Analyses of Receptive and Productive Korean EFL Vocabulary:

Computer-based Vocabulary Learning Program

by

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ABSTRACT

The present research study investigated the effects of 8 versions of a computer-based vocabulary learning program on receptive and productive knowledge levels of college students. The participants were 106 male and 103 female Korean EFL students from Kyungsueng University and Kwandong University in Korea. Students who participated in versions of the vocabulary learning program with target-word based sentences as well as definitions tended to perform better on receptive and productive vocabulary assessments than those who participated in versions of the program with definitions of words only. Furthermore, results indicated that the difference in receptive scores from immediately after the program to one week later showed a higher drop-rate than the difference in productive scores. In addition, female learners performed receptively better than male learners in post and one-week delayed tests, but significant gender difference failed to occur for the productivity measure. Overall, these results emphasized the importance of productive vocabulary knowledge for better retention of English vocabulary words.
DEDICATION

To my father and mother who brought me into this wonderful world, and showed me how to fulfill my duties and responsibilities as a living person.

Also, to my wife, Michelle Hea Kim who has always been standing by me rain or shine.
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May God bless you!

Love U all!
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Chapter 1

INTRODUCTION

Overview

**Vocabulary is a key component for EFL Learners**

Acquiring a well-rounded English vocabulary is a first step for learners who want to learn English as a foreign language (EFL: learning English in non English speaking countries for academic and social reasons). As stated in Wilkins’ notion (1972), “without grammar very little can be conveyed, without vocabulary nothing can be conveyed” (p. 111). This implies that the crucial role of vocabulary cannot be underestimated, considering meanings and forms that help EFL learners understand English in reading and listening as a *receptive knowledge* and utilize English in speaking and writing as a *productive knowledge* (Crow, 1986; Schmitt, 2010a; Stuart Webb, 2008; Zhou, 2010).

Also, a high correlation between vocabulary size and language proficiency has been found in numerous other studies (B. Laufer, 1992; B. Laufer & Goldstein, 2004a; Staehr, 2008), and vocabulary’s crucial value has been emphasized by many education researchers (Ahmad, 2011; Amiryousefi & Dastjerdi, 2010; P. J. Groot, 2000; Yingling Gu, 2011; 2011; Timothy Cornwall, 2010). Furthermore, Nguyen and Nation (2011) and Staehr (2009) propose that 98% word recognition in a given text is required to grasp the overall meaning of the text.

A significant positive link between word knowledge level and reading comprehension has been shown by a number of researchers (e.g. Sorbi, 2010; Tannenbaum, Torgesen, & Wagner, 2006). Mehrpour and Rahimi (2010) showed that second language (aka L2) learners’ vocabulary knowledge is an influencing factor on
reading. The figures in the Table 1 help demonstrate the importance and value of a learner’s vocabulary size on reading comprehension. As a learner’s vocabulary size increases, the number of unknown words in a given text gradually decreases, helping to bolster reading comprehension.

Table 1.

Vocabulary size and text coverage in the Brown Corpus compiled in the 1960s by Kucera and Francis, containing about 1 million American English words

<table>
<thead>
<tr>
<th>Voc. Size</th>
<th>1000</th>
<th>2000</th>
<th>3000</th>
<th>4000</th>
<th>5000</th>
<th>6000</th>
<th>15,851</th>
</tr>
</thead>
<tbody>
<tr>
<td>Text Coverage</td>
<td>72.0%</td>
<td>79.7%</td>
<td>84.0%</td>
<td>86.8%</td>
<td>88.7%</td>
<td>89.9%</td>
<td>97.8%</td>
</tr>
<tr>
<td>Calculatio based on 250 words per page</td>
<td>250X28% = 70 unknown words, 250/70 = 4</td>
<td>250X20.3% = 50.75 unknown words, 250/50.75 = 5</td>
<td>250X16% = 40 unknown words, 250/40 = 6</td>
<td>250X13.2% = 33 unknown words, 250/33 = 8</td>
<td>250X11.3% = 28 unknown words, 250/28 = 9</td>
<td>250X10.1% = 25 unknown words, 250/25 = 10</td>
<td>250X2.2% = 5.5 unknown words, 250/5.5 = 46</td>
</tr>
<tr>
<td>Density of unknown words</td>
<td>1 in every 4</td>
<td>1 in every 5 unknown words</td>
<td>1 in every 6 unknown words</td>
<td>1 in every 8 unknown words</td>
<td>1 in every 9 unknown words</td>
<td>1 in every 10 unknown words</td>
<td>1 in every 46 unknown words</td>
</tr>
</tbody>
</table>

Note. The figures of vocabulary size and text coverage shown in the first two rows are excerpted from Nation and Waring (1997b) on page 3. The figures are originally from Francis and Kucera (Nelson W. Francis & Henry Kucera, 1982). The 3rd and 4th rows are generated by Scott Kim, a researcher in this study, to help understand the density of unknown words based on 250 written words per page.

As shown in Table 1 (Nation & Waring, 1997a), language learners with a vocabulary size of less than 1,000 words will not know about 28% of the words in a given passage, equaling 1 unknown word in every 4 words, on average. About 1 word in every 5 words will be unknown to language learners who have a vocabulary size of 2,000 words.

Conversely, learners with a vocabulary size of 15,851 words will know all but 2.2% of the words encountered in a reading passage; equivalent to only one unknown word for every 46 words.

Similarly, Table 2 shows that the frequency at which teenagers face unknown words when reading novels depends on their vocabulary size. The difference of meeting unknown words even between the 2,000 word and 5,000 word vocabulary size is very
significant, with readers meeting one unknown word in every 10 words versus one unknown word in every 67 words respectively. Even though the text coverage between Tables 1 and 2 is different because of the frequency of word appearance researchers are using, the critical role of language learners’ vocabulary size speaks for itself.

Table 2.

Vocabulary size and coverage in novels for teenagers

<table>
<thead>
<tr>
<th>Vocabulary size</th>
<th>2000 words</th>
<th>2000 + proper nouns</th>
<th>2600 words</th>
<th>5000 words</th>
</tr>
</thead>
<tbody>
<tr>
<td>% coverage</td>
<td>90%</td>
<td>93.7%</td>
<td>96%</td>
<td>98.5%</td>
</tr>
<tr>
<td>Density of unknown words</td>
<td>1 in every 10</td>
<td>1 in every 16</td>
<td>1 in every 25</td>
<td>1 in every 67</td>
</tr>
</tbody>
</table>

Note: This table is excerpted from Nation and Waring (1997b) on page 4. The figures are originally from Hirsh and Nation (Hirsh & Nation, 1992).

Also, significant results between the role of vocabulary knowledge and listening comprehension have been found by Staehr (2009), who states that a lexical coverage of 98% is also essential to understand any given spoken texts. A similar required vocabulary coverage rate was seen in Nation’s (2006) study for spoken and written texts with 6,000 to 7,000 and 9,000 word families respectively. Finally, vocabulary knowledge was found to play an important role in English speaking by Higgs and Clifford (1982). Staehr (2008) found that low-level EFL learners who knew the most frequent 2000 English words performed adequately on writing, listening and reading tests than who did not. Also, Web (2005) stated that learners’ vocabulary size is a barometer as to reading comprehension, listening and speaking ability, and writing.

In an effort to understand how to best support critical vocabulary learning for EFL learners in Korea, this dissertation study centers on computer-based intentional instruction, focused on bolstering retention and productive word use. To provide a
foundation for the dissertation study, it is necessary to discuss some major terminology and concepts such as intentional and incidental vocabulary learning, receptive and productive vocabulary knowledge related to vocabulary research and learning. Also, cognitive load theory to an EFL Learners’ Vocabulary Learning program and vocabulary learning approaches are discussed to scaffold their deficiencies. Since growing research points to the likelihood that EFL learners can achieve better receptive and productive vocabulary learning in a short period of time through a computer-based vocabulary instruction, further discussion on computer-assisted instruction of vocabulary follows for EFL learners. Then, essential vocabulary research factors being included in the current study are discussed with related research findings.
Chapter 2

LITERATURE REVIEW

EFL learners’ English vocabulary accumulation through Incidental and Intentional learning

It is necessary to draw a line between incidental and intentional vocabulary learning for EFL learners to provide a clear understanding of the current direction in vocabulary learning, teaching, and research in the EFL context. Schmitt (2010a) defines incidental learning as “a by-product of language usage without the intended purpose of learning a particular linguistic feature” (p. 29). Laufer and Hulstijn (2001) state that incidental vocabulary learning takes place “without learners’ awareness of an upcoming retention test, or without learners’ deliberate decision to commit information to memory” (p. 11), while intentional vocabulary learning is a pre-informed learning condition for an upcoming test to agitate and enhance learners’ attention and retention rate. In other words, intentional vocabulary learning is a more attention and retention-driven learning strategy with a pre-informed learning objective such as a posttest, with an expected better outcome at the end of learning.

ESL (English as a second language: learning English in English speaking countries for academic and social reasons) learners tend to have more incidental L2 inputs inside and outside English classes through frequent text-based reading, listening, writing, and speaking opportunities, while EFL learners mostly experience very limited, intentional L2 inputs from their bilingual English classes. The difference in acquiring English vocabulary between the two kinds of input plays a crucial role how language learners’ vocabulary level and size will be accumulated within a given period of learning.
time. The aspect of L2 learners’ vocabulary level and size is also an important element to consider in vocabulary learning, teaching, and researching. First, the English vocabulary level and size work as a measurement of the number of words learners know at their current learning stage. Based on learners’ English vocabulary level and size, appropriate learning and teaching objectives and materials can be designed to be more effective and productive without imposing unnecessary cognitive learning burdens on learners by disregarding their current receptive and productive language ability.

Many learning and teaching interventions have been adopted in two leading areas of vocabulary research: incidental learning and intentional learning. Researchers dealing with intermediate or advanced ESL learners generally support incidental vocabulary learning. Ahmad (2011) found significantly better performance of 20 ESL learners in an incidental setting than in an intentional setting. For intermediate and advanced ESL learners, writing tasks in an incidental vocabulary learning setting produced superior recall rates to reading tasks in the same incidental vocabulary learning setting (Pichette, de Serres, & Lafontaine, 2012). Also, incidental vocabulary learning through reading was found to be most beneficial for advanced L2 learners (Jan H. Hulstijn & Hollander, 1996).

However, Chen (2006) found 78 intermediate ESL learners performed better for immediate vocabulary recall under intentional learning condition. Peters et al. (Peters, Hulstijn, Sercu, & Lutjeharms, 2009) provided significant results that incidental vocabulary retention rate through reading was low. Paribakht and Wesche (1997) considered L2 vocabulary acquisition through incidental reading as a slow and inefficient process, adding that “reading probably accounts for most L1 vocabulary expansion beyond the first few thousand words in common oral usage” (p.174). Further
intentional vocabulary learning recently investigated by Kasahara (2011) resulted in significantly better retention through a known-and-unknown word combination.

Debates about which instructional method (intentional or incidental) is more effective and productive for EFL learners’ vocabulary learning depends in part on vocabulary researchers’ interests and beliefs. For example, Schmitt (2010a), a well-known vocabulary researcher, never mentions intentional vocabulary learning in his latest book. Most vocabulary research has focused on reading-based incidental learning. This approach was criticized by Wesche and Paribakht (2000) as being useful only for word meaning and recognition rather than for word production in writing and speaking.

In terms of learners’ cognitive enhancement, related learning factors such as presentation, spaced rehearsal, number of times encountering new words, and cognitive load theory need to be considered. These factors help produce better learning outcomes when designing vocabulary learning and teaching strategies for EFL learners. No wonder many vocabulary researchers agree that intentional and incidental vocabulary learning need to be put together to promote better and more effective vocabulary learning along with “four vocabulary learning partners” (students, teachers, materials writers, and researchers) (Schmitt, 2008).

However, acquiring new English vocabulary words can be challenging and tedious for EFL learners. It is a laborious and time consuming process attempting to master English for the non-English speaker. Native English speakers gradually acquire vocabulary through incidentally encountered, natural inputs from birth. Further, they acquire vocabulary both through use of formulaic sequences (Schmitt, 2010a) with associated forms, and also through the natural course of the incidental learning. Typical
five-year old native English speakers are already familiar with 4000 to 5000 word families, and university graduates will possess about 20,000 word families by acquiring 1,000 word families every year, compared to EFL learners who tend to begin their English learning at almost point zero (Goulden, Nation, & Read, 1990; Nation & Waring, 1997b). Also, unlike native speakers and ESL students, the tendency of EFL students is to intentionally garner most of their vocabulary through textbook-based input as presented in a classroom setting, and not as frequently encountered in daily situations as is the case with native speakers in social, work and academic settings. Further, many EFL learners start acquiring their new English vocabulary when they begin to learn English after their first language (L1) has been placed in a productive stage of fluency.

Thus, learning English vocabulary is not considered as an easy learning task especially for EFL learners who have to simultaneously deal with different cross-linguistic influences such as definitions, pronunciations, spellings, forms, and grammars associated with new words to build up formulaic sequences like natives (Schmitt, 2010a). The vocabulary learning condition for EFL learners is an incrementally challenging process requiring more learning time, efforts, cognitive processes, and strategies when insufficient social and school input; no prior knowledge and learning behavior have been experienced. Also, the learning task demands more cognitive intentions and strategies such as “ability to produce …, differentiate …, connect …, and … be bidirectional” (Schneider, Healy, & Bourne Jr, 2002, p. 419) if the target language, English, differs from L2 learner’s L1 words in terms of orthography, morphology, semantics, syntax, phonology, pragmatics, morpheme orders, etc.
In this dissertation study, an intentional vocabulary learning strategy was used as the base or core instructional strategy. This strategy was implemented by informing Korean EFL learners about an immediate posttest and a delayed posttest prior to an English vocabulary lesson without comparing intentional to incidental vocabulary learning strategies in the design of the study. This is not because incidental vocabulary learning is not valued as much as intentional learning but because Korean EFL learners mostly favor a quick and immersive approach to vocabulary learning over a short period of time. They have limited incidental vocabulary learning opportunities and learning conditions are mostly confined in a bilingual classroom.

**EFL Learners’ Vocabulary learning in terms of receptive and productive knowledge**

EFL learners’ vocabulary knowledge also needs to be understood in terms of receptive and productive knowledge because of different English skills linked with them. As receptive vocabulary is related to the skills of listening and reading, productive vocabulary learning is related to the skills of writing and speaking (Schmitt, 2010a). The distinction between these two types of knowledge is meaningful when a vocabulary learning and teaching objective is established to meet L2 learners’ needs and expectations. Also, measurement of learners’ vocabulary knowledge can be categorized into four types: receptive recall and recognition and productive recall and recognition (B. Laufer & Goldstein, 2004b). Recall is often measured by producing a target word that goes with a given meaning or producing the word in a sentence with a required blank, while recognition is evaluated by having the learner choose a target word from a list of given words (B. Laufer & Goldstein, 2004b). Further, the distinction helps researchers to measure learners’ specific vocabulary knowledge and recall and recognition performance.
in vocabulary research experiments by focusing on specific research questions. The first level of English vocabulary learning (receptive) becomes a foundation for the next higher level (productive) in the process of language acquisition of L1 or L2. Depending on the vocabulary level, its size in receptive and productive vocabulary knowledge is another important factor of how much L2 learners are capable of reading, listening, writing and speaking. As described earlier, as text coverage of known words increases from 72% at the 1,000 word vocabulary level to 97.8% at the 15,851 word level, L2 learners will possess more words in their receptive and productive vocabulary size as their English vocabulary level goes up (N. W. Francis & H. Kucera, 1982).

Even though Melka (1997) and Laufer and Paribakht (1998) found different ratios of receptive and productive vocabulary in EFL learners’ vocabulary knowledge, both researchers found that learners’ receptive vocabulary size is larger than productive vocabulary. Webb’s findings (2008) pointed out that a larger receptive vocabulary indicates more productive vocabulary size. The fact is that just knowing a word receptively will not function as a silver bullet in reading, listening, speaking and writing for EFL learners. The four sub-skills of English (reading, writing, speaking, and listening) can be enhanced with a specific skill-driven learning objective and strategy by knowing what vocabulary size a learning group has both receptively and productively, rather than aiming for the four sub-skills at the same time. Webb (2009) stated that productive learning is greatly linked into “both receptive and productive knowledge of orthography,…meaning, syntax, and grammatical functions” (p. 360). In a recent study, Park (2010) pointed out that thirty-two Korean university EFL students had a limited productive understanding of the even basic target words (i.e. busy, cheap, difficult, hard,
heavy, poor, rich, rough, shy, and slow), which implies that Korean EFL learners acquire English words receptively, and with a very limited understanding of words’ meanings. It seems that even the stored receptive vocabulary can be further limited in productive in writing and speaking due to the limitedly acquired meaning.

It has been known that both EFL and ESL learners tend to have more L2 receptive language knowledge than productive knowledge (B. Laufer & Paribakht, 1998). As mentioned earlier, adequate reading comprehension requires knowledge of about 98% of the words used in written text, while speaking and writing tasks need less vocabulary knowledge. This is not to say that the speaking and writing tasks require a smaller vocabulary size overall, but the availability of productive vocabulary is always less than receptive vocabulary. Schmitt’s (2008) states that necessary vocabulary word families for reading are 8,000 – 9,000, and 5,000 – 7,000 are needed for oral discourse. However, writing tasks require a larger productive vocabulary size than speaking tasks (Nation, 2006). In particular, EFL learners whose English learning objective is mostly receptive knowledge for reading and listening will have more receptive vocabulary than productive.

Until novice EFL learners reach a certain level of fluency in L2, their expectation of vocabulary learning through slow incremental and incidental vocabulary learning (J.H. Hulstijn, 1992; Jacobs, Dufon, & Hong, 1994) will not be realistic or productive compared to L1 natives or fluent L2 learners. In other words, receptive vocabulary knowledge in EFL environments has to be first accumulated enough to initiate the subsequent acquisition of productive knowledge. In order to compensate for the lack of incremental and incidental inputs for EFL learners, a more attention- and retention-driven intervention is necessary. The aforementioned slow incremental and incidental approach
may not be the right vocabulary learning strategy for EFL learners who want to increase their vocabulary size quickly.

