special Edition" installed on your computer?

☐Yes ☐No

Please read the system requirement for the game

SYSTEM REQUIREMENTS
MINIMUM:
OS: Windows 7/8.1/10 (64-bit Version)
Processor: Intel i5-750/AMD Phenom II X4-945
Memory: 8 GB RAM
Graphics: NVIDIA GTX 470 1GB /AMD HD 7870 2GB
Storage: 12 GB available space

Are you currently in Sheffield?

☐Yes ☐No

Do you need assistance with electronic equipment?

The assistance is only available for participants who reside in Sheffield. If you request assistance, an email will be sent to you for confirmation and further details.

☐Yes ☐No

Thank you for completing the questionnaire. Next, please complete Activity 1.

--- END OF Questionnaire---

Appendix D

Vocabulary Size Test Examples

Vocabulary Size Test1

Circle the letter a-d with the closest meaning to the key word in the question.

First 1000

1. SEE: They **saw** it.
a. cut
b. waited for
c. looked at
d. started

2. TIME: They have a lot of **time**.
a. money
b. food
c. hours
d. friends

3. PERIOD: It was a difficult **period**.
a. question
b. time
c. thing to do
d. book

4. FIGURE: Is this the right **figure**?
a. answer
b. place
c. time
d. number

5. POOR: We are **poor**.
a. have no money
b. feel happy
c. are very interested
d. do not like to work hard

6. DRIVE: He **drives** fast.
a. swims
b. learns
c. throws balls
d. uses a car

7. JUMP: She tried to **jump**.
a. lie on top of the water
b. get off the ground suddenly
c. stop the car at the edge of the road
d. move very fast

8. SHOE: Where is your **shoe**?
a. the person who looks after you
b. the thing you keep your money in
c. the thing you use for writing
d. the thing you wear on your foot

9. STANDARD: Her **standards** are very high.
a. the bits at the back under her shoes
b. the marks she gets in school
c. the money she asks for
d. the levels she reaches in everything

10. BASIS: This was used as the **basis**.
a. answer
b. place to take a rest
c. next step
d. main part

Note: The test is created by Paul Nation, Victoria University of Wellington, and found at http://www.lextutor.ca/. This test is freely available and can be used by teachers and researchers for a variety of purposes. As mentioned previously in the methodology, the test has a total of 14 levels testing up until the most frequent 14,000 word families in the same format with 10 questions for each frequency band.

Appendix E

Form-recall and Meaning-recognition test formats

All tests' formats, including form-recall and meaning-recognition of target nonwords and distracters are provided in this section. As stated in the methodology, the tests were distributed online through Google Form. However, the form formats were disorganised when converted into PDF. Therefore, the questions were re-typed into word document formats for a more organised composition.

Form-recall questions

Write the appropriate word in the space to complete the sentences. The word begins with the letter given. It is okay if you do not know the answer to the questions. You can try and guess or use - for a blank answer.

