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To What Extent Do L1 Speakers and L2 Learners Have Productive Derivational Knowledge

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Abstract

The present study investigated the extent to which L1 English speakers and L2 English learners could produce the derivatives of 90 head words in a decontextualized derivative recall test. This research also examined whether productive derivational knowledge varied between institutional levels (i.e., graduate, undergraduate, and high school) and vocabulary levels (i.e., 1000-5000). The results indicated that L1 speakers had greater productive derivational knowledge than L2 learners. However, no significant differences were found between L1 speakers and the advanced L2 learners. The results also indicated that the degree to which L2 learners have productive derivational knowledge significantly varied between the institutional levels and vocabulary levels. The findings provide some evidence that L2 productive derivational knowledge may develop in a similar way as L1 productive derivational knowledge does. The findings also provide important pedagogical and methodological implications.

Keywords

L1 productive vocabulary knowledge; L2 productive vocabulary knowledge; word family; productive derivational knowledge; productive word part knowledge

Summary

Derivational knowledge, the ability to understand and use derivatives of a word, plays an important role in lexical development (Anglin, 1993; Nation, 2013; Thorndike, 1941). While receptive derivational knowledge has received considerable attention in first language (L1) and second language (L2) acquisition studies (e.g., McLean, 2017; Mochizuki & Aizawa, 2000; Nagy, Diakidoy, & Anderson, 1993; Sasao & Webb, 2017; Tyler & Nagy, 1989; Ward & Chuenjundaeng, 2009), little is known about L1 speakers and L2 learners' productive derivational knowledge.

Research has shown that L2 learners' ability to produce derivatives may be limited (Schmitt & Meara, 1997; Schmitt & Zimmerman, 2002). L1 research has primarily investigated young L1 learners' ability to produce derivatives and found that this knowledge develops rather slowly and incrementally (e.g., McCutchen & Stull, 2015). The present study investigated the extent to which adult L1 speakers and L2 learners with differing institutional levels and vocabulary levels have productive derivational knowledge and how their ability varied. The findings indicated that L1 speakers have greater productive derivational knowledge than L2 learners. However, no significant difference was found between L1 speakers and the advanced L2 learner groups. The findings also indicated that L2 learners' ability to produce different derivatives of a word varied significantly between different institutional levels and vocabulary levels.

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Chapter 1

1 Thesis Introduction

Chapter one provides a brief introduction to the background, the purpose and rationale, and the theoretical framework of the current study.

1.1 Background

Learning vocabulary is essential for developing language proficiency. Researchers have long been interested in understanding why vocabulary knowledge can develop exponentially in the process of first language (L1) acquisition (Anglin, 1993; Nagy, Anderson, Schommer, Scott, & Stallman, 1989; Nagy et al., 1993; Tyler & Nagy, 1989). L1 research has indicated that learners' ability to understand and produce derivative forms of a word is one of the key aspects of vocabulary knowledge that facilitates vocabulary acquisition (Anglin, 1993). This ability is referred to as derivational knowledge (Leontjev, Huhta, & Mäntylä, 2016; Schmitt & Zimmerman, 2002).

Researchers have recognized a need to develop second language (L2) learners' derivational knowledge because morphologically complex words are extremely common in English (Laufer, 2017; Nation, 2013; Sasao & Webb, 2017; Thorndike, 1941). For example, Nation (2013) reported that there were 68,018 different word types in the first 20,000 word families in the BNC word lists (Nation, 2014). Thus, developing derivational knowledge has substantial value because it can expand learners' vocabulary to communicate in English.

While the importance of derivational knowledge has been recognized, earlier studies tended to focus on receptive derivational knowledge (McLean, 2017; Mochizuki & Aizawa, 2000; Nagy et al., 1989, 1993; Sasao & Webb, 2017; Tyler & Nagy, 1989; Ward & Chuenjundaeng, 2009). In particular, little research has examined L1 speakers and L2 learners' productive derivational knowledge (Schmitt & Zimmerman, 2002).

The few studies that have been conducted indicated that accurate production of derivatives is difficult for both L1 and L2 learners (e.g., Carlisle, 1996; Green et al.,

2003; Hemchua & Schmitt, 2006; McCutchen & Stull, 2015; Nagy, Diakidoy, & Anderson, 1993; Northey, McCutchen, & Sanders, 2016; Schmitt & Zimmerman, 2002). Research has also shown that the incorrect use of derivatives is prevalent in learners' language production (e.g., *the people who live there are honesty**, instead of *honest*: Hemchua & Schmitt, 2006). Clearly, there is a need to investigate productive derivational knowledge and provide insight into how learners can develop productive derivational knowledge effectively.