As Web (2005) states, vocabulary size is a barometer of reading comprehension, listening and speaking tasks, and writing. Without considering the vocabulary size factor including vocabulary level in L2 vocabulary research, confounding results in research can be obtained, leading to possible misinterpretation of outcomes. That is why appropriately attainable L2 target words in vocabulary experiment design need to be chosen based on the target learners’ current English vocabulary level and size (Schmitt, 2010b). In this way, the selected attainable L2 words can be receptively and productively stored in the learner’s brain. Too easy or too hard L2 target words not based on L2 learner’s current receptive and productive vocabulary knowledge may result in invalid interpretations and conclusions of vocabulary research outcomes.

**Cognitive Load Theory to an EFL Learners’ Vocabulary Learning program**

Cognitive load theory (CLT) started with George Miller’s concept of limited working memory capacity, with a 7 item plus or minus cognitive processing limit (Miller, 1956). Since then, researchers (Clark, Nguyen, & Sweller, 2006; Jong, 2012; Miller, 1956; Plass, 2010; Sweller, Jeroen, Merrienboer, & Paas, 1998) have long suggested that effective and efficient instructional design promotes faster learning times and better learning outcomes by minimizing unnecessary cognitive load to learners. More research findings (Chandler & Sweller, 1991; Sweller, 1994; Sweller, et al., 1998) have reinforced the idea that effective learning can be expected when an ideal amount of targeted learning material is intentionally presented to learner through carefully constructed instructional design that does not overload a learner’s working memory.
Similarly, computer-based instructional environments should be design to minimize learner’s extraneous cognitive load (Chandler & Sweller, 1996).

One source of extraneous cognitive load in computer-based learning environments is related to the split-attention effect. With split-attention, learners use working memory to process related information that appears in separate locations on screen. Such design acts as “a heavy cognitive overload” (p.293) (Chandler & Sweller, 1991). One study by Chandler and Sweller examined split-attention by investigating the physical integration of text and related diagrams in a learning environment. The visually integrated words and diagrams showed shorter processing time and significantly higher learning outcomes compared to conventional instructional materials in which text and related diagrams are presented separately (Chandler & Sweller, 1992). Also, the split-attention effect was confirmed as an extraneous cognitive load factor in an instructional design in which verbal and pictorial information sources were presented as a split-source format compared to an integrated format (Cierniak, Scheiter, & Gerjets, 2009).

Information overload (IO) such as abundant information was also recognized as a source of impairing learner’s working processing capacity that is mainly required to focus on main learning materials (Davis, 2011).

Second language acquisition researchers have applied cognitive load theory to instructional designs for second language learners to enhance learning outcomes by properly managing split-attention resources. In one study, integrated instructional formats (i.e., word meanings presented within a sentence) for second language online learning and vocabulary learning produced better learning outcomes without the influence of split attention (Al-Shehri & Gitsaki, 2010). In another study, reading comprehension and
vocabulary learning were tested under different cognitive load and learner expertise produced two different aspects of split-attention for different learner expertise (Yeung, et al., 1998). Further, their findings suggested that even the same presentation of integrated formats can be a split-attention source or a performance facilitator depending on learners’ expertise.

**Vocabulary Learning Approaches with Korean EFL (English as a Foreign Language) Learners**

Kim (2006) investigated Korean EFL learners’ English vocabulary acquisition through input elaborated reading that is a form of modified incidental learning. The study found that mere exposure to English words through reading will not be effectively linked to receptive and productive vocabulary acquisition, as happens with L1 learners. Also, Cha (2009) points out inevitable English learning problems Korean EFL learners face in learning English vocabulary such as inadequate exposure to English words and insufficient practice opportunity of lexical use. Given these issues, what would be an effective vocabulary learning approach for Korean EFL learners that compensates for such deficiencies? Kang (1995) examined four vocabulary instructional approaches with Korean learners: “the Paper and Pencil (P&P), the Computer-based Word-for-word (CW), the Computer-based word-for-word plus picture (CP), and the Computer-based Context (CC)” (p. 43). Kang’s findings revealed that the CC group’s vocabulary retention rate was significantly higher than one of other test groups.

Researchers have found that L2 learners’ retention rate of vocabulary varies depending on how English words are presented to them (Kasahara, 2011; Krashen & Terrel, 1983; Martin-Chang, Levy, & O’Neil, 2007; Mengesha, 2011; Sydorenko, 2010).
For example, the combination of a known word and a target word presented together produced significantly improved retention rate than the presentation of single target words alone (Kasahara, 2011). Martin-Chang, et al (2007) demonstrated that word acquisition, retention, and transfer are better achieved in context-based word training than in isolation. Mengesha (2011) found an integrated vocabulary teaching and relevant vocabulary activities promoted learner’s retention rate better than learning vocabulary through semantically unrelated sentences and clauses. More vocabulary learning was gained through isolated and integrated instruction than incidental reading (File & Adams, 2010). Also, the effectiveness of vocabulary learning with explicit instruction resulted in better vocabulary learning outcomes for 146 female Japanese EFL learners (Mizumoto & Takeuchi, 2009).

Expecting Korean EFL learners to acquire necessary unknown English words through mere incidental learning such as reading is not practical and effective. It is not because their English learning is mostly confined within a bilingual classroom, but because the incidental learning requires a certain level of vocabulary size that can help learners understand any reading. Despite this limitation, universities, private business sectors, and governmental offices in Korea are asking for strong test scores on the TOEIC (Test of English for International Communication) as a critical tool for use as a graduation requirement, selecting job applicants, and giving job promotions and pay increases. Such test score-driven school, business, and governmental systems incentivize Korean EFL learners to receptively acquire enough English words to achieve the required TOEIC scores within a short period of time. Even though TOEIC is structured to test EFL learner’s receptive vocabulary knowledge for listening and reading comprehension, and
productive vocabulary knowledge for speaking and writing, Korean EFL learners are required to take only the listening and reading comprehension tests measuring their receptive vocabulary knowledge. Unfortunately, the half-tested TOEIC has ended up promoting receptive vocabulary learning for Korean EFL learners.

EFL pedagogy in Korea has been shifting toward more productive language knowledge by having native English speakers in English class, due to current governmental support and policy, and Internet-based globalization. However, limited L2 inputs in EFL learning and teaching environments still pose a major hindrance in moving from receptive vocabulary knowledge acquisition toward productive vocabulary knowledge.

How much EFL learners can recognize and remember English vocabulary is further extended to how long they can productively retain and use vocabulary including its form, meaning, and use (Nation, 2001). This notion is both academically and linguistically meaningful and useful to Korean EFL learners who must retrieve learned target words receptively in reading and listening, and furthermore productively in speaking and writing whenever necessary. In this sense, both word knowing and word knowledge (Nation, 2001) are interchangeably used to indicate a comprehensive understanding of target words, not just a meaning itself in this study.

L1-based academic settings and English learning environments mostly confined in a classroom for Korean EFL learners are not a practical and promoting factor to march along with reading-based incidental vocabulary learning. This is not because EFL learners are not encouraged to read English books like natives, but because their insufficient vocabulary means they cannot fully understand what they read. What is even
worse, they cannot guess what unknown words mean if they don’t possess a high enough receptive English vocabulary level. Plus, contextual guessing may not be feasible for them. Even with strong receptive vocabulary knowledge in reading and listening, one may not claim that the same level of productive vocabulary knowledge in writing and speaking has been achieved by EFL learners at the same time. This is because receptive vocabulary knowledge is mostly limited to its semantic matter, not requiring any additional understanding such as phonological, linguistic difference and formulaic sequence. Conversely, productive vocabulary knowledge in speaking and writing requires dealing with all of these simultaneously.

One possible approach to overcome these challenges is to create a computer-based English vocabulary learning program aiming to improve EFL learners’ receptive and productive vocabulary knowledge at the same time through previously researched learning factors-driven methods.

**Computer-Assisted Instruction of English Vocabulary Learning**

Today’s emerging technologies that provide speed, convenience, and versatile potentials are affecting our daily lives including language learning. Just transforming vocabulary learning material into a convenient technology box is meaningless and ineffective. Technology should be employed to effectively and efficiently promote and boost all other learning factors associated with it. That includes designs for minimizing split-attention and extraneous cognitive load, convenience for time, place, and carrying. For computer-based vocabulary learning, literally unlimited databases with thousands of words will help enhance individual learner’s vocabulary level. Also, word-shuffling feature for better retaining, embedded receptive and productive questions based on
learned target words, and various options for different learning types and goals for receptive and productive vocabulary knowledge can be embedded in computer-assisted vocabulary instruction. As Zheng’s (2012) survey findings suggest, today’s technology can play a significant role as a part of effective and efficient English vocabulary learning strategies. For example, Nakata (2011) stated that the *iKnow!* vocabulary program supports a wide range of features for data entry, automatically generated multiple-choice exercises and systemically embedded various exercises. Also, the effectiveness of an intelligent computer-assisted language learning (ICALL) program for Turkish learners was found to be positively effective and promoting learners’ positive learning attitude by Esit (2011).

As early as 1984, Fox praised CALL (Computer-Assisted Language Learning) as “a rich and stimulating learning environment” (p. 27) for language learners. Since then numerous CALL studies have been supporting substantial quantity and quality of English vocabulary acquisition for EFL learners needed within a short period of time, considering their time constraints and learning conditions. The need for quick acquisition of English vocabulary for EFL learners is supported by Groot (2000), emphasizing that an intentional vocabulary learning is more effective than incidental vocabulary learning through CALL. For example, CALL pre-teaching vocabulary was found to be effective for Japanese EFL learners. They acquired significantly more words out of the targeted words per unit for receptive and productive tests through three different experiment studies (Allum, 2004). Vocabulary learning strategies through the computer-assisted vocabulary learning (CAVL) are recommended for EFL learners to help them to learn English vocabulary more effectively and efficiently (Ma & Kelly, 2006).
Further possibilities and potentials of utilizing emerging technologies are emphasized in language learning and use by Thorne and Smith (2011). Also, Japanese EFL learners were found to prefer a CALL interface (Computer Assisted Language Learning) over picture cards in vocabulary learning (Oberg, 2011). Task-based language learning (TBLT) like communicative tasks for the quality and quantity of language production enhanced by technology was highlighted by Lai and Li (2011). Richards (2009) described today’s technology as “a focal point of intended teachings and constructed learning” (p. 334) for English learners.

The effectiveness of CALL is further recognized as a continuous vocabulary learning tool to promote better learning gains through productive recall exercises (Allum, 2004). More CALL benefits have been seen, such as Turkish EFL learners’ positive attitude and improved vocabulary learning on an intelligent computer-assisted language learning (ICALL) program (Esit, 2011). Better pedagogical advantages of online vocabulary workbooks over paper workbooks were confirmed through lengthy exposure treatment in the CALL environment (Zapata & Sagarra, 2007). Computer-mediated English dictionaries for text processing have proven to be helpful for improving vocabulary learners’ receptive vocabulary knowledge (Li, 2010). For example, an individualized vocabulary building program called The First 4000 words (Seward, 2012) that provides read-along activities with voice-recognition feedback, underlined reading sentences, and repeatable listening to sentences was tested, and significantly improved vocabulary gains were reported for the experimental groups (Fehr et al., 2012). Positive outcomes such as significant vocabulary gains, improved reading comprehension, and
fast word recognition were confirmed through a direct CALL learning program for frequent vocabulary (Tozcu & Coady, 2004).

Also, CALL has been found to promote learners’ retention and attention rate. Ma (2008) reported significantly improved learner vocabulary retention rate through use of a program providing practice in different contexts. Added target word-related graphics promoting learner’s cognitive attention in a web-based English vocabulary learning program were found to improve outcomes for Korean EFL learners (D. Kim & Gilman, 2008). Chun and Plass (1996) claimed that new words can be more easily acquired when presented with related actual objects or graphics than without them. In another study, the effects of L1 and L2 gloss with and without pictures for EFL learners to acquire new words showed no significant performance difference but improved vocabulary gains were seen when words were learned along with related pictures (Yoshii, 2006). The effects of both L1 and L2 glosses without target-word related pictures tested for L2 learners revealed improved outcomes for immediate post-test better than no glosses, but a four-week delayed retention test showed no difference (Jacobs, Dufon, & Fong, 1994). Further, participants seemed to prefer L2 glosses to L1. A 17% better performance of L2 learners in reading comprehension was achieved by students using CALL-based glosses compared to paper-based glosses (Taylor, 2009).

Quantitative research on CALL shows tangible vocabulary learning benefits, and qualitative research recommends learner training for optimizing CALL resources, useful design for promoting better outcomes, and content considerations for meaningful vocabulary knowledge (Ranalli, 2009). Given the proven benefits of CALL-based vocabulary instruction, the current study evaluated a computer-based intentional
vocabulary learning intervention for Korean EFL learners to support a durable retention level along with productive word usage as well as receptive vocabulary knowledge.

Especially when Korean EFL learners study new English vocabulary through a computer-based learning program without being supervised, their attention and retention rates may depend on how effectively and efficiently each target word is constructed and presented to them by getting learners’ attention and maintaining their attention level at an optimal rate. By examining participants’ learning attitudes and reactions to the vocabulary instruction experience through questionnaires in this dissertation study, along with their performance results, the presentation factor was investigated and evaluated.
Chapter 3

SELECTED VOCABULARY RESEARCH FACTORS BEING INCLUDED IN THE STUDY

There are many vocabulary research factors that have been explored by numerous vocabulary researchers, such as modified learning conditions, and learner behaviors and characteristics toward new English words. Even psycholinguistic and neurolinguistic aspects of vocabulary learning have dealt with the role of learners’ cognitive and brain activities on language acquisition, technology, comprehension, and production. However, only significantly related factors such as elements of intentional vocabulary learning, presentation, practice, spacing, and gender were included in the current study as independent variables, along with Korean EFL learners’ unique learning conditions, needs, and associated characteristics to find an effective, efficient, and productive learning and teaching vocabulary methodology. The following sections describe the factors that were used as an independent variable in the current study.

Rehearsal Factor

A rehearsal factor in which a learner frequently encounters the same word again after first seeing a new target word is an essential learning factor strongly linked to learner’s long-term vocabulary retention rate (J. H. Hulstijn, 2001; Nation, 2001; Stuart Webb, 2007), which can be transferred to a learner’s receptive and productive vocabulary use. In the current study, rehearsal factor is defined as an intentionally-provided learning opportunity to review a word that has been learned earlier.

Positive effects of rehearsal opportunities on L2 vocabulary learning have been investigated (Barcroft, 2007), finding about 10% improved vocabulary learning for
learners exposed to retrieval-oriented and control conditions. Rehearsal opportunity for vocabulary learning shows L2 learners’ improved retention (Slamecka & Graf, 1978). The positive impact on learning of meeting new words in three consecutive sentences rather than one sentence alone has been found in an experiment with thirty-two Iranian EFL learners (Baleghizadeh & Shahry, 2011). However, just repeating a new word aloud several times was found to be insignificant in the acquisition of new words (Abbs, Gupta, & Khetarpal, 2008). The effect of three repeated exposures to new words, and different presentation factors in encountering new words were also investigated by Laufer and Rozovski-Roitblat (2011), and their findings reveal that effective presentation benefits learners in retaining new words better than just the frequency of meeting new words. The further effects of repeated word occurrence (i.e., 1, 3, 7, 10 occurrences) on vocabulary learning suggest that more learning gains can be expected as repetition numbers increase (Stuart Webb, 2007).

By including a practice factor as an independent variable in the current study, an effect of practice opportunities was examined and evaluated in detail for Korean EFL learners.

**Spacing Factor**

Along with other factors discussed above, a spacing factor that controls the visual layout on-screen of presented vocabulary was included as an independent variable in the study to investigate and evaluate its impact on learning. This spacing factor is linked to the cognitive load aspect of the split-attention effect: showing more than one target word simultaneously on the computer screen in a vocabulary learning program may increase a learner’s cognitive load by requiring them to switch attention between multiple essential
pieces of information. An EFL learner’s vocabulary retention rate may vary depending on how well their attention can be focused on each target word simultaneously. In the current study, a modified spacing factor defined as a separate screen for each target word compared to showing multiplied target words on each screen was used to investigate Korean EFL learners’ receptive and productive vocabulary retention rate.

In prior studies, the relationship of vocabulary learning and retention has been examined through spaced repetitions that control the time of meeting a new target word, and learners’ increased retention of vocabulary was proved to be effective in instruction designed to incorporate spacing (Baturay, Yildirim, & Daloglu, 2009). Bird (2011) confirmed the superior benefits of a distributed, long-term learning intervention in language learning by controlling the spaced time. Even a 6-second lag between a target word and its target picture resulted in positive results (Barcroft, 2007). More spacing effects were investigated by Sobel, et al. (2008), finding that one week spaced learning produced a better long-term retention rate than non-spaced one. Furthermore, the effects of spaced vocabulary learning compared to non-spaced one explored by Sobel, et al. (2011) demonstrate superior long-term retention rate as well.

**Gender Factor**

In order to optimize vocabulary learning and teaching through computer assisted vocabulary learning, the impact of gender should not be undervalued. Numerous research studies suggest that different vocabulary learning strategies are employed by female and male learners, which affects design and content of the computer assisted vocabulary learning. Gender in the current study was included as an independent variable to investigate the correlation between a spacing factor and a rehearsal one, because it would
be meaningful to find out whether Korean EFL learners replicate vocabulary researchers’ findings that female learners perform better than males in English vocabulary learning.

In related work, Lin (2011) found that female university EFL learners in Taiwan showed better vocabulary gain scores than males in immediate and retention test. Further gender differences in Chinese EFL learners were explored by Gu (2002) with equivalent research findings to Lin’s. Tabatabaei and Hejazi (2011) reported significantly better performance of Iranian EFL female subjects on their vocabulary immediate and delayed retention test through a key-word vocabulary learning method. More gender differences on vocabulary acquisition and retention were explored by Lin (2011), finding that Taiwanese female EFL subjects performed significantly better than males in a video-based CALL program.