Example

0. I had to cover my eyes when coming into the room, as it was too b_____ for my eyes. Answer: bright

1. A p_____ is a large heavy hammer with a long handle and usually spikes. It is used as a weapon.

Answer: _____

2. I use a c_____ which is a long sharp blade to fight my enemies.

Answer: _____

3. They use a s_____ to shoot arrows.

Answer: _____

4. A d_____ is a large two-handed weapon with a big, long sharp blade.

Answer: _____

5. He carries a r_____, a defensive tool, to protect himself in the battlefield.

6. She shoots a s_____ from a bow.

Answer: _____

7. A s_____ is a small sword, resembling a knife.

Answer: _____

8. He wears a b_____ on his head to avoid getting hurt in a battlefield.

Answer: _____

9. I wear a pair of t_____ on my hands as a part of my armour set.

Answer: _____

10. I wore c_____ to cover my foot. It covers all my foot up to my ankle.

Answer: _____

11. I drink t_____ to restore my health points.

Answer: _____

12. She puts her worn clothes in the s_____.

Answer: _____

13. He sweeps the floor with a p_____.

Answer: _____

14. She forgot her key, so she opens the door with a s_____.

Answer: _____

15. I use k_____ to buy bread.

Answer: _____

16. He pours water into a r_____ and carries it into the bathroom.

Answer: _____

17. He went into a cave and found a s_____ full of treasure.

Answer: _____

18. He opens the s_____ and walks into another room.

Answer: _____

19. A b_____ is an insect with 8 legs. It can also produce silk threads to create its web.

Answer: _____

20. I saw a q_____ in the woods. It is a big, brown, furry mammal. It likes honey.

Answer: _____

Meaning-recognition

Choose the correct meaning of the word in [square brackets]. If you do not know the answer, please choose "I don't know."

1. He is carrying a [phloob].

☐Warhammer ☐Sword ☐Broom ☐Mace ☐I don't know

2. He attacks the enemy with a [cheigh].

☐Warhammer ☐Battleaxe ☐Sword ☐Broom ☐I don't know

3. He drops a [swilge].

☐Bow ☐Sword ☐Arrow ☐Broom ☐I don't know

4. He picks a [dwined] up.

☐Mace ☐Dagger ☐Sword ☐Greatsword ☐I don't know

5. He carries a [relp].

☐Stick ☐Broom ☐Shield ☐Dagger ☐I don't know

6. He crafts a [snarm].

☐Sword ☐Arrow ☐Bow ☐Shield ☐I don't know

7. A [slodge] is sharp.

☐Sword ☐Dagger ☐Knife ☐Axe ☐I don't know

8. He wears a [bepth].

☐Helmet ☐Hat ☐Armour ☐Cuirass ☐I don't know

9. He wears [thests].

☐Gloves ☐Gauntlets ☐Shoes ☐Boots ☐I don't know

10. He wears [claits].

☐Gloves ☐Gauntlets ☐Shoes ☐Boots ☐I don't know

11. He drinks [thwist].

☐Beer ☐Wine ☐Potion ☐Water ☐I don't know

12. A [smoch] is on the floor.

☐Bucket ☐Basket ☐Broom ☐Chest ☐I don't know

13. He is carrying a [prauced].

☐Bucket ☐Basket ☐Broom ☐Chest ☐I don't know

14. He opens the door with a [sweered]

☐Key ☐Lockpick ☐Crowbar ☐Keycard ☐I don't know

15. I have a lot of [Kavs].

☐Coins ☐Banknotes ☐Chips ☐Diamond ☐I don't know

16. I am carrying a [rhogged].

☐Bucket ☐Basket ☐Broom ☐Crowbar ☐I don't know

17. I put them in my [sprunt].

☐Wardrobe ☐Drawer ☐Box ☐Chest ☐I don't know

18. I open the [scact].

☐Window ☐Door ☐Drawer ☐Chest ☐I don't know

19. That is a [blawked].

☐Spider ☐Snake ☐Bear ☐Mosquito ☐I don't know

20. That is a [quares].

☐Rhinoceros ☐Bear ☐Spider ☐Hippopotamus ☐I don't know

Note: Square brackets were used in the meaning recognition part since bold or italics were not available on Google Form.

Distractors

Form-recall: Distractors

1. I hit him with a short spikey hammer. The hammer is called a m_____.

   Answer: _____

2. A piece of leather armour for the body is called a c_____.

   Answer: _____

3. The court generally do not treat interpretive rules as b_____.

   Answer: _____

4. A d_____ is a lizard-like mythical creature. It can fly and breathe fire.

Answer: _____

5. Dresses, suits, slacks, and skirts are examples of a_____.

Answer: _____

6. In order to change our class from a novice to a knight we need to complete a q_____.

Answer: _____

7. The goods taken from an enemy is called a l_____.

Answer: _____

8. An animated character players can choose to play in a game is called an a_____.

Answer: _____

9. The power a player has to use in order to cast magical spells is called m_____.

Answer: _____

10. You can find an a_____ at the end of a shoelace. It is usually made of plastic.

Answer: _____

Meaning-recognition: Distractors

1. I hit it with a [mace].

☐Spiky hammer ☐Giant hammer☐Sword ☐Small knife ☐I don't know

2. He wears a [cuirass].

☐Leather armour ☐Bracers ☐Robe ☐Suit ☐I don't know

3. He removes the [binding].

☐The ability to see ☐Stain ☐Clothing ☐Restraint ☐I don't know

4. I see a [dragon].

☐ A dog-like creature, transforms into a wolf on a full moon night

☐A lizard-like creature, breathes fire or other elements

☐A dog-like creature, guards an ancient tomb

☐A human-like creature, drinks human blood

☐I don't know

5. She likes her [apparel].

☐ Clothing ☐ Make-up ☐ Jewellery ☐ Hairstyle ☐I don't know

6. I complete a [quest].

☐ Mission ☐ Tour ☐ Degree ☐ List ☐I don't know

7. I take [loot] from enemies.

☐ Item ☐ Life ☐ Damage ☐ Advice ☐I don't know

8. He is an [avatar].

☐ Reincarnated god

☐ Playable character

☐ Boy with an arrow on his forehead

☐ Blue creature from another planet

☐I don't know

9. I ran out of [mana].

☐ Money

☐ Life force

☐ Power needed to do a physical damage

☐ Power needed to cast spells

☐I don't know

10. He produces [aglet]s.

☐ Plastic tags at the end of shoe laces

☐ Silver hooks at the end of necklaces

☐ Metal arrows on compasses

☐ Plastic cover in newly bought items

☐I don't know

Appendix F

Full activities

All English Activities are provided in this section. Similar to the vocabulary test formats, the forms were distributed online through Google Form. However, the form formats were disorganised when converted into PDF. Likewise, the questions were re-typed into word document formats for a more organised composition. Sample pictures of the activity will be given at the end of this section.

English Learning Activity 1

This is an activity involving English knowledge. It should not take more than 30 minutes to complete this activity.

ID

Answer: _____

Today's date

Answer: _____

About the activity

The activity consists of 3 main parts.
Feel free to have a mini break between the sections.

Part I

Choose the correct answer

1. The first letter of the first word in a sentence should be

☐ a large letter ☐ a capital letter

2. Which is correct?

☐ You're looking good ☐ Your looking good

3. Which list only contains prepositions?

☐ too, here, soon ☐ to, with, until ☐ for, yet, but

4. Which tense is used in this sentence? "I haven't had breakfast yet."

☐ present perfect ☐ present continuous ☐ present perfect continuous

Part II

Form-recall Questions (See Appendix B.1)

Part III

Meaning-recognition Questions (See Appendix B.2)

Thank you for completing the activity.

Now, it's gaming time!

An email containing detailed information about the game and the quest will be sent to you shortly after you have submitted the form.

This includes a detailed guide to installing Steam, Skyrim and the mod. Please read very carefully the steps and instructions in the sheet.

Please make sure to install the game and the mod before your booked session started. If you wish to reschedule, please kindly cancel your booking and re-book another slot in the same link provided before. Or reply to the email or send me one via isuprapas1@sheffield.ac.uk.

Thank you very much!

--- END OF ACTIVITY 1---

English Learning Activity 2

This is an activity involving English knowledge. It should not take more than 30 minutes to complete this activity.

ID

Answer: _____

Today's date

Answer: _____

About the activity

The activity consists of 3 main parts.
Feel free to have a mini break between the sections.

Part I: Gaming experience

How many golden coin-shaped currency did you find?

Answer: _____

Enjoyment

How do you feel about The Elder Scrolls V: Skyrim Special Edition? (Linear Likert scale)

Extremely unenjoyable 1 2 3 4 5 6 7 Extremely enjoyable

What do you think of The Elder Scrolls V: Skyrim Special Edition? (Linear Likert scale)

Extremely difficult to play 1 2 3 4 5 6 7 Extremely easy to play

You would like to play The Elder Scrolls V: Skyrim Special Edition in the future.

☐Yes ☐No ☐Maybe

In-game interactions

I interacted with ...