Different vocabulary learning strategies employed by male and female Iranian EFL learners have been studied, and it was found that their employing vocabulary learning strategies were significantly different (Soureshjani, 2011). A vocabulary learning advantage for female learners was seen in a study of Chinese students (Yan, 2009). In a study of L1 speakers’ language production, female subjects produced more sentences semantically than males who performed better syntactically (Drummond, Dancer, & Pierce, 1996). In another experiment, L1 female speakers’ performance on a word-learning task revealed an advantage in learning phonologically-familiar novel words but not in learning phonologically-unfamiliar novel words (Kaushanskaya, Marian, & Yoo, 2011).
Chapter 4

OBJECTIVES OF STUDY

The purpose of this study was to investigate whether and to what extent Korean EFL learners’ English vocabulary learning performance in immediate and one-week delayed posttests could be receptively and productively enhanced by selected interventions. In the study, the receptive learning was defined as Korean EFL learners’ ability to produce meaning of newly learned target words when English words are presented; while productive learning was defined as Korean EFL learners’ expanded ability to produce or utilize learned target words especially in writing or listening without words being given. In the study Korean EFL learners’ productive vocabulary knowledge was measured by asking them to fill in a blank with a learned target word but the list of target words was not provided.

Specifically, the study addressed the following six monotonic research hypotheses that “…predictions about the ordering of group population means” (Braver & Sheets, 1993):

1. A L1DEF (L1 Definition) + 1TWBS (1 Target Word-based Sentence) treatment is receptively and productively more effective than a definition only treatment (L1DEF) in immediate and one-week delayed posttests.

2. A L1DEF (L1 Definition) + 2TWBS (2 Target Word-based Sentences) treatment is receptively and productively better than a L1DEF + 1TWBS treatment in immediate and one-week delayed posttests.
3. A L1DEF (L1 Definition) + 3TWBS (3 Target Word-based Sentences) treatment is receptively and productively better than a L1DEF + 2TWBS treatment in immediate and one-week delayed posttests.

4. All spaced treatments in an English vocabulary-learning program produce receptively and productively better learning performance than not spaced ones in the immediate and one-week delayed posttests.

5. Treatments with more opportunities encountering a target word produce receptively and productively better learning performance under spaced treatments both in the immediate and one-week delayed posttests.

6. Female participants produce receptively and productively better learning performance than males under all treatments in the immediate and one-week delayed posttests.

In order to investigate the six monotonic hypotheses above, three independent variables were introduced in the study: spacing {spaced / not spaced (aka massed)}, treatments (L1Definition only, L1Def. + 1 target-word based sentence, L1Def. + 2 target-word based sentences, and L1Def. + 3 target-word based sentences), and gender (male and female). A dependent variable was Korean EFL learners’ English vocabulary learning performance on receptive and productive use measures. The study measured Korean EFL learners’ receptive and productive English vocabulary learning performance from immediate posttests and one-week delayed tests under eight different learning conditions for both male and female participants. Also, questionnaires were conducted to investigate Korean EFL learners’ learning attitudes and behavior towards computer-based English learning over textbook based vocabulary learning.
Chapter 5

METHOD

Participants and Design

218 Korean college participants, 110 males and 108 females, from Kyungsung (68 males, 35 females) and Kwandong (42 males, 73 females) universities in Korea participated in the study. During the experiment, three male participants walked out without completing an immediate posttest, and six female participants did not come back for the one-week delayed test. They were excluded in this study. Therefore, the number of participants who completed the entire experiment was 209 (see Table 3 below): 106 males (50.7%) and 103 females (49.3%) from Kyungsung (65 males, 33 females) and Kwandong (41 males, 70 females).

Table 3.

Number of Participants in each Treatment

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Spaced (male, female)</th>
<th>Massed (male, female)</th>
<th>Total (male, female)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Def. only</td>
<td>13, 12</td>
<td>15, 14</td>
<td>28, 26</td>
</tr>
<tr>
<td>Def. + 1S</td>
<td>15, 14</td>
<td>13, 13</td>
<td>28, 27</td>
</tr>
<tr>
<td>Def. + 2S</td>
<td>13, 13</td>
<td>13, 13</td>
<td>26, 26</td>
</tr>
<tr>
<td>Def. + 3S</td>
<td>12, 12</td>
<td>12, 12</td>
<td>24, 24</td>
</tr>
<tr>
<td>Total</td>
<td>53, 51</td>
<td>53, 52</td>
<td>106, 103</td>
</tr>
</tbody>
</table>

Note. Def. = definition, 1S = one sentence, 2S = 2 sentences, 3S = 3 sentences

The two universities were selected due to their similar educational level. All participants were undergraduate students who had completed at least one or two required English classes, and who were enrolled in various majors, including: media literature, advertising and public relations, civil engineering, health and environmental hygiene, interior design, healthcare management, English education, home economic education, advanced materials engineering, urban design and development engineering, and Chinese.
Participant ages ranged from 20 to 24. Their participation was voluntary. Ten drawings for $20 at Kyungsung University, and two drawings for $100 at Kwandong University were given to them to encourage their participation.

**Computer-Based Vocabulary Learning Program**

In this study, eight different versions of a computer-based English vocabulary learning program [4 versions x spacing (spaced / massed)] were used. There were pretest, immediate posttest, and one-week delayed tests to measure participants’ receptive and productive vocabulary knowledge, as well as a questionnaire.

Eight versions of computer-based English vocabulary learning program (see Appendix A) were used to teach 24 English target words. The words consisted of 9 nouns (deportation, bristle, hilarity, indolence, kennel, graffiti, obituary, trepidation, and utterance), 7 verbs (venerate, nudge, quiver, astound, chortle, entwine, and manifest) and 8 adjectives (legible, poignant, sterile, rigorous, authentic, wretched, frantic, and jubilant) excerpted from Alan Beale’s Core Vocabulary list of 21,877 words (Manythings.org, 2003). By selecting 7 to 9 different words in each noun, verb, and adjective, a roughly equal distribution of target English words was achieved. The 24 target words were carefully chosen based on average word length (7.71 characters and 3.08 vowels) in the Standard English Vocabulary (Medero & Ostendorf, 2009), word difficulty, and average frequency level of 25, 917 out of 86,800 words in the WordCount archive based on data from British National Corpus that includes a 100 million word collection of written and spoken words (WordCount, 2003). Even though English grammar is composed of eight types of words such as verb, noun, adjective, adverb, pronoun, preposition, conjunction, and interjection, distributed three major types of words were used in the study to be more
meaningful in measuring Korean EFL learners’ productive vocabulary knowledge on semantic meaning, word type, and position rather than testing only meaning itself. Further consideration was paid to the first letter of each target word without reusing the same first letter to be fair to all participants. Easily recognizable words, comprehensible sentence structures, and a same or similar level of were used in the target-word based sentences and productive test questions to reduce unnecessary cognitive load to participants.

The vocabulary-learning program consisted of eight different presentation styles being embedded with a spacing factor and/or a target-word based sentence or sentences (see screen shots at Appendix B). Treatment in the study has four levels: L1DEF (L1 definition only), L1DEF (L1 definition) + 1TWBS (one target word-based sentence), L1DEF+2TWBS (Two target word-based sentences), and L1DEF+3TWBS (Three target word-based sentences). Embedding the spacing factor increased a number of the vocabulary learning styles in the program to eight. Font style, size, and color for target words in the study were bolded and underlined Times New Roman in size 14 and black (see Appendix C). All four treatments were presented by using the same font style, size and color.

**Measures**

In order to measure receptive and productive vocabulary performance, male and female participants were randomly assigned to one of eight different computer-based English vocabulary learning program versions in a designated computer lab. Desktop computers at three different computer labs (two at Kyungsung University and one at Kwandong University) were used to conduct this experiment. Each computer was pre-
loaded with the English vocabulary learning program as planned for 16 experiment groups [8 programs x gender (male / female)]. All computers were equipped with a flat color monitor whose size varied between 15 and 20 inches. The computer lab at Kyungsung University held up to 40 participants at a time, and the one at Kwandong University held up to 25 participants at a time. Indoor lighting during the entire experiment was adequate and no apparent disruption or disturbance occurred except two participants whose computers were frozen had to move to another computer to complete the vocabulary-learning program.

A pretest (see Appendix D) was conducted to screen participants’ prior receptive and productive knowledge of the 24 target English words before they began to study the words through the vocabulary-learning program. An immediate posttest (see Appendix E) was used to measure participants’ immediate receptive and productive vocabulary knowledge learned through the program. A one-week delayed post-test for receptive and productive vocabulary knowledge was conducted to find out how well each participant could recall the words written correctly on the immediate receptive and productive posttests.

In order to investigate Korean EFL learners’ learning behavior and attitude towards the vocabulary learning program, questionnaires (see Appendix F) were conducted right after immediate posttests were completed. In addition to intentional learning methods, differentiated features including spacing and rehearsal were embedded in the vocabulary learning program to examine the impact of these features on vocabulary retention rate and enhanced productive word usage in writing. In this study, Korean EFL learners’ productive knowledge in writing was measured by presenting them with English
sentences that included a blank space for a correct target word rather than asking them to write a complete sentence using one of the target words. This approach follows category V (Table 4) in the Vocabulary Knowledge Scale (VKS) developed by Paribakht and Wesche (T. S. Paribakht & M. Wesche, 1997).

Table 4.
Vocabulary Knowledge Scale (VKS)

<table>
<thead>
<tr>
<th>Self-Report Categories</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>I don’t remember having seen this word before.</td>
</tr>
<tr>
<td>II</td>
<td>I have seen this word before, but I don’t know what it means.</td>
</tr>
<tr>
<td>III</td>
<td>I have seen this word before, and I think it means _______. (synonym or translation)</td>
</tr>
<tr>
<td>IV</td>
<td>I know this word, it means _____. (synonym or translation)</td>
</tr>
<tr>
<td>V</td>
<td>I can use this word in a sentence: ___________. (Write a sentence.)</td>
</tr>
<tr>
<td></td>
<td>If you do this section, please also do Section IV.)</td>
</tr>
</tbody>
</table>

Employing category V of the VKS was not practical or realistic in the current study because of the participants’ inability to construct English sentences by themselves. However, the categories I, II, and III were included in the questionnaire.

The questionnaire composed of 23 questions (see Appendix F) was designed to investigate participants’ English vocabulary learning behaviors and attitudes, which might help explain correlations and some findings in this study.

The pretest composed of 48 English vocabulary questions (24 receptive questions testing for word meaning recognition and 24 productive sentence completion questions) was used to measure Korean EFL learners’ prior English vocabulary knowledge of the 24 target words as in the following examples (Table 5):
Table 5.
Samples of Receptive and Productive Vocabulary Questions

**Example 1: Receptive Question for immediate receptive posttest**
‘authentic’ 단어의 뜻은? (What is the meaning of ‘authentic’ in Korean?):
____________________________________

**Example 2: Receptive Question for delayed receptive posttest**
‘authentic’ 단어의 뜻은? 단어의 뜻을 모르면 옆 질문에 답하시요.
(Translation: What is the meaning of ‘authentic’ in Korean? If you don’t know its meaning, answer to the additional question.):
____________________________________
( ) 전에 본 기억없음 (I don’t remember having seen this word before.)
( ) 본 기억은 있는데 기억안남 (I have seen this word before, but I don’t know what it means.)

**Example 1: Productive Question**
오늘 배운 단어중에서 문장에 맞는 단어를 넣으세요.
(Fill in the blank with an appropriate word learned from today’s lesson in the following sentence.)
(_______) paintings need to be examined and verified by experts who have trained eyes.
Answer: authentic

There were four posttests in the study: an immediate posttest measured Korean EFL learners’ receptive and productive English vocabulary knowledge right after the treatments, and a one-week delayed receptive and productive test measuring participants’ retention rate compared to the immediate posttest outcomes. The same test questions were used for the receptive pretest and posttest, but the sequence of presenting target words was shuffled to eliminate a possible same sequence effect. An immediate receptive and productive posttest and a one-week delayed receptive and productive posttest were scored with the same scoring system in which each correct answer was
awarded 1 point. No answer or wrong answer given was scored as 0 points. A correct answer for receptive and productive questions included misspelled words and close meanings answered in Korean in which the learner seemed to know the meaning. The score for each response was counted and recorded. Participants could obtain a maximum score of 24 points each in the receptive and productive pretest, posttest, and delayed test.

The delayed receptive posttest asked participants two additional questions about unknown words: (1) I have not seen this word before and (2) I have seen this word before but I cannot remember its meaning. Questions for the immediate productive test and the delayed productive test varied in three different versions to purposely minimize possible exposure and same sequence effects, and the different versions were randomly assigned to subjects across treatments in productive pre- and post-tests.

Further, Korean EFL learners’ learning behavior and attitude towards computer-based English vocabulary learning were measured through a list of 23 questions including how they perceived it compared to textbook based vocabulary learning right after an immediate posttest. Their learning behavior and attitude were compared and analyzed for possible correlation. Each response on the questionnaire was coded and recorded in an Excel sheet for analyses.

**Procedures**

With a preregistered list of participants, an approximate number of males and females per session were expected and randomly assigned to computer terminals. All procedures on the pretest, immediate posttest, questionnaire, and one-week delayed posttest except all hypotheses in this study were explained to participants. As a responsible proctor and researcher for this study, I personally supervised all experiments.
with two student helpers at Kwandong University and two professors’ help at Kyungsung University.

First, participants were given a pretest to measure their prior vocabulary knowledge of the 24 target English words. They spent about three to five minutes to complete the receptive pretest and five to ten minutes for the productive pretest. In order to eliminate possible benefits from the target words written on the receptive pretest, the productive pretest for filling in a blank with a learned word was first given to participants. Second, upon completing the pretests, I collected the tests and then participants were allowed to open their assigned version of the vocabulary-learning program to study 24 target English words.

Even though they were given 60 minutes to study the 24 target words, most participants were able to complete the vocabulary learning after between 25 and 50 minutes. Depending on the version of the vocabulary-learning program given, it was expected that each group might have a different learning time to study the given 24-target words. Once they informed the researcher they were ready for the immediate posttest, participants were asked to close the vocabulary learning program, and the posttest was given. Like the pretest, the productive posttest was given first to eliminate possible word acquaintance on the receptive posttest shown 24 target words asking their meanings in Korean. After the two posttests were given, participants were asked to complete the questionnaire and come back a week later to take delayed receptive and productive tests. The one-week delayed posttest was conducted in the same manner as the pretest and the immediate posttest in that the productive test was given first prior to the receptive test.
The immediate and one week-delayed receptive tests were designed to eliminate a possible sequence effect by shuffling target words. The delayed receptive test included additional questions not included in the receptive immediate posttest designed to investigate learners’ target-word related recognition information: (1) *I don’t remember having seen this word before*, and (2) *I have seen this word before, but I don’t know what it means* (T. S. Paribakht & M. Wesche, 1997). Furthermore, the productive post-test and delayed posttest were constructed to eliminate possible exposure and sequence effect by both shuffling words and using different sentences at the same or similar level of difficulty in three versions of productive post-test (see Appendix G).

**Analysis**

There were six dependent variables: immediate post receptive scores, immediate post productive scores, one-week delayed receptive scores, one-week delayed productive scores. Also, two more additional dependent variables (difference receptive scores between post receptive and delayed receptive, and difference productive scores between post productive scores and delayed productive scores) were included to answer the six hypotheses. Therefore, a first series of 3-way ANOVAs were run six times for six dependent variables with a fixed factor of spacing, gender, and treatment.

The questionnaire consisting of 23 questions was coded and recorded in an Excel program to analyze each question, and its results were attached as an Appendix G.
Chapter 6

RESULTS

A series of a 2 (gender) X 2 (spacing) X 4 (treatments) ANOVAs were conducted to investigate the main and interaction effects of gender, spacing, and treatments on changes in receptive and productive scores (a) from prior to the treatment to immediately after treatment (pre-post change), (b) from prior to the treatment to one-week after treatment (pre-follow change), and (c) from immediately after treatment to one-week after treatment (post-follow change). When appropriate, follow-up analyses were conducted to explore main and interaction effects.

Receptive Scores

For pre-post change in receptive scores, the significant effects for the 3-way ANOVA were as follows: main effect of gender, $F(1, 193) = 6.38, p = .012$, partial $\eta^2 = .032$, and treatments, $F(3, 193) = 2.85, p = .039$, partial $\eta^2 = .042$. However, no tests were significant for the spacing main effect, the 2-way interactions, or 3-way interactions.

Follow up Tukey tests were conducted to examine the pairwise mean differences for the treatments factor. Results showed that the mean difference between the Def. + 1 sentence treatment and the Def. only treatment was statistically different ($p = .023$), but none of the other pairwise comparisons were statistically significant (see Table 6). The means, $SD$, and $n$ per treatment for post receptive scores can be found in Table 7.

Table 6.

Multiple Comparisons of Treatments for Post Receptive Scores by Tukey HSD

<table>
<thead>
<tr>
<th>(I) Treatments</th>
<th>(J) Treatment</th>
<th>Mean Difference (I-J)</th>
<th>Std. Error</th>
<th>Sig.</th>
<th>95% Confidence Interval</th>
</tr>
</thead>
<tbody>
<tr>
<td>Def. only</td>
<td>Def. + 1S</td>
<td>-2.26</td>
<td>.786</td>
<td>.023</td>
<td>-4.29 -2.22</td>
</tr>
<tr>
<td></td>
<td>Def. + 2S</td>
<td>-.92</td>
<td>.797</td>
<td>.656</td>
<td>-2.99 1.14</td>
</tr>
</tbody>
</table>
Table 7. Descriptive Statistics for Post Receptive Scores.