☐ All items possible, including NPCs, items necessary to complete the quest, containers, loots, and miscellaneous

☐ Some items, including items necessary to complete the quest, loots, and miscellaneous

☐ Only items that are required to complete the quest, such as weapon, armour, and quest items

☐ Only items the quest instructed me to find, such as "search ..., or find ..."

☐ Other …

I searched for items in …

☐ Every container possible

☐ Some containers

☐ A few containers

☐ Only the containers marked as a "quest container"

☐ Other …

Part II

Form-recall Questions (See Appendix B.1)

Part III

Meaning-recognition Questions (See Appendix B.2)

Thank you for your contribution

An email with a google form to the last questionnaire will be sent to you 5 days after you have completed this activity. Please complete the questionnaire within one day after you have received the link to the form.

Again, I cannot thank you enough for your participation.

Sincerely,

The researcher.

--- END OF ACTIVITY 2---

English Learning Activity 3

This is an activity involving English knowledge. It should not take more than 30 minutes to complete this activity.

ID

Answer: _____

Today's date

Answer: _____

About the activity

The activity consists of 3 main parts.
Feel free to have a mini break between the sections.

Part I: Short questionnaire

Have you been playing any games during this past week?

☐Yes ☐No

If yes, what games did you play?

Answer: _____

How much time did you spend playing games this past week?

☐0 hours ☐less than 3 hours ☐3-5 hours ☐more than 5 hours

Part II

Form-recall Questions (See Appendix B.1)

Part III

Meaning-recognition Questions (See Appendix B.2)

Thank you for your contribution

Thank you very much for completing all activities. Your contribution means a lot to this research and the second language learning and gaming field as a whole.

I appreciate your efforts in participating. Again, I cannot thank you enough.

I wish you the best of luck in the lucky draw and all the best in any future endeavours.

Sincerely,

Iwarin Irene Suprapas

--- END OF ACTIVITY 3---

Appendix G

Information sheet and Consent Form

Information Sheet

Please read the following information

You are invited to take part in a master's degree dissertation research project.

Before you decide whether or not to participate, it is important for you to understand the purpose and the procedures of this research. Please take time to read the following information carefully and discuss it with others if you wish. Please feel free to contact us if there anything is unclear or if further information is needed. Take time to decide whether or not you wish to take part. Thank you in advance for your time and consideration.

About this project

This project is a part of a Master's degree dissertation. It aims to explore how much second language learning can occur by playing computer games. There has long been a belief that English language can be learnt through gaming; however, no research has been done with Commercial off the shelf (CoT) games, e.g., games distributed by Steam. Therefore, a better understanding of the relationship between gaming and learning would benefit every English learner who is a gamer, and gaming could be encouraged instead of demonised.

The decision is entirely yours to make whether or not to take part in this project. If you do decide to take part, you will be given an information sheet to keep and be asked to sign a consent form. Nevertheless, you can still withdraw at any time without any consequences, and there is no need to provide any reason for doing so.

If you wish to participate in this research, please read carefully the information provided below.

Procedures

This research will be taking place from 21st of July until 31th of August 2021. All the procedures will not take longer than 3 hours in 3 settings. The procedures are as follows:

1. After signing the consent form, you will get access to the following data via email:
    a. A detailed information sheet to keep
    b. Further instructions
    c. Links to:

i. Questionnaire
ii. English language learning activities
iii. Timeslot booking form for the gaming session

2. Complete a questionnaire, and English learning activities through Google Form within 3-5 days after completing this form
    a. After completing the activities, you will get access to a Steam account. Therefore, you can download the game prior to your booking slot in your own time. A detailed guide to installing the game and the mod will also be sent to you via email.
3. Play the game!
4. Immediately after playing the game, complete another English language activity through Google Form. The form will be sent to you via email one hour after your session have started.
5. After one week, please come back again to complete another activity. This should not take more than 30 minutes.

By participating in this research, you will get a chance to know about your vocabulary proficiency and join a lucky draw for the game! Above all, it is hoped that this work will lead to a better understanding of gaming and second language learning. If the results show positive gains, playing games could be accepted as a creative hobby instead of being demonised as a waste-of-time activity.