<table>
<thead>
<tr>
<th>Treatments</th>
<th>Male</th>
<th>Female</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean</td>
<td>SD</td>
</tr>
<tr>
<td>Def. only</td>
<td>17.38</td>
<td>3.885</td>
</tr>
<tr>
<td>Def. + 1S</td>
<td>17.20</td>
<td>3.745</td>
</tr>
<tr>
<td>Def. + 2S</td>
<td>17.31</td>
<td>4.939</td>
</tr>
<tr>
<td>Def. + 3S</td>
<td>17.75</td>
<td>4.048</td>
</tr>
<tr>
<td>Total</td>
<td>17.40</td>
<td>4.049</td>
</tr>
</tbody>
</table>

Note. Def. = definition, 1S = one sentence, 2S = two sentences, 3S = three sentences.

The significant gender main effect indicated that females on average scored higher than males on pre-post change in receptive scores. However, I also chose to plot the scores for males and females in each of the treatment conditions. Female participants performed better than male participants for the Def. only, Def. + 1S, and Def. + 2S treatments, but not for the Def. + 3S treatment (see Figure 1).

Figure 1: Estimated Marginal Means of Post Receptive Scores per treatment
For pre-follow change in receptive scores, there was a statistically significant main effect of gender, $F(1, 193) = 10.56, p = .001$, partial $\eta^2 = .052$, but no other significant main effects were found, spacing: $F(1, 193) = .005, p = .943$, partial $\eta^2 = .000$; treatment: $F(3, 193) = 2.52, p = .059$, partial $\eta^2 = .038$ respectively. Only one interaction was significant and it was for the spacing X gender interaction, $F(1, 193) = 6.61, p = .011$, partial $\eta^2 = .033$.

Further analyses investigating the spacing X gender interaction showed that female participants did not differ significantly from male participants on the mean pre-follow receptive change scores, $p = .633$, 95% CI [-2.055 to 1.252]. However, under massed conditions female participants performed significantly better than males, $p < .001$, mean difference = -3.44, 95% CI [-5.08 to -1.80]. So the simple main effects of gender were found only under massed treatments. I present these results visually in Figure 2.

![Figure 2: Estimated Marginal Means Plot of Delayed Receptive Scores](image)

The results of descriptive statistics for delayed receptive scores are shown below in Table 8, and the results of means, standards, and 95% confidence intervals of the significant 2-way interaction between spacing and gender are listed in Table 9.
Table 8.

Descriptive Statistics for Delayed Receptive Scores.

<table>
<thead>
<tr>
<th>Treatments</th>
<th>Male</th>
<th>Female</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Spaced</td>
<td>Massed</td>
</tr>
<tr>
<td></td>
<td>Mean</td>
<td>SD</td>
</tr>
<tr>
<td>Def. only</td>
<td>6.92</td>
<td>4.991</td>
</tr>
<tr>
<td>Def. + 1S</td>
<td>8.27</td>
<td>4.061</td>
</tr>
<tr>
<td>Def. + 2S</td>
<td>7.85</td>
<td>6.466</td>
</tr>
<tr>
<td>Def. + 3S</td>
<td>7.67</td>
<td>3.312</td>
</tr>
<tr>
<td>Total</td>
<td>7.70</td>
<td>4.734</td>
</tr>
</tbody>
</table>

Note. Def. = definition, 1S = one sentence, 2S = two sentences, 3S = three sentences.

Table 9.

Means and Confidence Interval Table for Delayed Receptive Scores

<table>
<thead>
<tr>
<th>Spacing</th>
<th>Gender</th>
<th>Mean</th>
<th>Std. Error</th>
<th>95% Confidence Interval</th>
<th>Lower Bound</th>
<th>Upper Bound</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>53</td>
<td>53</td>
</tr>
<tr>
<td>Spaced</td>
<td>Male</td>
<td>7.67</td>
<td>.587</td>
<td>6.517</td>
<td>8.34</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Female</td>
<td>8.07</td>
<td>.598</td>
<td>6.897</td>
<td>9.257</td>
<td></td>
</tr>
<tr>
<td>Massed</td>
<td>Male</td>
<td>6.19</td>
<td>.587</td>
<td>5.040</td>
<td>7.357</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Female</td>
<td>9.64</td>
<td>.592</td>
<td>8.471</td>
<td>10.807</td>
<td></td>
</tr>
</tbody>
</table>

For post-follow change in difference receptive scores, the significant effects for the 3-way ANOVA were as follows: main effect of treatment, \( F(1, 193) = 3.556, p = .015 \), partial \( \eta^2 = .052 \), but no tests were significant for the gender and spacing main effect.

Also, two interactions were significant: the spacing X gender interaction, \( F(1, 193) = 13.003, p = .000 \), partial \( \eta^2 = .063 \), and the spacing X treatment interaction, \( F(3, 193) = 3.826, p = .011 \), partial \( \eta^2 = .056 \). There were no 3-way interactions.

Follow up Tukey tests were conducted to examine the pairwise mean differences for the treatments factor. Results (see Table 10) showed that the mean difference between the Def. + 1 sentence treatment and the Def. + 2 sentences treatment was statistically significant (\( p = .034 \)). Also, the mean difference between the Def. + 2 sentences
treatment and the Def. + 3 sentences treatment was statistically significant ($p = .026$).

None of other pairwise comparisons was statistically significant. The means, $SD$, and $n$ per treatment for difference receptive scores can be found in Table 11.

Table 10.

Multiple Comparisons of Treatments for Difference Receptive Scores by Tukey HSD

<table>
<thead>
<tr>
<th>(I) Treatments</th>
<th>(J) Treatment</th>
<th>Mean Difference (I-J)</th>
<th>Std. Error</th>
<th>$p$</th>
<th>95% Confidence Interval</th>
</tr>
</thead>
<tbody>
<tr>
<td>Def. only</td>
<td>Def. + 1S</td>
<td>-.74</td>
<td>.728</td>
<td>.737</td>
<td>-2.63 to 1.14</td>
</tr>
<tr>
<td></td>
<td>Def. + 2S</td>
<td>1.26</td>
<td>.738</td>
<td>.320</td>
<td>-.65 to 3.18</td>
</tr>
<tr>
<td></td>
<td>Def. + 3S</td>
<td>-.89</td>
<td>.754</td>
<td>.639</td>
<td>-2.84 to 1.06</td>
</tr>
<tr>
<td>Def. + 1S</td>
<td>Def. + 2S</td>
<td>2.01</td>
<td>.735</td>
<td>.034*</td>
<td>.10 to 3.91</td>
</tr>
<tr>
<td></td>
<td>Def. + 3S</td>
<td>-.15</td>
<td>.750</td>
<td>.997</td>
<td>-2.09 to 1.80</td>
</tr>
<tr>
<td>Def. + 2S</td>
<td>Def. + 3S</td>
<td>-2.16</td>
<td>.760</td>
<td>.026*</td>
<td>-4.13 to -.18</td>
</tr>
</tbody>
</table>

*Note. Based on observed means. The error term is Mean Square (Error) = 14.436. The mean difference is significant at the .05 level.

Table 11.

Descriptive Statistics for Difference Receptive Scores (= post receptive scores - delayed receptive scores).

<table>
<thead>
<tr>
<th></th>
<th>Male</th>
<th></th>
<th></th>
<th>Female</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Spaced</td>
<td>Mean</td>
<td>SD</td>
<td>$n$</td>
<td>Massed</td>
<td>Mean</td>
</tr>
<tr>
<td>Treatments</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Def. only</td>
<td>10.46</td>
<td>5.333</td>
<td>13</td>
<td>11.33</td>
<td>4.254</td>
<td>15</td>
</tr>
<tr>
<td>Def. + 1S</td>
<td>8.93</td>
<td>4.431</td>
<td>15</td>
<td>12.69</td>
<td>4.270</td>
<td>13</td>
</tr>
<tr>
<td>Def. + 2S</td>
<td>9.46</td>
<td>4.235</td>
<td>13</td>
<td>7.15</td>
<td>3.760</td>
<td>13</td>
</tr>
<tr>
<td>Def. + 3S</td>
<td>10.08</td>
<td>2.712</td>
<td>12</td>
<td>13.75</td>
<td>3.341</td>
<td>12</td>
</tr>
<tr>
<td>Total</td>
<td>9.70</td>
<td>4.232</td>
<td>53</td>
<td>11.19</td>
<td>4.583</td>
<td>53</td>
</tr>
<tr>
<td>Total</td>
<td>11.18</td>
<td>3.303</td>
<td>51</td>
<td>8.81</td>
<td>3.548</td>
<td>52</td>
</tr>
</tbody>
</table>

*Note. Def. = definition, 1S = one sentence, 2S = two sentences, 3S = three sentences. In this table, the smaller the mean score, the better it is because the difference receptive scores equal to post receptive scores minus delayed receptive scores.

Further analyses investigating the spacing X gender interaction showed that under spaced conditions male participants differed significantly from female participants on the mean post-follow difference receptive scores, $p = .045$, 95% CI [-2.958 to -.037]. In other
words, males receptively retained more target words than males under spaced conditions. Conversely, under massed conditions, female participants retained target words significantly better than males even a week after, \( p = .022 \), mean difference \(-2.303\), 95% CI \([-3.783\) to \(-.824]\) (see Figure 3).

![Figure 3: Estimated Marginal Means Plot of Difference Receptive Scores](image)

Other analyses investigating the spacing X treatments interaction showed that under spaced conditions the Def. + 2 sentences treatment differed significantly from massed conditions on the mean post-follow difference receptive scores, \( p = .007 \), 95% CI \([-4.963\) to \(-.806]\). In other words, under spaced conditions the Def. + 2 sentences treatment worked receptively better than under massed conditions. Other pairwise comparisons between spacing and treatments were not statistically significant.
Productive Scores

For pre-post changes in productive scores, the significant effects for the 3-way ANOVA were as follows: main effect of spacing, $F(1, 193) = 6.757, p = .010$, partial $\eta^2 = .034$, and treatments, $F(3, 193) = 3.686, p = .013$, partial $\eta^2 = .054$. However, no tests were significant for the gender factor, $F(1, 193) = .011, p = .918$, partial $\eta^2 = .000$, and the 2-way interactions, or 3-way interactions.

Follow up Tukey tests were conducted to examine the pairwise mean differences for the treatments factor. Results showed that the mean difference between the Def. only treatment and the Def. + 1 sentence treatment was statistically different ($p = .012$), but no other pairwise comparisons were statistically significant (see Table 12). The means, SD, and N per treatment for post productive scores can be found in Table 13.

Table 12.

Multiple Comparisons of Treatments for Post Productive Scores by Tukey HSD

<table>
<thead>
<tr>
<th>(I) Treatments</th>
<th>(J) Treatment</th>
<th>Mean Difference (I-J)</th>
<th>Std. Error</th>
<th>Sig.</th>
<th>95% Confidence Interval Lower Bound</th>
<th>Upper Bound</th>
</tr>
</thead>
<tbody>
<tr>
<td>Def. only</td>
<td>Def. + 1S</td>
<td>-2.52</td>
<td>.817</td>
<td>.012*</td>
<td>-4.64</td>
<td>-.41</td>
</tr>
<tr>
<td></td>
<td>Def. + 2S</td>
<td>-2.03</td>
<td>.828</td>
<td>.072</td>
<td>-4.17</td>
<td>.12</td>
</tr>
<tr>
<td></td>
<td>Def. + 3S</td>
<td>-1.98</td>
<td>.846</td>
<td>.092</td>
<td>-4.17</td>
<td>.21</td>
</tr>
<tr>
<td>Def. + 1S</td>
<td>Def. + 2S</td>
<td>.50</td>
<td>.825</td>
<td>.931</td>
<td>-2.63</td>
<td>1.64</td>
</tr>
<tr>
<td></td>
<td>Def. + 3S</td>
<td>.54</td>
<td>.842</td>
<td>.918</td>
<td>-1.64</td>
<td>2.73</td>
</tr>
<tr>
<td>Def. + 2S</td>
<td>Def. + 3S</td>
<td>.04</td>
<td>.853</td>
<td>1.000</td>
<td>-2.17</td>
<td>2.26</td>
</tr>
</tbody>
</table>

*Note.* Based on observed means. The error term is Mean Square (Error) = 18.180. *The mean difference is significant at the .05 level.
Table 13.

Descriptive Statistics for Post Productive Scores.

<table>
<thead>
<tr>
<th>Treatments</th>
<th>Male Spaced</th>
<th>Male Massed</th>
<th>Female Spaced</th>
<th>Female Massed</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean</td>
<td>SD</td>
<td>n</td>
<td>Mean</td>
</tr>
<tr>
<td>Def. only</td>
<td>3.38</td>
<td>3.84</td>
<td>13</td>
<td>5.00</td>
</tr>
<tr>
<td>Def. + 1S</td>
<td>7.87</td>
<td>5.56</td>
<td>15</td>
<td>9.46</td>
</tr>
<tr>
<td>Def. + 2S</td>
<td>6.15</td>
<td>5.49</td>
<td>13</td>
<td>8.15</td>
</tr>
<tr>
<td>Def. + 3S</td>
<td>6.00</td>
<td>4.51</td>
<td>12</td>
<td>8.83</td>
</tr>
<tr>
<td>Total</td>
<td>5.92</td>
<td>5.07</td>
<td>53</td>
<td>7.74</td>
</tr>
</tbody>
</table>

Note. Def. = definition, 1S = one sentence, 2S = two sentences, 3S = three sentences.

The significant spacing and treatment main effect indicated that massed conditions on average scored higher than spaced on pre-post change in productive scores. I also chose to plot the scores for massed and spaced in each of the treatment conditions. Massed conditions performed better than spaced conditions for all treatments, and these results are presented visually in Figure 4.

![Estimated Marginal Means of Post Productive Scores](#)

*Figure 4: Estimated Marginal Means of Post Productive Scores*
For pre-follow change in productive scores, there was no statistically significant main effect of gender: $F(1, 193) = .994, p = .320$, partial $\eta^2 = .005$; spacing: $F(1, 193) = .553, p = .458$, partial $\eta^2 = .003$, or treatments [$F(3, 193) = .643, p = .588$, partial $\eta^2 = .010$]. Also, no tests were significant for the 2-way interactions, or 3-way interactions.

Follow up Tukey tests were conducted to examine the pairwise mean differences for the treatments factor. Results showed that the mean difference for all pairwise comparisons were not statistically significant (see Table 14). The means, $SD$, and $n$ per treatment for delayed productive scores can be found in Table 15.

Table 14.

**Multiple Comparisons of Treatments for Delayed Productive Scores by Tukey HSD**

<table>
<thead>
<tr>
<th>(I) Treatments</th>
<th>(J) Treatment</th>
<th>Mean Difference (I-J)</th>
<th>Std. Error</th>
<th>Sig.</th>
<th>95% Confidence Interval</th>
<th>Lower Bound</th>
<th>Upper Bound</th>
</tr>
</thead>
<tbody>
<tr>
<td>Def. only</td>
<td>Def. + 1S</td>
<td>-.01</td>
<td>.301</td>
<td>1.00</td>
<td>-.79</td>
<td>.77</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Def. + 2S</td>
<td>.35</td>
<td>.305</td>
<td>.662</td>
<td>-.44</td>
<td>1.14</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Def. + 3S</td>
<td>.24</td>
<td>.312</td>
<td>.867</td>
<td>-.57</td>
<td>1.05</td>
<td></td>
</tr>
<tr>
<td>Def. + 1S</td>
<td>Def. + 2S</td>
<td>.36</td>
<td>.304</td>
<td>.636</td>
<td>-.43</td>
<td>1.15</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Def. + 3S</td>
<td>.25</td>
<td>.310</td>
<td>.850</td>
<td>-.55</td>
<td>1.06</td>
<td></td>
</tr>
<tr>
<td>Def. + 2S</td>
<td>Def. + 3S</td>
<td>-.11</td>
<td>.315</td>
<td>.986</td>
<td>-.92</td>
<td>.71</td>
<td></td>
</tr>
</tbody>
</table>

*Note. Based on observed means. The error term is Mean Square (Error) = 2.469.*

Table 15.

**Descriptive Statistics for Delayed Productive Scores.**

<table>
<thead>
<tr>
<th>Treatments</th>
<th>Male</th>
<th></th>
<th></th>
<th></th>
<th>Female</th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Spaced</td>
<td>Massed</td>
<td>Spaced</td>
<td>Massed</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Mean</td>
<td>$SD$</td>
<td>$n$</td>
<td>Mean</td>
<td>$SD$</td>
<td>$n$</td>
<td>Mean</td>
<td>$SD$</td>
</tr>
<tr>
<td>Def. only</td>
<td>1.38</td>
<td>1.710</td>
<td>13</td>
<td>2.07</td>
<td>2.463</td>
<td>15</td>
<td>1.25</td>
<td>1.765</td>
</tr>
<tr>
<td>Def. + 1S</td>
<td>1.53</td>
<td>1.302</td>
<td>15</td>
<td>1.08</td>
<td>1.441</td>
<td>13</td>
<td>1.36</td>
<td>1.499</td>
</tr>
<tr>
<td>Def. + 2S</td>
<td>1.00</td>
<td>2.000</td>
<td>13</td>
<td>1.62</td>
<td>1.938</td>
<td>13</td>
<td>.38</td>
<td>.650</td>
</tr>
<tr>
<td>Def. + 3S</td>
<td>1.33</td>
<td>1.670</td>
<td>12</td>
<td>.92</td>
<td>.996</td>
<td>12</td>
<td>1.17</td>
<td>1.267</td>
</tr>
<tr>
<td>Total</td>
<td>1.32</td>
<td>1.638</td>
<td>53</td>
<td>1.45</td>
<td>1.846</td>
<td>53</td>
<td>1.04</td>
<td>1.371</td>
</tr>
</tbody>
</table>

*Note. Def. = definition, 1S = one sentence, 2S = two sentences, 3S = three sentences.*
For post-follow change in difference productive scores, there were two statistically significant main effects of spacing: \( F(1, 193) = 6.77, p = .010, \) partial \( \eta^2 = .034; \) treatments: \( F(3, 193) = 5.15, p = .002, \) partial \( \eta^2 = .074. \) No significant main effect of gender was found: \( F(1, 193) = .087, p = .768, \) partial \( \eta^2 = .000. \) Only one interaction was significant, and it was for the gender X treatments interaction, \( F(3, 193) = 3.75, p = .012, \) partial \( \eta^2 = .055. \) There were no other 2-way or 3-way interactions.

Follow up Tukey tests were conducted to examine the pairwise mean differences for the treatments factor. Results showed that the mean difference between the Def. only treatment and other treatments plus a sentence or sentences treatment was statistically significant (see Table 16). The means, \( SD, \) and \( n \) per treatment for difference productive scores can be found in Table 17.

Table 16.

Multiple Comparisons of Treatments for Difference Productive Scores by Tukey HSD

<table>
<thead>
<tr>
<th>(I) Treatments</th>
<th>(J) Treatment</th>
<th>Mean Difference (I-J)</th>
<th>Std. Error</th>
<th>Sig.</th>
<th>95% Confidence Interval</th>
<th>Lower Bound</th>
<th>Upper Bound</th>
</tr>
</thead>
<tbody>
<tr>
<td>Def. only</td>
<td>Def. + 1S</td>
<td>-2.51</td>
<td>.730</td>
<td>.004</td>
<td>-4.41</td>
<td>-.62</td>
<td></td>
</tr>
<tr>
<td>Def. only</td>
<td>Def. + 2S</td>
<td>-2.38</td>
<td>.740</td>
<td>.008*</td>
<td>-4.30</td>
<td>-.46</td>
<td></td>
</tr>
<tr>
<td>Def. only</td>
<td>Def. + 3S</td>
<td>-2.22</td>
<td>.756</td>
<td>.019*</td>
<td>-4.18</td>
<td>-.26</td>
<td></td>
</tr>
<tr>
<td>Def. + 1S</td>
<td>Def. + 2S</td>
<td>.14</td>
<td>.737</td>
<td>.998</td>
<td>-1.77</td>
<td>2.05</td>
<td></td>
</tr>
<tr>
<td>Def. + 1S</td>
<td>Def. + 3S</td>
<td>.29</td>
<td>.753</td>
<td>.980</td>
<td>-2.05</td>
<td>1.77</td>
<td></td>
</tr>
<tr>
<td>Def. + 2S</td>
<td>Def. + 3S</td>
<td>.15</td>
<td>.763</td>
<td>.997</td>
<td>-1.82</td>
<td>2.13</td>
<td></td>
</tr>
</tbody>
</table>

*Note.* Based on observed means. The error term is Mean Square (Error) = 14.525.* The mean difference is significant at the .05 level.
Table 17.

Descriptive Statistics for Difference Productive Scores (post productive scores-delayed productive scores).

<table>
<thead>
<tr>
<th>Treatments</th>
<th>Male</th>
<th>Female</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Spaced Mean</td>
<td>SD</td>
</tr>
<tr>
<td>Def. only</td>
<td>2.00</td>
<td>2.972</td>
</tr>
<tr>
<td>Def.+ 1S</td>
<td>6.33</td>
<td>5.080</td>
</tr>
<tr>
<td>Def.+ 2S</td>
<td>5.15</td>
<td>4.200</td>
</tr>
<tr>
<td>Def.+ 3S</td>
<td>4.67</td>
<td>3.200</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>4.60</strong></td>
<td><strong>4.226</strong></td>
</tr>
</tbody>
</table>

*Note.* Def. = definition, 1S = one sentence, 2S = two sentences, 3S = three sentences

The significant main effects of spacing and treatments indicated that massed conditions on average showed higher drop rates for retention than spaced conditions on post-follow change in difference productive scores. I chose to plot the scores for spaced and massed in each of the treatment conditions, and spaced treatments showed lower drop rates for word retention than massed treatments (see Figure 5).
Results of Hypotheses

Hypothesis 1. The L1DEF (L1 Definition) + 1TWBS (1 Target Word-based Sentence) treatment was found to be receptively and productively more effective, on average, than a definition only treatment (L1DEF) on the immediate and one-week delayed posttests.

Hypothesis 2. The L1DEF (L1 Definition) + 2TWBS (2 Target Word-based Sentences) treatment was found to be receptively and productively better, on average, than a L1DEF + 1TWBS treatment on the immediate and one-week delayed posttests.

Hypothesis 3. The L1DEF (L1 Definition) + 3TWBS (3 Target Word-based Sentences) treatment was found to be receptively and productively better, on average, than a L1DEF + 2TWBS treatment on the immediate and one-week delayed posttests.

Combining the hypotheses 1, 2, and 3, it was hypothesized that the mean scores on posttests would be ordered from lowest to highest for the treatment conditions in the following order: Def. only, Def. + 1S, Def. + 2S, and Def. + 3S receptively and productively in the immediate posttest and one-week delayed posttest. The lineally ordered treatments from lowest to highest were not confirmed as hypothesized, but as shown in Table 18 and in Figure 6, hypothesis 1 was confirmed in that a word definition plus 1 example target sentence was better than a definition-only treatment for all four dependent variables: post receptive and productive scores, and delayed receptive and productive scores. Hypothesis 2 was only supported by the results of delayed receptive scores, and the hypothesis 3 was consistent with the results of post receptive scores and delayed productive scores.
Table 18.

Results of Hypothesis 1, 2, and 3

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Hypothesis 1</th>
<th>Hypothesis 2</th>
<th>Hypothesis 3</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>PR</td>
<td>PP</td>
<td>DR</td>
</tr>
<tr>
<td>Def. only</td>
<td>n/a</td>
<td>n/a</td>
<td>n/a</td>
</tr>
<tr>
<td>Def. + 1S</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Def. + 2S</td>
<td>n/a</td>
<td>n/a</td>
<td>n/a</td>
</tr>
<tr>
<td>Def. + 3S</td>
<td>n/a</td>
<td>n/a</td>
<td>n/a</td>
</tr>
</tbody>
</table>

*Note.* PR = post receptive, PP = post productive, DR = delayed receptive, and DP = delayed productive.
Hypothesis 4. Use of spaced treatments in the English vocabulary learning software was associated with receptively and productively better mean learning performance than not spaced (massed) ones on the immediate and one-week delayed posttests.

As seen in Table 19, spaced treatments appeared to be more effective than massed treatments for post receptive scores and delayed receptive scores. However, spaced treatments were not better than massed ones for post and delayed productive scores as shown in Figure 7. Therefore, the results were receptively consistent with hypothesis 5, but not productively consistent with hypothesis 4.

Table 19.
Mean (SD, n) target word gained by Spacing

<table>
<thead>
<tr>
<th>Spacing</th>
<th>Mean for Post</th>
<th>Mean for Post</th>
<th>Mean for Delayed</th>
<th>Mean for Delayed</th>
</tr>
</thead>
<tbody>
<tr>
<td>Definition only</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Definition plus 1 sentence</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Definition plus 2 sentences</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Definition plus 3 sentences</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Figure 6: Effects of Treatments for post and delayed receptive and productive scores
<table>
<thead>
<tr>
<th></th>
<th>Receptive</th>
<th>Productive</th>
<th>Receptive</th>
<th>Productive</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Spaced</strong></td>
<td>18.33 (4.076, 104)</td>
<td>6.09 (4.211, 104)</td>
<td>7.90 (4.436, 104)</td>
<td>1.18 (1.512, 104)</td>
</tr>
<tr>
<td><strong>Massed</strong></td>
<td>17.89 (4.311, 105)</td>
<td>7.52 (4.433, 105)</td>
<td>7.88 (4.441, 105)</td>
<td>1.35 (1.611, 105)</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>18.11 (4.195, 209)</td>
<td>6.81 (4.323, 209)</td>
<td>7.89 (4.438, 209)</td>
<td>1.27 (1.562, 209)</td>
</tr>
</tbody>
</table>

*Note.* Def. = definition, 1S = one sentence, 2S = two sentences, 3S = three sentences.
Hypothesis 5. Treatments with more opportunities for encountering a target word produced receptively and productively better average learning performance under spaced treatments both on the immediate and one-week delayed posttests.
As shown in Table 20, results were consistent with hypothesis 5 except for delayed productive scores. In other words, use of treatments with more opportunities for encountering a target word was associated with receptively and productively better mean learning performance under spaced treatments both in the immediate and one-week delayed posttests, except for delayed productive scores which showed mixed results.

Table 20.
Mean (SD, n) target word gained by spaced treatment

<table>
<thead>
<tr>
<th>Treatment Spaced</th>
<th>Mean for Post Receptive</th>
<th>Mean for Post Productive</th>
<th>Mean for Delayed Receptive</th>
<th>Mean for Delayed Productive</th>
</tr>
</thead>
<tbody>
<tr>
<td>Def. only</td>
<td>17.76 (4.085, 25)</td>
<td>4.76 (4.095, 25)</td>
<td>6.96 (4.686, 25)</td>
<td>1.32 (1.701, 25)</td>
</tr>
<tr>
<td>Def. + 1S</td>
<td>18.93 (3.981, 29)</td>
<td>7.07 (4.448, 29)</td>
<td>8.62 (3.793, 29)</td>
<td>1.45 (1.378, 29)</td>
</tr>
<tr>
<td>Def. + 2S</td>
<td>18.38 (4.419, 26)</td>
<td>6.04 (4.322, 26)</td>
<td>8.08 (5.447, 26)</td>
<td>.69 (1.490, 26)</td>
</tr>
<tr>
<td>Def. + 3S</td>
<td>18.13 (3.946, 24)</td>
<td>6.33 (3.784, 24)</td>
<td>7.83 (3.714, 24)</td>
<td>1.25 (1.452, 24)</td>
</tr>
<tr>
<td>Total</td>
<td>18.33 (4.076, 104)</td>
<td>6.09 (4.211, 104)</td>
<td>7.90 (4.436, 104)</td>
<td>1.18 (1.512, 104)</td>
</tr>
</tbody>
</table>

Note. Def. = definition, 1S = one sentence, 2S = two sentences, 3S = three sentences.

Hypothesis 6. Female participants demonstrated receptively and productively better average learning performance than males under all treatments in the immediate and one-week delayed posttests.

It was hypothesized that females would be better learning performers, on average, receptively and productively than males under all treatments in the immediate and one-week delayed posttest. The results were consistent with the hypothesis for post receptive and delayed receptive scores, but for the post productive and delayed productive scores the results did not support the hypothesis (see Table 21 and Figure 8). The means and standard deviations are listed in Table 22.
Table 21.

Results of Hypothesis 6 as a gender, female participants.

<table>
<thead>
<tr>
<th>Spacing</th>
<th>Hypothesis 6</th>
<th>PR</th>
<th>PP</th>
<th>DR</th>
<th>DP</th>
</tr>
</thead>
<tbody>
<tr>
<td>Female</td>
<td>Yes</td>
<td>No</td>
<td>Yes</td>
<td>No</td>
<td></td>
</tr>
</tbody>
</table>

*Note.* Yes = better than male participants, No = not better than male participants, PR = post receptive, PP = post productive, DR = delayed receptive, DP = delayed productive.

Table 22.

Mean (SD, n) target word gained by gender

<table>
<thead>
<tr>
<th>Gender</th>
<th>Mean for Post Receptive</th>
<th>Mean for Post Productive</th>
<th>Mean for Delayed Receptive</th>
<th>Mean for Delayed Productive</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male</td>
<td>17.36 (4.270, 106)</td>
<td>6.83 (5.092, 106)</td>
<td>6.92 (4.447, 106)</td>
<td>1.39 (1.738, 106)</td>
</tr>
<tr>
<td>Female</td>
<td>18.87 (3.984, 103)</td>
<td>6.79 (3.508, 103)</td>
<td>8.89 (4.198, 103)</td>
<td>1.15 (1.353, 103)</td>
</tr>
<tr>
<td>Total</td>
<td>18.11 (4.191, 209)</td>
<td>6.81 (4.373, 209)</td>
<td>7.89 (4.428, 209)</td>
<td>1.27 (1.561, 209)</td>
</tr>
</tbody>
</table>
Results of the Survey

The results of the survey completed by 209 participants (106 males, 103 females) revealed a few interesting findings (see Appendix H). Most of the participants reported thinking that males would perform better than females by 157 vs. 51 respectively. Further investigation showed that only 25 females (about 24%) reported thinking that they are better than males in vocabulary learning, while about 75% of male participants (79 males) reported thinking they are better vocabulary learners than females.

Results from the survey further showed that 65% of participants (135 participants) said they studied vocabulary intentionally, only 18% reported picking up new English words incidentally, and 17% for both. These results are associated with ones showing that 79% of participants learn new vocabulary better when there is an exam announced.

As expected, about 69% of 209 Korean participants revealed that they tend to mostly memorize meanings only when they study new words, while only 27% use target-word based sentence or sentences. Along with these results, about 66% of all participants
indicated that memorizing word meanings is the most important thing for learning new vocabulary. More results on other remaining questions can be found in Appendix H.
Chapter 4

Discussion

Discussion of Overall Findings

As stated in the results section, the linear ordered hypothesis 1 was consistent with the results of this study, but hypotheses 2 and 3 were not. However, evidence was found that treatments with a target-word based sentence or sentences in addition to the word definition had a better effect than the definition-only treatment on Korean EFL learners’ receptive and productive vocabulary learning. Participant post-implementation receptive recall in treatments with a target-word based sentence or sentences was better than participants using the definition-only treatment by 6.56% (70.54% vs. 77.10%), and post productive recall by 9.05% (21.63% vs. 30.68%), and delayed receptive recall by 6.05% (28.33% vs. 34.38%) except delayed productive recall. When compared between Def. only and Def. + 1 sentences, the treatment effect went up even higher for post receptive recall by 9.38%, post productive recall by 10.5%, and delayed receptive recall by 6.30% as shown in Table 23.

Table 23.
Percent rate of gained scores (Mean, n) per treatment

<table>
<thead>
<tr>
<th>Treatments</th>
<th>Posttest Scores</th>
<th>Delayed scores</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>PR</td>
<td>PP</td>
</tr>
<tr>
<td>Def. only</td>
<td>70.54% (16.93, 54)</td>
<td>21.63% (5.19, 54)</td>
</tr>
<tr>
<td>Def. + 1S</td>
<td>79.92% (19.18, 55)</td>
<td>32.13% (7.71, 55)</td>
</tr>
<tr>
<td>Def. + 2S</td>
<td>74.38% (17.85, 52)</td>
<td>30.04% (7.21, 52)</td>
</tr>
<tr>
<td>Def. + 3S</td>
<td>77.00% (18.48, 48)</td>
<td>29.88% (7.17, 48)</td>
</tr>
<tr>
<td>Total</td>
<td>75.46% (18.11, 209)</td>
<td>28.38% (6.81, 209)</td>
</tr>
</tbody>
</table>

Note. Def. = definition, 1S = one sentence, 2S = two sentences, 3S = three sentences, PR = post receptive, PP = post productive, DR = delayed receptive, and DP = delayed productive.

A possible explanation for the statistically insignificant differences in learning outcomes between Def. +1S, Def. + 2S and Def. + 3S may be seen in Korean EFL learners’ self-
reported vocabulary learning behavior in the survey. 66.51% of participants reported being used to memorize only word meanings (Table 24) as a method for studying new English vocabulary. Even though all participants were instructed to go over all target-word based sentences listed in the vocabulary learning program, it is possible they only went through the first sentence. Only 7.2% participants were reporting being interested in vocabulary learning for writing. The results of a Def. + 1S treatment for post receptive and productive recall, and delayed receptive recall being increased by such 9.42%, 10.5%, and 6.3% respectively more than a Def. only treatment may reflect such general lack of interest in productive vocabulary use.

Table 24.

The most important thing in learning vocabulary rated by 209 participants

<table>
<thead>
<tr>
<th>What is the most important thing when studying a word?</th>
<th>meaning</th>
<th>writing</th>
<th>spelling</th>
<th>speaking</th>
<th>synonym</th>
<th>antonym</th>
<th>various words</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Percent</td>
<td>66.51%</td>
<td>7.2%</td>
<td>5.74%</td>
<td>19.14%</td>
<td>2.39%</td>
<td>0</td>
<td>0</td>
<td>100%</td>
</tr>
</tbody>
</table>

As seen in Table 25, there were significantly different percent rates found between post receptive scores and post productive scores, and between delayed receptive scores and delayed productive scores. There are several possible explanations for such differences. First, since Korean EFL learners typically memorize only word meanings receptively as shown in Table 24, they may not be able to recall the target words productively without seeing a list of target words provided on the post and delayed test even though they recalled more target words receptively.
Second, even with productively recalled words learners may not be able to utilize the words in sentences on the post and delayed productive test, for they may not be able to comprehend the sentences and/or sentence structures used on the post and delayed productive tests. In other words, such hidden language issues might have prevented participants from reflecting their true level of receptive word knowledge.

Table 25.

Difference in scores between posttest scores and delayed scores per treatment

<table>
<thead>
<tr>
<th>Treatments</th>
<th>Posttest Scores</th>
<th>Delayed scores</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>PR</td>
<td>PP</td>
<td>Diff.</td>
</tr>
<tr>
<td>Def. only</td>
<td>70.54%</td>
<td>21.63%</td>
<td><strong>48.91%</strong></td>
</tr>
<tr>
<td>Def. + 1S</td>
<td>79.92%</td>
<td>32.13%</td>
<td><strong>47.79%</strong></td>
</tr>
<tr>
<td>Def. + 2S</td>
<td>74.38%</td>
<td>30.04%</td>
<td><strong>44.34%</strong></td>
</tr>
<tr>
<td>Def. + 3S</td>
<td>77.00%</td>
<td>29.88%</td>
<td><strong>47.12%</strong></td>
</tr>
<tr>
<td>Total</td>
<td>75.46%</td>
<td>28.38%</td>
<td><strong>47.03%</strong></td>
</tr>
</tbody>
</table>

*Note. Def. = definition, 1S = one sentence, 2S = two sentences, 3S = three sentences, PR = post receptive, PP = post productive, DR = delayed receptive, and DP = delayed productive.*

As seen in Table 25, when comparing immediate posttest receptive and productive scores between Def. only and Def. + 1S, the score difference went to 47.79% from 48.91%, and then dropped further to 44.34% in Def. +2S, and then the difference in Def. + 3S stayed almost the same as Def. + 1S. In other words, the treatment with two target-word based 2 sentences helped participants retain productively more correct words than other treatments. Otherwise, the difference scores between post receptive scores and productive scores should be bigger, which means that learners recall less target words productively. A possible explanation for these results can be related to the optimum number of target-based sentences in each program learners are willing to go through without experiencing any distractor effect.
When comparing delayed receptive and productive scores for participants in the Def. only and Def. + 1S versions of the program, the difference scores were 22.45% and 28.71% respectively, which indicated that participants in Def. only program produced more correct words than Def. +1S productively. The contrary phenomenon could be explained with more target-word related information pieces differently affecting learners’ 7-day memory as a possible distractor like one-week delayed test in this study if no further review opportunity is provided in between.