Confidentiality

Despite containing identifiable data, no participant information will be used in any presentations or related to this research. If there is a need to refer directly to a participant, pseudonyms will be used to ensure anonymity.

Contact information

Iwarin (Irene) Suprapas (Researcher): isuprapas1@sheffield.ac.uk

Dr Beatriz Gonzalez-Fernandez (Supervisor): b.gonzalez-fernandez@sheffield.ac.uk

The University Of Sheffield.

SCHOOL OF ENGLISH

Sheffield, S10 2TN

www.shef.ac.uk/english/

Consent form

Working title: Gaming as an Extramural Incidental Learning activity for L2-English learners

By completing this questionnaire, you agree to the following statements:

Taking Part in the Project	Yes	No
I have read and understood the project information sheet or the project has been fully explained to me.	☐	☐
I agree to take part in the project.	☐	☐
I understand that my taking part is voluntary and that I can withdraw from the study at any time; I do not have to give any reasons for why I no longer want to take part and there will be no adverse consequences if I choose to withdraw.	☐	☐
How my information will be used during and after the project	☐	☐
I understand my personal details such as name, phone number, address and email address etc. will not be revealed to people outside the project.	☐	☐
I understand and agree that my words may be quoted in publications, reports, web pages, and other research outputs. I understand that I will not be named in these outputs unless I specifically request this.	☐	☐
I understand and agree that other authorised researchers will have access to this data only if they agree to preserve the confidentiality of the information as requested in this form.	☐	☐
I understand and agree that other authorised researchers may use my data in publications, reports, web pages, and other research outputs, only if they agree to preserve the confidentiality of the information as requested in this form.	☐	☐
I agree to assign the copyright I hold in any materials generated as part of this project to The University of Sheffield.	☐	☐

Name (Participant): _____ **Date:** _____

Name (Researcher): Iwarin Suprapas **Date:** _____

Project contact details for further information:

Iwarin Suprapas (Researcher): isuprapas1@sheffield.ac.uk
Beatriz Gonzalez-Fernandez (Supervisor): b.gonzalez-fernandez@sheffield.ac.uk

Appendix H

In-game interactions: Pictures and explanations

As previously mentioned, the players can interact with items, take the items, wear them and decide which one suits their playstyle better. This section will provide pictures to illustrate the game's user interface which could further elaborate the participants' experience during their gaming session. In this section, the words participants and player will be used interchangeably since both will encounter the same user interface and gaming system when they play Skyrim.

Firstly, the player could roam around freely in the map, using the WASD keys. While walking around, they will encounter different items, both necessary and unnecessary for the quest. When the players walk near a particular item, the name and actions that could be done will pop up on the screen (Figure 1). This does not limit only to items, but also containers (Figure 2), nonplayable characters (NPCs) including both allies and enemies (Figure 3). These spots on the map that the learners could interact with will be referred to as hotspots, similar to hotspots found in e-books.

Figure H 1
Item hotspot

Figure H2
Container Hotspot

Figure H3
NPC Hotspot

After the players take the items, it will be stored in the players' Inventory. Here, the players will be able to see a list of items they had collected, their status (stats), e.g., weight, attack damage, and cost (Figure 4). After looking at the item stats, the player could contemplate whether they want to equip or discard (drop) the item. Also, they could equip items from the inventory by clinking on the name and have unlimited access to the inventory to change, consume and discard items throughout the game. While they are accessing their inventory, the game surroundings will be paused.

Figure H4

Inventory

When players equip an item, for example, a *phloob* (*warhammer*), the in-game visuals will also show the character carrying the weapon (Figure 5 & 6). Moreover, as mentioned, the player can actually "use" the item by attacking enemies or creatures using that particular weapon (Figure 7). Similarly, food items, such as bread, or potions such as *thwists*, can be consumed by accessing the inventory.

Figure H5

Equipping a PHLOOB from 1st person point of view

Figure H 6

Equipping a PHLOOB from 3rd person point of view

Figure H 7

Attacking a QUARES with a PHLOOB