Table 26.

Difference of a drop rate of gained scores between posttest receptive scores and delayed receptive scores, and between posttest productive scores and delayed productive scores per treatment

<table>
<thead>
<tr>
<th>Treatments</th>
<th>PR</th>
<th>DR</th>
<th>Dif.</th>
<th>PP</th>
<th>DP</th>
<th>Dif.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Def. only</td>
<td>70.54%</td>
<td>28.33%</td>
<td>42.21%</td>
<td>21.63%</td>
<td>5.88%</td>
<td>15.75%</td>
</tr>
<tr>
<td>Def. + 1S</td>
<td>79.92%</td>
<td>34.63%</td>
<td>45.29%</td>
<td>32.13%</td>
<td>5.92%</td>
<td>26.21%</td>
</tr>
<tr>
<td>Def. + 2S</td>
<td>74.38%</td>
<td>37.42%</td>
<td>36.96%</td>
<td>30.04%</td>
<td>4.42%</td>
<td>25.62%</td>
</tr>
<tr>
<td>Def. + 3S</td>
<td>77.00%</td>
<td>31.08%</td>
<td>45.92%</td>
<td>29.88%</td>
<td>4.88%</td>
<td>25.00%</td>
</tr>
<tr>
<td>Total</td>
<td>75.46%</td>
<td>32.88%</td>
<td>44.73%</td>
<td>28.38%</td>
<td>5.29%</td>
<td>23.15%</td>
</tr>
</tbody>
</table>

*Note: Def. = definition, 1S = one sentence, 2S = two sentences, 3S = three sentences, PR = post receptive, PP = post productive, DR = delayed receptive, and DP = delayed productive.*

However, when comparing drop rates of retention between posttest scores and delayed scores receptively and productively (Table 26), participants in the Def. only treatment showed a lower drop rate than those in the Def. + 1S for post receptive scores vs. delayed receptive scores, and post productive scores vs. delayed productive scores.

Furthermore, when comparing the score drop rate of participants in the Def. only treatment and the average drop rate of the Def. + 1 sentence, Def. + 2 sentences, and Def. + 3 sentences treatment, the Def. only treatment revealed, the drop rate still stayed lower by 42.21% to 45.58% and 15.75% to 18.61% respectively. A possible explanation for this
low drop rate for participants in the Def. only treatment may be that more information pieces for each target word are contributing to the higher drop rate of retention as a distractor unless there is a review opportunity for the target words previously learned before the 7-day delayed test. In other words, more information could produce positive effects on Korean EFL learners’ immediate recall performance but might cause negative effects as a distractor when their immediate recall was not completely stored receptively and productively in their long-term memory without any review opportunity for learned target words.

In analyses comparing posttest receptive scores and delayed receptive scores, and between posttest productive scores and delayed productive scores (Table 26), there was a lower drop rate of retention for productive recall performance. In other words, during the 7 day period before the delayed test, Korean EFL learners were able to retain more words productively by 21.58% when they previously recalled target words on the post productive test, which suggests that productive vocabulary learning may enable Korean EFL learners to retain new words better than receptive vocabulary learning. This may be because their productive knowledge of English words gained through a productive learning format might help them perform better productively.

The study results supported the hypothesis (#4) that spaced treatments were better than massed ones, but only in post receptive scores and delayed receptive scores. However, the difference between the two scores was very small, suggesting that Korean EFL learners possibly tended to stick to their usual vocabulary learning strategy of studying mainly for vocabulary word meaning. Because 69.38% of participants reporting being used to studying word meanings only (Table 27), they might not have been quickly
influenced by other vocabulary learning intervention styles presented within 60 minutes. It may be that a fully functioning effect of newly introduced vocabulary learning approaches may take time to take effect.

Table 27. ‘How to study a new word’ rated by 209 participants

<table>
<thead>
<tr>
<th>‘How to study’</th>
<th>meaning only</th>
<th>meaning + 1 sentence</th>
<th>meaning + 1 Sentence plus</th>
<th>no answer</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gender</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>73(50.34%)</td>
<td>28(57.14%)</td>
<td>2(28.57%)</td>
<td>2(28.57%)</td>
<td>106</td>
</tr>
<tr>
<td>Female</td>
<td>72(49.66%)</td>
<td>21(42.86%)</td>
<td>5(71.43%)</td>
<td>5(71.43%)</td>
<td>103</td>
</tr>
<tr>
<td>Total</td>
<td>145(100.00%)</td>
<td>49(100.00%)</td>
<td>7(100.00%)</td>
<td>7(100.00%)</td>
<td>209</td>
</tr>
<tr>
<td>% by How</td>
<td>69.38%</td>
<td>23.44%</td>
<td>3.35%</td>
<td>3.35%</td>
<td></td>
</tr>
</tbody>
</table>

Contrary to the non-significant results of spaced treatments for post receptive and delayed receptive scores, massed treatments showed significantly better results in post productive scores and delayed productive scores (see Table 28). These results suggest that massed treatments benefit Korean EFL learners’ productive vocabulary learning more than spaced ones. This conclusion needs to be considered in light of the tendency of Korean EFL learners to be poor at answering productively in sentences, which means that the scores for immediate productive and delayed productive performance might not represent reliable results because the results could be coincident.

Table 28. Difference of a drop rate of gained scores between spaced and massed treatment by treatment

<table>
<thead>
<tr>
<th></th>
<th>Posttest Scores</th>
<th>Delayed scores</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>PR Spaced / Massed</td>
<td>PP Spaced / Massed</td>
<td>Dif.</td>
<td>Dif.</td>
</tr>
<tr>
<td></td>
<td>Dif.</td>
<td>Dif.</td>
<td></td>
<td>Dif.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Def. only</td>
<td>74.00% / 67.54%</td>
<td>6.5%</td>
<td>19.83% / 23.13%</td>
<td>-3.3%</td>
</tr>
<tr>
<td></td>
<td>29.00% / 27.75%</td>
<td>1.3%</td>
<td>5.50% / 6.17%</td>
<td>-.67%</td>
</tr>
<tr>
<td>Def. +</td>
<td>78.88% / 81.08%</td>
<td>-2.2%</td>
<td>29.46% / 35.08%</td>
<td>-5.6%</td>
</tr>
<tr>
<td></td>
<td>35.92% / 33.17%</td>
<td>2.8%</td>
<td>6.04% / 5.75%</td>
<td>.29%</td>
</tr>
</tbody>
</table>
Hypothesis 5 predicted that spaced treatments with more opportunities for encountering a target word would produce receptively and productively better scores on the immediate and one-week-delayed posttests. The hypothesis was borne out in the results for post receptive scores (74% vs. 77%), post productive scores (19.83% vs. 27%), and delayed receptive scores (29% vs. 34.07%), but not with the results for the delayed productive scores (5.5% vs. 4.71%) (Table 29). Generally, more opportunities for encountering target words seemed to benefit participants in recalling more words receptively and productively, except for in the delayed productive recall measure. Productively delayed recall process might require more review opportunities, which suggests the idea of an optimal review time.

Table 29.

Percent in scores between spaced treatments with more opportunities meeting a target word

<table>
<thead>
<tr>
<th>Spaced Treatments</th>
<th>Posttest Scores</th>
<th>Delayed scores</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>PR</td>
<td>PP</td>
</tr>
<tr>
<td>Def. only</td>
<td>74.00%</td>
<td>19.83%</td>
</tr>
<tr>
<td>Def. + 1S</td>
<td>78.88%</td>
<td>29.46%</td>
</tr>
<tr>
<td>Def. + 2S</td>
<td>76.58%</td>
<td>77%</td>
</tr>
<tr>
<td>Def. + 3S</td>
<td>75.54%</td>
<td>26.38%</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>76.38%</strong></td>
<td><strong>25.38%</strong></td>
</tr>
</tbody>
</table>

*Note. Def. = definition, 1S = one sentence, 2S = two sentences, 3S = three sentences, PR = post receptive, PP = post productive, DR = delayed receptive, DP = delayed productive.*

Hypothesis 6 predicts that females would be a better performer in vocabulary learning than males. This was supported by the results of immediate post and delayed receptive scores, but not by the results of immediate post and delayed productive scores,
as seen in Table 30. According to the survey results shown in Table 31, almost half of participants did not believe that females are better performers than males in English vocabulary learning. The survey results may not be scientifically representable, but many researchers have found that females are superior to males in vocabulary learning (Drummond, et al., 1996; Kaushanskaya, et al., 2011; Lin, 2011; Tabatabaei & Hejazi, 2011; Yan, 2009). Results from the survey also revealed that 73.5% of male participants thought they were better vocabulary learners, and moreover, 76.7% of females also thought males would be better learners. Despite these self-reported views, results from this study suggest that females were superior to males in receptive vocabulary learning (Table 30).

Table 30.

Mean (SD, n) target word gained by gender as a fixed factor

<table>
<thead>
<tr>
<th>Gender</th>
<th>Mean for Post Receptive</th>
<th>Mean for Post Productive</th>
<th>Mean for Delayed Receptive</th>
<th>Mean for Delayed Productive</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male</td>
<td>17.36 (4.270, 106)</td>
<td>6.83 (5.092, 106)</td>
<td>6.92 (4.447, 106)</td>
<td>1.39 (1.738, 106)</td>
</tr>
<tr>
<td>Female</td>
<td>18.87 (3.984, 103)</td>
<td>6.79 (3.508, 103)</td>
<td>8.89 (4.198, 103)</td>
<td>1.15 (1.353, 103)</td>
</tr>
<tr>
<td>Total</td>
<td>18.11 (4.191, 209)</td>
<td>6.81 (4.373, 209)</td>
<td>7.89 (4.428, 209)</td>
<td>1.27 (1.561, 209)</td>
</tr>
</tbody>
</table>

Table 31.

‘Who is a better learner in learning new words?’ rated by 209 participants

<table>
<thead>
<tr>
<th>Gender</th>
<th>Males think.</th>
<th>Females think.</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Female is better</td>
<td>27 (25.47%)</td>
<td>24 (23.30%)</td>
<td>51 (24.40%)</td>
</tr>
<tr>
<td>Male is better.</td>
<td>79 (74.53%)</td>
<td>79 (76.70%)</td>
<td>158 (75.12%)</td>
</tr>
<tr>
<td>Total</td>
<td>106 (50.72%)</td>
<td>103 (49.28%)</td>
<td>209 (100%)</td>
</tr>
</tbody>
</table>

Also, results of the two additional questions on the delayed productive test suggested that females were superior to males in retaining information on learned target
words (Tables 32 and 33), which is consistent with a few vocabulary researchers’ findings on gender and vocabulary learning. It is interesting to notice that after 7 days, males had an average total loss of 2.72 words out of 24 target words, while females experienced a total loss of 2.34 words on average. Furthermore, females showed a slower average drop rate than males during a 7-day period (Table 32).

Table 32.
Number of “I don’t remember having seen this word before.” on the Delayed Productive Test

<table>
<thead>
<tr>
<th>Program</th>
<th>Male</th>
<th>Female</th>
</tr>
</thead>
<tbody>
<tr>
<td>#1 Spaced</td>
<td>34</td>
<td>21</td>
</tr>
<tr>
<td>#2 Massed</td>
<td>53</td>
<td>20</td>
</tr>
<tr>
<td>#2 Spaced</td>
<td>21</td>
<td>38</td>
</tr>
<tr>
<td>#3 Massed</td>
<td>21</td>
<td>21</td>
</tr>
<tr>
<td>#3 Spaced</td>
<td>54</td>
<td>31</td>
</tr>
<tr>
<td>#4 Massed</td>
<td>62</td>
<td>59</td>
</tr>
<tr>
<td>#4 Spaced</td>
<td>18</td>
<td>36</td>
</tr>
<tr>
<td>Total</td>
<td>288/106 = 2.72 words</td>
<td>241 / 103 = 2.34 words</td>
</tr>
</tbody>
</table>

Table 33.
Number of “I have seen this word before, but I don’t know what it means.” on the delayed Productive Test

<table>
<thead>
<tr>
<th>Program</th>
<th>Male</th>
<th>Female</th>
</tr>
</thead>
<tbody>
<tr>
<td>#1 Massed</td>
<td>254</td>
<td>170</td>
</tr>
<tr>
<td>#1 Spaced</td>
<td>176</td>
<td>163</td>
</tr>
<tr>
<td>#2 Massed</td>
<td>164</td>
<td>167</td>
</tr>
<tr>
<td>#2 Spaced</td>
<td>204</td>
<td>166</td>
</tr>
<tr>
<td>#3 Massed</td>
<td>330</td>
<td>140</td>
</tr>
<tr>
<td>#3 Spaced</td>
<td>147</td>
<td>166</td>
</tr>
<tr>
<td>#4 Massed</td>
<td>149</td>
<td>283</td>
</tr>
<tr>
<td>#4 Spaced</td>
<td>182</td>
<td>165</td>
</tr>
<tr>
<td>Total</td>
<td>1,606/106 = 15.15 words</td>
<td>1,420 / 103 = 13.79 words</td>
</tr>
</tbody>
</table>
Limitations

Recruiting more than 200 Korean EFL learners from a single university was a big challenge, so two universities that appeared to be at a same level were chosen to take part in this research study. Rather than the 2X2X4 ANOVA design in this study, a 2X2X2 ANOVA design focused on comparing a definition-only treatment to a definition plus one target word sentence could have been conducted with a lower number of participants at a single university. Also, finding serious and responsible participants was another challenge, as was expecting that they would go through all given learning materials without skipping for any reason. Especially when a group of students came and sat at a computer terminal with different versions of the vocabulary learning program, some students were able to finish quicker than others because the massed, definition-only version of the program could be completed quickly. When some of the participants started leaving the room early, others seemed to hurry up to finish their experiment procedures. Such unexpected incidents might have caused negative effects on some participants’ final performance.

Since each participant has his or her own vocabulary learning strategy, it was not clear that all participants went through all the given learning materials per program even though they were told to study everything on the program. There is a possibility that some participants might have used their existing vocabulary learning strategy without regard to the version of the vocabulary-learning program given to them. That may be why results of this study did not align with those seen in Baleghizadeh and Shahry’s (2011) research findings that indicated a positive impact on learning of meeting new words in three consecutive sentences. By adding an additional survey question, ‘I have gone
through all study materials provided on the program’, more insights on learners’ vocabulary learning strategies could be investigated.

The inability of many participants in this study to demonstrate their existing receptive knowledge on the productive test indicates that a different approach to measuring learner’s productive vocabulary knowledge is needed, taking into account the participants’ confidence level in grammar and word type. By adding two statements on the productive test, learner’s productive knowledge could more accurately be measured: (1) I know the meaning of the sentence but I don’t know the answer and (2) I don’t know the meaning of the sentence so I don’t know the answer.

Another challenge was that how much each version of the vocabulary-learning program was actually in effect in participants’ brains. If participants quickly adapted to the new program, could a full reflection of the new learning approach be expected from them? If participants did not spontaneously adapt to the new vocabulary-learning program, how much could the resultant data be trusted? This challenge may be beyond vocabulary researchers’ capability to deal with.

The fact that more than 80% of participants were able to receptively and productively recall one particular target word, kennel, was curious, and led the researcher to ask some participants why. Their answer was that the word kennel had been frequently encountered in everyday life, along with a picture. When choosing target words, more careful consideration is needed to avoid such easy giveaway if possible.

Future Research

First, based on the relatively large drop rate in scores between the immediate and one-week delayed posttests, this research can be developed further to increase
understanding of the retention effects of vocabulary learning interventions. Rather than one-week delayed posttest, possibly both 3-day and 7-day delayed tests may provide different views of drop rate in retaining targets words. If a peak point for holding target words in learner’s short-term memory can be located, it could provide the optimal time to review words without wasting learner’s learning hours and memory capacity.

Second, this research can be explored in a classroom setting throughout a semester to investigate how Korean EFL learners’ usual receptive vocabulary learning strategy may be adapted to a new vocabulary teaching and learning methodology. This approach would provide more progressive stories about how learners behave and make progress over time, rather than examining very short-term instruction that might not be able to produce reliable results.

Conclusion

Although the present study provides only limited insights into English vocabulary learning for Korean EFL learners based on computer-based vocabulary learning programs, it is hoped that the findings in this study may lead to more realistic research ideas in the future. Especially, all English teachers, second language vocabulary researchers, EFL and ESL learners, parents, and related stakeholders should be aware of both receptive and productive vocabulary instructional approaches that can maximize learners’ vocabulary knowledge by purposely redesigning methodology in teaching and learning. That way learners, teachers, educators, parents, and stakeholders can be all winners in teaching and learning English.
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APPENDIX A

EIGHT (8) VOCABULARY LEARNING PROGRAMS
영어단어 프로그램 NO. 1

주의: 주어진 프로그램을 선택하여 단어를 60분동안 공부해 주십시오. 실전에 임하는 자세로 열심히 해 주시길 부탁드립니다.
여러분의 귀한 시간과 협조가 한국 영어 발전에 크게 이바지 한다는 긍지를 갖으시고 끝까지 분투해 주시길 부탁드립니다.

준비되었으면 아래 화살표를 클릭하고 단어공부를 시작하기 바랍니다.

다음 영어단어를 암기하세요_L1DEF_Massed

1. deportation [dɪˌpɔ:riˈfən] : 추방, 퇴거
2. astound [əˈstaʊnd]: 경악시키다. 큰 충격을 주다
3. wretched [ˈrɛdɪ] : 못(기분)이 안좋은, 비참한
4. graffiti [ˈɡreɪfɪtɪ] : 낙서(공공장소등에)
5. chortle [ˈʃɔrtl] : (기뻐서) 깔깔거리다
6. bristle [ˈbrɪsl] : 짜고 빗нат한 털
7. hilarity [ˈhaɪlərəti] : 아주 우스움
8. entwine [ˈɛntwain] : 고다. 튀감다
9. frantic [ˈfræntɪk]: 정신없는, 폐정신이 아닌
10. indolence [ɪnˈdələns]: 게으름, 나태
11. manifest [ˈmænɪfɛst]: (감정, 태도를 분명히) 나타내다
12. jubilant [dʒuˈbɪlənt]: 승리감에 넘쳐, 의기양양한
다음 영어단어를 암기하세요_L1DEF_Massed

<table>
<thead>
<tr>
<th>번호</th>
<th>단어</th>
<th>발음</th>
<th>뜻</th>
</tr>
</thead>
<tbody>
<tr>
<td>13.</td>
<td>kennel</td>
<td>kenl</td>
<td>개집</td>
</tr>
<tr>
<td>14.</td>
<td>venerate</td>
<td>venəret</td>
<td>공경 (숭배)하다</td>
</tr>
<tr>
<td>15.</td>
<td>legible</td>
<td>ledʒəbl</td>
<td>읽을 수 있는, 또렷한</td>
</tr>
<tr>
<td>16.</td>
<td>obituary</td>
<td>əˈbɪtʃuəri</td>
<td>사망기사 (신문에 실리는)</td>
</tr>
<tr>
<td>17.</td>
<td>quiver</td>
<td>kwɪvə(r)</td>
<td>떨다 (가볍게)</td>
</tr>
<tr>
<td>18.</td>
<td>poignant</td>
<td>ˈpɔɪnjənt</td>
<td>가슴 아픈 (저미는)</td>
</tr>
<tr>
<td>19.</td>
<td>trepidation</td>
<td>ˌtrepɪdeɪʃn</td>
<td>두려움, 공포 (앞일에 대한)</td>
</tr>
<tr>
<td>20.</td>
<td>sterile</td>
<td>ˈsterəl</td>
<td>살균한, 소독한</td>
</tr>
<tr>
<td>21.</td>
<td>rigorous</td>
<td>ˈrɪgərəs</td>
<td>철저한, 엄격한</td>
</tr>
<tr>
<td>22.</td>
<td>utterance</td>
<td>ʌtərəns</td>
<td>발언, 발성</td>
</tr>
<tr>
<td>23.</td>
<td>nudge</td>
<td>nʌdƷ</td>
<td>쿡 찌르다 (특히 팔꿈치로 살짝)</td>
</tr>
<tr>
<td>24.</td>
<td>authentic</td>
<td>ˈɔθentɪk</td>
<td>진품인, 진짜인</td>
</tr>
</tbody>
</table>

참여해 주시어 매우 감사합니다.

이제 10분간 휴식후 공부한 단어 시험을 보게 됩니다. 충실히 임해 주시고 설문지에도 꼭 빠짐없이 답해 주시기 바랍니다.

Thank You
영어단어 프로그램 NO. 2

주의: 주어진 프로그램을 선택하여 단어를 60분 동안 공부해 주십시오. 실전에 임하는 자세로 열심히 해 주시길 부탁드립니다. 여러분의 귀한 시간과 협조가 한국 영어 발전에 크게 이바지 한다는 긍지를 갖으시고 끝까지 분투해 주시길 바랍니다.

준비되었으면 아래 화살표를 클릭하고 단어공부를 시작하기 바랍니다.

다음 영어단어를 암기하세요 L1DEF_Spaced

1. deportation [dɪˈpɔːrtəʃən] : 추방, 퇴거
다음 영어단어를 암기하세요_L1DEF_Spaced

2.

*astound* [əˈstaʊnd]: 경악시키다, 큰 충격을 주다

Note: Other remaining screens are omitted.
영어단어 프로그램 NO. 3

주의: 주어진 프로그램을 선택하여 단어를 60분 동안 공부해 주십시오. 실전에 임하는 자세로 열심히 해 주시길 부탁드립니다.

준비되었으면 아래 화살표를 클릭하고 단어공부를 시작하기 바랍니다.

다음 영어단어를 암기하세요_L1DEF_1TWBS_Massed

1. **deportation** [ˈdɪpərteɪʃən] : 추방, 퇴거
   Many illegal residents will face **deportation**.
   많은 불법주민은 추방에 처하게 될 것이다.

2. **astound** [əˈstɔːnd] : 경악시키다, 큰 충격을 주다
   His car accident **astounded** his parents.
   그의 차사고가 자신의 부모님들에게 큰 충격을 줬다.

3. **wretched** [ˈrɛtʃɪd] : 몸(기분)이 안좋은, 비참한
   She looks **wretched**. What happened to her?
   그녀는 기분이 안좋아 보인다. 그녀에게 무슨 일이 일어났나요?

4. **graffiti** [ˌɡræfiːti] : 낙서(공공장소 등에)
   **Graffiti** can be considered as an art.
   낙서는 예술로 여겨질 수 있다.

5. **chortle** [ˈtʃɔːrtl] : (기뻐서) 깨kek거리다
   I **chortled** when I heard the funny story.
   나는 그 웃기는 얘기를 들었을 때 깨kek거리고 웃었다.

6. **bristle** [ˈbrɪsl] : 짧고 뻣뻣한 털(수염)
   His chin is covered with gray **bristles**.
   그의 턱은 회색 까칠한 수염으로 덮여있다.

Note: Other remaining screens are omitted.
영어단어 프로그램 NO. 4

주의: 주어진 프로그램을 선택하여 단어를 60분 동안 공부해 주십시오. 실전에 임하는 자세로 열심히 해 주시길 부탁 드리며, 여러분의 귀한 시간과 협조가 한국 영어 발전에 크게 이바지 한다는 긍지를 갖으시고 끝까지 분투해 주시길 부탁드립니다.

준비되었으면 아래 화살표를 클릭하고 단어공부를 시작하기 바랍니다.

다음 영어단어를 암기하세요_L1DEF_1TWBS_Spaced

1. deportation [dəˌpɔrtəˈʃən] : 추방, 퇴거

Many illegal residents will face deportation.

많은 불법주민은 추방에 처하게 될 것이다.

Note: Other remaining screens are omitted.
Program No. 5

영어단어 프로그램 NO. 5

주의: 주어진 프로그램을 선택하여 단어를 60분동안 공부해 주십시오. 실전에 임하는 자세로 열심히 해 주시기 바랍니다. 여러분의 귀한 시간과 협조가 한국 영어 발전에 크게 이바지 한다는 긍지를 갖고시고 꼭까지 분투해 주시기 바랍니다.

준비되었으면 아래 화살표를 클릭하고 단어공부를 시작하기 바랍니다.

다음 영어단어를 암기하세요_L1DEF_2TWBS_Massed

1. **deportation** [dɪpɔrˈteɪʃən]: 추방, 퇴거
   Many illegal residents will face deportation.
   많은 불법주민은 추방에 처하게 됩니다.
   If you live illegally in a foreign country, you will get a letter of deportation before long.
   만일 당신이 타국에 불법으로 산다면 아직도 추방편지를 받게 됩니다.

2. **astound** [əˈstaʊnd]: 경악시키다, 큰 충격을 주다
   His car accident astounded his parents.
   그의 차사고가 자신의 부모님에게 큰 충격을 줬다.
   I was astounded by how many people are younger than me at the party.
   나는 파티에서 얼마나 많은 사람들이 나보다 젊다는 것에 놀라웠다.

3. **wretched** [ˈretʃɪd]: 몸(기분)이 안좋은, 비참한
   She looks wretched. What happened to her?
   그녀는 기분이 안좋아 보인다. 그녀에게 무슨 일이 일어났나요?
   I became wretched when I weighted over 60 kilograms.
   난 내 몸무게가 60킬로가 넘었을때 비참했다.

4. **graffiti** [ˈɡræfɪtɪ]: 낙서 (공공장소등에)
   Graffiti can be considered as an art.
   낙서는 예술로 여겨질 수 있다.
   We can see a lot of graffiti on the building walls.
   우리는 벽돌벽에 많은 낙서를 볼 수 있다.

Note: Other remaining screens are omitted.
영어단어 프로그램 NO. 6

주의: 주어진 프로그램을 선택하여 단어를 60분동안 공부해 주십시오. 실전에 임하는 자세로 열심히 해 주시길 부탁드리며, 여러분의 귀한 시간과 협조가 한국 영어 발전에 크게 이바지 한다는 희망을 갖으시고 끝까지 분투해 주시길 부탁드립니다.

준비되었으면 아래 화살표를 클릭하고 단어공부를 시작하기 바랍니다.

다음 영어단어를 암기하세요_ L1DEF_ 2TWBS_Spaced

1. deportation [ˌdɪ.pɔːrˌtepʃən] : 추방, 퇴거
Many illegal residents will face deportation.
많은 불법주민은 추방에 처하게 될것이다.

If you live illegally in a foreign country, you will get a letter of deportation before long.
만일 당신이 타국에 불법으로 산다면 마지막에 추방편지를 받게 될것입니다.

Note: Other remaining screens are omitted.
Program No. 7

영어단어 프로그램 NO. 7

주의: 주어진 프로그램을 선택하여 단어를 60분동안 공부해 주십시오. 실전에 임하는 자세로 열심히 해 주시길 부탁드립니다.

준비되었으면 아래 화살표를 클릭하고 단어공부를 시작하기 바랍니다.

다음 영어단어를 암기하세요_L1DEF_3TWBS_Massed

1. **deportation** [diˈpɔrteiʃən]: 추방, 퇴거
   Many illegal residents will face deportation.
   If you live illegally in a foreign country, you will get a letter of deportation before long.
   He was taken away to jail pending deportation.

2. **astound** [əˈstaʊnd]: 경악시키다, 큰 충격을 주다
   His car accident astounded his parents.
   I was astounded by how many people are younger than me at the party.
   He was quite astounded at just how computer literate I was.

3. **wretched** [ˈretʃɪd]: 몸(기분)이 안좋은, 비참한, 괴작한
   She looks wretched. What happened to her?
   I became wretched when I weighted over 60 kilograms.
   The wretched virus may damage my lung, but it will never break my spirit.

Note: Other remaining screens are omitted.
영어단어 프로그램 NO. 8

주의: 주어진 프로그램을 선택하여 단어를 60분 동안 공부해 주십시오. 실전에 임하는 자세로 열심히 해 주시길 부탁드립니다. 여러분의 귀한 시간과 협조가 한국 영어 발전에 크게 이바지 한다는 긍지를 갖고시고 끈까지 분투해 주시길 부탁드립니다.

준비되었으면 아래 화살표를 클릭하고 단어공부를 시작하기 바랍니다.

다음 영어단어를 암기하세요 _L1DEF_ 3TWBS_Spaced

1. 

deportation /dɪpɔːrtəʃən/ : 추방, 퇴거

Many illegal residents will face deportation.

많은 불법주민은 추방에 처하게 될 것이다.

If you live illegally in a foreign country, you will get a letter of deportation before long.

만일 당신이 타국에 불법으로 산다면 머지않아 추방편지를 받게 될 것입니다.

He was taken away to jail pending deportation.

그는 추방심사중에 감옥으로 송치됐다.

Note: Other remaining screens are omitted.
APPENDIX B

SCREEN SHOTS OF VOCABULARY PROGRAMS
1. 

**deportation**  [dɪˈpɔːrteɪʃɔn] : 추방, 퇴거

Many illegal residents will face deportation.
많은 불법주 민은 추방에 처해지게 됩니다.

If you live illegally in a foreign country, you will get a letter of deportation before long.
만일 당신이 타국에 불법으로 살다면 이.zh 마지막에 추방 편지를 받게 됩니다.

He was taken away to jail pending deportation.
그는 추방 편지 소지로 감옥으로 송치되었다.
APPENDIX C
SCREEN SHOT OF TEXT SIZE AND COLORS
1. **deportation** ([dɪˈpoʊrteɪʃən]): 추방, 퇴거
   Many illegal residents will face deportation.
   많은 불법주민은 추방에 처하게 될 것이다.

2. **astound** ([əˈstɔːnd]): 경악시키다, 큰 충격을 주다
   His car accident astounded his parents.
   그의 자동차 사고는 부모님들에게 큰 충격을 줬다.

3. **wretched** ([ˈrɛtʃd]): (봄(기분)이 안좋은, 비참한
   She looks wretched. What happened to her?
   그녀는 기분이 안좋아 보인다. 그녀에게 무슨 일이 일어났나요?

4. **graffiti** ([ˈɡræfɪti]): 낙서 (공공장소 등에)
   Graffiti can be considered as an art.
   낙서는 예술로 여겨질 수 있다.

5. **chortle** ([ˈʃɔrtl]): (기뻐서) 까 |_| | |_| |
   I chortled when I heard the funny story.
   나는 그 웃기는 얘기를 들었을 때 까 |_| | |_| |

6. **bristle** ([ˈbrɪzl]): 짜고 빗발치한 털 (수염)
   His chin is covered with gray bristles.
   그의 멱은 회색 까칠한 수염으로 덮여 있었다.
APPENDIX D

RECEPTIVE AND PRODUCIVE PRETEST
단어시험 1 (Productive Pretest)

참가자 번호: ______________________________

아래 빈칸에 주어진 첫 자로 시작하는 문맥에 맞는 단어를 적으세요.

1. Even to the trained eyes the copied painting looked a________ because it was made in the original way.
2. He n_____ me with his elbow when he saw my wife at the airport.
3. His fast u_____ made people confused at the presentation.
4. Students learn more from a r_______ teacher who is extremely strict and careful.
5. Surgical knives have to be thoroughly s_______ before each use to be free from bacteria or virus.
6. Students are full of t________ whenever they take tests.
7. The p____ movie moved millions of people in the world because it was about a very sad princess story.
8. He started to q____ suddenly at his daughter's death.
9. There is an o_____ section on newspapers to inform people about someone's funeral.
10. Medical doctors' writing are not easily l_______ because they don't have enough time to write properly.
11. If you v______ your parents, your children will do the same thing for you.
12. During the cold winter days, my dog stays in the cozy k_____ he loves.
13. I was j_____ when I won the gold medal at the World Winter Olympics.
14. He wants to m____ his strong opinion to make sure everyone agrees with him.
15. His i____ made him lose his house because he ended up spending all his money.
16. He became f___ when he heard the sad news.
17. The famous golfer is e_______ with many wrong doings.
18. The pure h________ made sick people forget their pains with lots of laughter.
19. His chin is covered with gray b______ like a famous movie star.
20. I c________ when I heard the funny story.
21. G______ can be considered as an art even though it can be found on walls, buildings, bridges, and towers.
22. She looks w_______. What happened to her? Something is bothering her.
23. His car accident a_____ his parents because his car fell off the high bridge.
24. Many illegal residents in Korea will face d_______.

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단어시험 2 (Receptive Pretest)

참가자 번호: __________________________

아래 주어진 단어의 뜻을 적으시오.

1. wretched: __________________________________________________________
2. rigorous: __________________________________________________________
3. poignant: __________________________________________________________
4. indolence: _________________________________________________________
5. jubilant: __________________________________________________________
6. obituary: __________________________________________________________
7. frantic: __________________________________________________________
8. bristle: __________________________________________________________
9. authentic: _________________________________________________________
10. chortle: __________________________________________________________
11. sterile: __________________________________________________________
12. manifest: _________________________________________________________
13. venerate: _________________________________________________________
14. utterance: _______________________________________________________ 
15. entwine: _________________________________________________________
16. nudge: __________________________________________________________
17. astound: _________________________________________________________
18. quiver: __________________________________________________________
19. trepidation: _______________________________________________________

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20. kennel: ____________________________________________________________
21. legible: ____________________________________________________________
22. hilarity: ____________________________________________________________
23. graffiti: ____________________________________________________________
24. deportation: ________________________________________________________
APPENDIX E

RECEPTIVE AND PRODUCTIVE POSTTEST AND DELAYED TEST
단어시험 1 (Productive Posttest_Version #1)

참가자 번호: __________________________

아래 빈칸에 프로그램에서 배운 단어 중에서 문맥에 맞는 단어를 적으세요.

1. His _____ made him lose his house.
2. His car accident _____ his parents.
3. Many illegal residents will face ________.
4. Students learn more from a ________ teacher.
5. His chin is covered with gray ________.
6. Students are full of _________ whenever they take tests.
7. The pure _________ made sick people forget their pains.
8. Medical doctors' writings are not easily ________.
9. There is an _______ section on newspapers to inform people about someone's funeral.
10. He started to _____ at his daughter's death.
11. She looks ________. What happened to her?
12. During the cold winter days, my dog stays in the cozy ________.
13. The famous golfer is __________ with many wrong doings.
14. He wants to ______ his strong opinion.
15. Even to the trained eyes the copied painting looked ________.
16. He became ____ when he heard the sad news.
17. I was _______ when I won the gold medal at the World Winter Olympics.
18. The _____ movie moved millions of people in the world.
19. Surgical knives have to be thoroughly ________ before each use.
20. I ________ when I heard the funny story.
21. ________ can be considered as an art even though it is painted every where.
22. If you ______ your parents, your children will do the same thing for you.

23. He ______ me when he saw my wife at the airport.

24. His fast ______ made people confused at the meeting.
단어시험 1 (Productive Posttest_Version #2)

참가자 번호: _________________________

아래 빈칸에 프로그램에서 배운 단어 중에서 문맥에 맞는 단어를 적으세요.

1. She was _____ when she didn't pass her final exam.
2. Today's young people are very familiar with _____ because it is a part of the 21st century folk art.
3. Her strong remarks _____ many listeners in an uneasy situation.
4. The marines in Korea is well-known for having _____ training.
5. You need to _____ your interest and effort in your dreams.
6. Whenever I ski in winter, I have to deal with growing _____.
7. The _____ movie moved millions of people in the world.
8. Your writing will not be _____ if you write like medical doctors.
9. If you want to find a list of dead people, you need to check out an _____ section in the newspaper.
10. My father built a very nice _____ for my lovely puppy.
11. Millions of Christians all over the world _____ Pope John Paul II.
12. It looks like he was a little nervous. He seemed to _____ a little bit.
13. I saw lots of _____ people at the big wedding party.
14. Hospitals should keep everything _____ free from virus and bacteria.
15. My granddaughter doesn't like my _____ mustache because it is not soft.
16. We become so _____ especially when we walk alone in the forest.
17. His _____ was clearly made to his friends to tell his opinion.
18. The funny-looking person makes me laugh and think of the word _____.
19. If you make a mistake at the meeting, I will give you a _____ to let you know.
20. He always makes us ______ with many funny jokes.

21. He was fired last month because of his _____.

22. I know the painting is ________ because it has an artist's original signature on it.

23. The size of his apartment will _____ you if you see it.

24. If you live in Korea illegally, soon or later you will face ________.
단어시험 1 (Productive Posttest_Version #3)

참가자 번호: _________________________

아래 빈칸에 프로그램에서 배운 단어 중에서 문맥에 맞는 단어를 적으세요.

1. As soon as my cat saw the snake, he began to have _____ hairs.
2. His father's old stories _____ people because he knows how to survive without much food in an island.
3. My mother was _____ when my father wants to divorce her.
4. _______ people always do their best to succeed.
5. Seeing _____ people will help you stay happy.
6. When I walked into the deep forest, I strongly felt some ______.
7. Even the movie title gave me a sense of ______ because it sounds funny.
8. When I am cold, I tend to _____ a little.
9. People should wash their hands to stay ______.
10. When you _____ your goals, your dreams will come true soon.
11. The King Sejong is a historical person who Korean people ______.
12. The spiders quickly _____ a big insect with their sticky web.
13. If you want to find a list of dead people, you need to check out an _____ section in the newspaper.
14. People cannot read and understand your writing if it is not _____.
15. The _____ story makes me think how happy I have been until today.
16. I was _____ when I found I lost my credit card at the airport.
17. My dog doesn't want to come out from his ______ because it is raining today.
18. His ______ made him out of his job very often.
19. I love to eat only ______ food whenever I visit other countries.
20. My friends always ______ whenever I tell them funny stories.

21. Even though ______ can be considered as a folk art in America, it is still an illegal activity.

22. People like to listen to his clearly stated ______.

23. If you ______ me when I talk, I know I made a mistake.

24. Many countries try to kick out illegal people through the ______ process.
단어시험 2 (Immediate Receptive Posttest_version 1)
참가자 번호: __________________________ 프로그램: ___ 성별: ____
아래 주어진 단어의 뜻을 적으시오.
1. graffiti: ________________________________________________________
2. bristle: _________________________________________________________
3. chortle: _________________________________________________________
4. astound: _________________________________________________________
5. jubilant: _________________________________________________________
6. legible: _________________________________________________________
7. venerate: _________________________________________________________
8. rigorous: _________________________________________________________
9. authentic: _________________________________________________________
10. poignant: _________________________________________________________
11. sterile: _________________________________________________________
12. manifest: _________________________________________________________
13. frantic: _________________________________________________________
14. utterance: _________________________________________________________
15. entwine: _________________________________________________________
16. deportation: _________________________________________________________
17. indolence: _________________________________________________________
18. quiver: _________________________________________________________
19. trepidation: _________________________________________________________
20. kennel: _________________________________________________________
21. obituary: _________________________________________________________
22. hilarity: _________________________________________________________
23. wretched: _________________________________________________________
24. nudge: _________________________________________________________
단어시험 1 (One-week Delayed Productive Posttest_Version #1)
참가자 번호: _______________ 프로그램: __ 성별: ___
아래 빈칸에 프로그램에서 배운 단어 중에서 문맥에 맞는 단어를 적으세요.
1. His ____ made him lose his house.
2. His car accident ____ his parents.
3. Many illegal residents will face ________.
4. Students learn more from a _______ teacher.
5. His chin is covered with gray ________.
6. Students are full of ______ whenever they take tests.
7. The pure ______ made sick people forget their pains.
8. Medical doctors' writing are not easily ________.
9. There is an _____ section on newspapers to inform people about someone's funeral.
10. He started to ____ at his daughter's death.
11. She looks _______. What happened to her?
12. During the cold winter days, my dog stays in the cozy ________.
13. The famous golfer is _______ with many wrong doings.
14. He wants to ____ his strong opinion.
15. Even to the trained eyes the copied painting looked _______.
16. He became ___ when he heard the sad news.
17. I was _____ when I won the gold medal at the World Winter Olympics.
18. The ____ movie moved millions of people in the world.
19. Surgical knives have to be throughly ______ before each use.
20. I _______ when I heard the funny story.
21. ______ can be considered as an art even though it is painted every where.
22. If you ______ your parents, your children will do the same thing for you.
23. He ____ me when he saw my wife at the airport.
24. His fast ____ made people confused at the meeting.
단어시험 1 (One-week Delayed Productive Posttest_Version #2)
참가자 번호: __________________ 프로그램: ______ 성별: ______
아래 빈칸에 프로그램에서 배운 단어 중에서 문맥에 맞는 단어를 적으세요.
1. She was ____ when she didn't pass her final exam.
2. Today's young people are very familiar with ____ because it is a part of the 21st
century folk art.
3. Her strong remarks ____ many listeners in an uneasy situation.
4. The marines in Korea is well-known for having ____ training.
5. You need to ____ your interest and effort in your dreams.
6. Whenever I ski in winter, I have to deal with growing ____.
7. The ____ movie moved millions of people in the world.
8. Your writing will not be ____ if you write like medical doctors.
9. If you want to find a list of dead people, you need to check out an ____ section
   in the newspaper.
10. My father built a very nice ____ for my lovely puppy.
11. Millions of Christians all over the world ____ Pope John Paul II.
12. It looks like he was a little nervous. He seemed to ____ a little bit.
13. I saw lots of ____ people at the big wedding party.
14. Hospitals should keep everything ____ free from virus and bacteria.
15. My granddaughter doesn't like my ____ mustache because it is not soft.
16. We become so ____ especially when we walk alone in the forest.
17. His ____ was clearly made to his friends to tell his opinion.
18. The funny-looking person makes me laugh and think of the word ____.
19. If you make a mistake at the meeting, I will give you a ____ to let you know.
20. He always makes us ____ with many funny jokes.
21. He was fired last month because of his ____.
22. I know the painting is ______ because it has an artist's original signature on it.
23. The size of his apartment will ____ you if you see it.
24. If you live in Korea illegally, soon or later you will face ______.
단어시험 1 (One-week Delayed Productive Posttest_Version #3)
참가자 번호: _________________________ 프로그램: ______ 성별: ______
아래 빈칸에 프로그램에서 배운 단어 중에서 문맥에 맞는 단어를 적으세요.
1. As soon as my cat saw the snake, he began to have _____ hairs.
2. His father's old stories _____ people because he knows how to survive without much food in an island.
3. My mother was ____ when my father wants to divorce her.
4. _____ people always do their best to succeed.
5. Seeing _____ people will help you stay happy.
6. When I walked into the deep forest, I strongly felt some _____.
7. Even the movie title gave me a sense of ______ because it sounds funny.
8. When I am cold, I tend to ____ a little.
9. People should wash their hands to stay _____.
10. When you _____ your goals, your dreams will come true soon.
11. The King Sejong is a historical person who Korean people _____.
12. The spiders quickly ____ a big insect with their sticky web.
13. If you want to find a list of dead people, you need to check out an ____ section in the newspaper.
14. People cannot read and understand your writing if it is not ______.
15. The _____ story makes me think how happy I have been until today.
16. I was _____ when I found I lost my credit card at the airport.
17. My dog doesn't want to come out from his _____ because it is raining today.
18. His _____ made him out of his job very often.
19. I love to eat only _____ food whenever I visit other countries.
20. My friends always _____ whenever I tell them funny stories.
21. Even though _____ can be considered as a folk art in America, it is still an illegal activity.
22. People like to listen to his clearly stated _____.
23. If you _____ me when I talk, I know I made a mistake.
24. Many countries try to kick out illegal people through the _____ process.
단어시험 2 (Receptive Delayed Posttest)

참가자 번호: ______________________

아래 주어진 단어의 뜻을 적으시오. 만약 뜻을 모르면 질문에 답해 주세요.

1. rigorous: __________, 전에 본 기억없음( ), 본 기억은 있는데 기억안남( )
2. wretched: ________, 전에 본 기억없음( ), 본 기억은 있는데 기억안남( )
3. hilarity: __________, 전에 본 기억없음( ), 본 기억은 있는데 기억안남( )
4. poignant: __________, 전에 본 기억없음( ), 본 기억은 있는데 기억안남( )
5. bristle: __________, 전에 본 기억없음( ), 본 기억은 있는데 기억안남( )
6. obituary: __________, 전에 본 기억없음( ), 본 기억은 있는데 기억안남( )
7. authentic: __________, 전에 본 기억없음( ), 본 기억은 있는데 기억안남( )
8. utterance: __________, 전에 본 기억없음( ), 본 기억은 있는데 기억안남( )
9. trepidation: ________, 전에 본 기억없음( ), 본 기억은 있는데 기억안남( )
10. chortle: __________, 전에 본 기억없음( ), 본 기억은 있는데 기억안남( )
11. entwine: __________, 전에 본 기억없음( ), 본 기억은 있는데 기억안남( )
12. manifest: __________, 전에 본 기억없음( ), 본 기억은 있는데 기억안남( )
13. nudge: __________, 전에 본 기억없음( ), 본 기억은 있는데 기억안남( )
14. quiver: __________, 전에 본 기억없음( ), 본 기억은 있는데 기억안남( )
15. sterile: __________, 전에 본 기억없음( ), 본 기억은 있는데 기억안남( )
16. venerate: _________, 전에 본 기억없음( ), 본 기억은 있는데 기억안남( )
17. astound: __________,전에 본 기억없음( ),본 기억은 있는데 기억안남( )
18. kennel: __________,전에 본 기억없음( ),본 기억은 있는데 기억안남( )
19. frantic: __________,전에 본 기억없음( ),본 기억은 있는데 기억안남( )
20. jubilant: __________,전에 본 기억없음( ),본 기억은 있는데 기억안남( )
21. legible: __________,전에 본 기억없음( ),본 기억은 있는데 기억안남( )
22. indolence: ________,전에 본 기억없음( ),본 기억은 있는데 기억안남( )
23. deportation: ________,전에 본 기억없음( ),본 기억은 있는데 기억안남( )
24. graffiti: __________ ,전에 본 기억없음( ),본 기억은 있는데 기억안남( )
APPENDIX F
SURVEY QUESTIONS
1. What is your gender?
   Male _____, Female _____

2. What is your major in college? ______________

3. Who learns English vocabulary better?
   Yes_____   No_______

4. How do you study vocabulary?
   (Incidental vocabulary learning: Learning new words mostly through reading. Intentional vocabulary learning: Learning new words on purpose.)
   Incidental Learning: ______
   Intentional Learning: _____
   Both: _________________

5. Which one works better for you?
   Incidental vocabulary learning: _____
   Intentional vocabulary learning: ____

6. What do you use most to study English vocabulary?
   Textbook-based: ______
   Computer-based: ______
   Web-based: __________
   Others: ________________

7. How do you study new English vocabulary?
   Definition only_______
   Definition + target word-based sentence________
   Definition + more than one target word-based sentence ____________
   Others: ________________________________

8. How do you review newly learned vocabulary?
   Definition only_______
   Definition + target word-based sentence________
   Definition + more than one target word-based sentence ____________
   Others: ________________________________

9. Any distraction when seeing more than one word on the computer screen at a time?
   Yes: __________
   No: __________

10. Additional cognitive overload when seeing more than one target word on a
11. computer screen? (Note: Cognitive Load will be explained in detail.)
   Yes: _______
   No: _______
   Why: _________________________

12. Encountering a same word often helps receptively, productively, or both?
   Receptively: _____________
   Productively: _____________
   Both Receptively and Productively: _____________
   No: _________________________

12. How often do you review newly learned English words?
   Within 24 hours: ___________
   Within 48 hours: ___________
   Within 72 hours: ___________
   When needed: ___________
   Never: _______________________

13. When do you learn English words better?
   Yes:______, No: _______, Make no difference: _____________

14. How satisfied are you in learning words on the computer-based program?
   Very satisfied: ___________
   Satisfied: _________________
   “N” (Neither satisfied nor dissatisfied): ___________
   Dissatisfied: _______________
   Very dissatisfied: ___________

15. What feature helps you study words better?

16. What is the best part of the program?

17. What is the worst part of the program?

18. 60 minutes is enough for learning 24 words?
   Too Long: _____ if too long, how many minutes will be sufficient enough? ____
   Just Enough: ______
   Not Enough: _____ if not enough, how more minutes do you need? _____

19. The maximum number of words you memorize for 60 minutes?
   1 – 10 words: ______
   11-20 words: ______
   21 – 30 words: ______
   31 – 40 words: ______
20. Arrange the following list in order from most (1) to least (6) important.
(a) grammar  (b) listening  (c) reading  (d) speaking  (e) vocabulary  (f) writing
1.______ 2.______ 3.______ 4.______ 5.______ 6.______

21. How much are you interested in learning / studying English vocabulary?
(0 = not at all … 5 = a lot)
0  1  2  3  4  5

22. What is your current vocabulary level?
Beginning (   )  Elementary (   )  Intermediate (   )  Advanced (   )

23. Which of the following do they need to know / do? Arrange the following list in order from most (1) to least (7) important.
(a) understand the meaning of a word  (b) use a word in a sentence  (c) spelling  (d) part of speech  (e) synonym  (f) antonym  (g) change the root to a different part of speech
1._____ 2._____ 3._____ 4._____ 5._____ 6._____ 7._____
APPENDIX G

SURVEY RESULTS
Q1. What is your gender

Male: 106  
Female: 103  
Total: 209

Q2. What is your major in college?  
Not listed.

Q3. Who learns English vocabulary better?  

Female: 51 (24%)  
Male: 157 (75.11%)  

*Note:* 26 males indicated that females are better vocabulary learners, while 79 males consider themselves a better vocabulary learner.

Q4. How do you study vocabulary?  

Incidental learning: 37 (17.70%)  
Intentional learning: 135 (64.59%)  
Both: 37 (17.70%)

Q5. Which one works better for you?  

Incidental learning: 37 (17.70%)  
Intentional learning: 135 (64.59%)  
Both: 37 (17.70%)

Q6. What do you use most to study English vocabulary?  

Vocabulary book: 157 (75.12%)  
English book: 35 (16.75%)  
Computer: 8 (3.80%)  
Web site: 6 (2.90%)

Q7. How do you study new English vocabulary?  

Meaning only: 145 (69.38%)  
Meaning + 1 target-word based sentence: 49 (23.44%)  
Meaning + more than 1 target-word based sentence: 7 (3.35%)

Q8. How do you review newly learned vocabulary?  

Meaning only: 145 (69.38%)
Meaning + 1 target-word based sentence: 49 (23.44%)
Meaning + more than 1 target-word based sentence: 7 (3.35%)

Q9. Any distraction when seeing more than one word on the computer screen at a time?

Yes: 126 (60.29%)
No: 83 (39.72%)

Q10. Additional cognitive overload when seeing more than one target word on a computer screen?

Yes: 116 (55.50%)
No: 91 (43.54%)

Q11. Encountering a same word often helps receptively, productively, or both?

Receptively: 51 (24.40%)
Productively: 31 (14.83%)
Both: 117 (55.98%)

Q12. How often do you review newly learned English words?

Within 24 hours: 22 (10.53%)
Within 48 hours: 8 (3.83%)
Within 72 hours: 0 (0.00%)
When necessary: 166 (79.43%)
None: 12 (5.74%)

Q13. When do you learn English words better?

When there is an exam: 165 (78.95%)
When there is no exam: 23 (11.00%)
No difference: 19 (9.09%)

Q14. How satisfied are you in learning words on the computer-based program?

Very satisfied: 7 (3.35%)
Satisfied: 97 (46.41%)
No difference: 48 (22.97%)
Unsatisfied: 53 (25.36%)
Very unsatisfied: 1 (.48%)

Q15. What feature helps you study words better? Omitted
Q16. What is the best part of the program? Omitted

Q17. What is the worst part of the program? Omitted

Q18. 60 minutes is enough for learning 24 words?

Too long: 57 (27.27%)
Just right: 127 (60.77%)
Not enough: 19 (9.09%)

Q19. The maximum number of words you memorize for 60 minutes?

1-10 words: 16 (9.09%)
11-20 words: 56 (26.79%)
21-30 words: 54 (25.84%)
31-40 words: 37 (17.70%)
41-50 words: 20 (9.57%)
50+: 24

Q20. Arrange the following list in order from most (1) to least (6) important.
(a) grammar (b) listening (c) reading (d) speaking (e) vocabulary (f) writing

Grammar: 31 (14.83%)
Listening: 40 (19.14%)
Reading: 16 (7.66%)
Speaking: 42 (20.09%)
Vocabulary: 75 (35.86%)
Writing: 3 (1.44%)

Q21. How much are you interested in learning English words?

None: 0 (0.00%)
A little: 76 (36.36%)
More than a little: 55 (26.32%)
Normal: 53 (25.36%)
Much: 17 (8.13%)
Very much: 5 (2.39%)

Q22. What is your current vocabulary level?

Beginning: 64 (30.62%)
Intermediate: 89 (42.58%)
Advanced: 47 (22.49%)

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Q23. Which of the following do they need to know /do? Arrange the following list in order from most (1) to least (7) important.

(a) understand the meaning of a word  (b) use a word in a sentence  (c) spelling  (d) part of speech  (e) synonym  (f) antonym  (g) change the root to a different part of speech

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