There are four crucial challenges in improving learners' ability to produce different forms of a word. First, the number of derivatives is daunting. As indicated in Nation's (2013) analysis, there are many different forms of most words. Therefore, it is difficult for teachers to decide how many derivatives should be taught inside the classrooms. Second, it is still unclear which teaching approach may be appropriate for learners at a particular proficiency level. For example, can learners use different forms of a word without explicit instruction? Furthermore, should derivative forms be learned with or without context? To determine the most appropriate teaching approach, it is necessary for teachers to be aware of how much productive derivational knowledge learners at a specific level have. Therefore, it would be useful to investigate the extent to which learners at different levels have productive derivational knowledge to provide an indication of what teaching methods may be the most useful and appropriate for learners at a particular level. Third, it is unclear what types of vocabulary exercises should be given to learners at a particular level. While there are some vocabulary learning activities that focus on derivatives such as word part tables (Webb & Nation, 2017), it is unclear whether such an exercise is appropriate for learners at any level. Fourth, setting learning and teaching goals for productive derivational knowledge is challenging as it is still unknown to what extent L1 speakers and L2 learners at differing levels of proficiency have productive derivational knowledge. Without having achievable goals, it would be difficult to assess learners' progress in lexical development.

The present study aimed to tackle these challenges by investigating both L1 speakers and L2 learners' productive derivational knowledge. The present study

investigated the extent to which L1 speakers and L2 learners could produce derivatives in a decontextualized derivative recall test (Ishii & Schmitt, 2009). The study also examined the degree to which L2 learners at different levels could produce derivatives and how their ability compared to L1 speakers.

1.2 Theoretical Background

1.2.1 What does it mean to know a word?

Among different approaches to describing what it means to know a word, the components approach is most commonly used in L2 vocabulary acquisition research (Schmitt, 2014). Richards (1976) first described multidimensionality in word knowledge; knowing a word involves knowing different aspects of a word such as (1) the degree of probability of encountering the word in spoken or written modes, (2) constraints on use, (3) grammatical functions, (4) derivatives, (5) associated words (i.e., collocations), and (6) different meanings associated with a word. Nation (1990) further explained that each of those different components of word knowledge may be mastered receptively and productively. The revised vocabulary knowledge framework (Nation, 2013) has been widely used in vocabulary acquisition research. Nation's (2013) framework classified word knowledge into three different components, namely: form, meaning, and use. Each component is divided into different aspects of vocabulary knowledge. These aspects are: spoken form, written form, word parts, form-meaning connection, concept and referents, associations, grammatical functions, collocations, and constraints on use. Each aspect can be acquired both receptively and productively. In sum, acquiring knowledge of a word means learning different aspects of a word and these aspects may develop incrementally over time (Nation, 2013; Schmitt, 2010; Webb & Nation, 2017).

Derivational knowledge, or the ability to change forms of a word according to the intended meaning, can be classified under the component of word parts. The present study aimed to investigate this component of word knowledge.

1.3 Human Ethics Requirement

As this research involved human participants, approval from the Western University Non-Medical Research Ethics Board was obtained prior to conducting the study. All procedures in the study were conducted in accordance with the human ethics requirements.

In the process of recruitment, the participants were informed of the details of the study. This study ensured that the participants who volunteered to take part would not be harmed both physically and mentally throughout the study. It also ensured that participation was fully voluntary, and the participants could choose to leave the study at any time. Written consent was obtained from each participant prior to starting the study.

No personal information that could threaten the confidentiality of the participants was collected. Any information obtained from the participants was kept securely and confidentially with the researcher performing this study.

Chapter 2

2 Abstract

Derivational knowledge, the ability to understand and produce derivatives of a word, is essential for vocabulary learners to expand their lexical knowledge (Anglin, 1993; Laufer, 2017; Nation, 2013, 2016; Thorndike, 1941). The present study investigated the extent to which first language (L1) and second language (L2) learners could produce the derivatives of 90 head words in a decontextualized derivative recall test. This research also examined whether productive derivational knowledge varied between institutional levels (graduate, undergraduate, and high school) and vocabulary levels (1000-5000). The results indicated that L1 speakers had greater productive derivational knowledge than L2 learners. However, no statistically significant differences were found between L1 speakers and advanced L2 learners. The degree to which L2 learners have productive derivational knowledge also significantly varied between the institutional levels and vocabulary levels. The findings provide some evidence that L1 and L2 productive derivational knowledge follow similar developmental pathways.

2.1 Introduction

The importance of derivational knowledge for lexical development has long been recognized (Laufer, 2017; Nation, 2013; Thorndike, 1941; Sasao & Webb, 2017; Schmitt & Zimmerman, 2002). One reason why gaining derivational knowledge is important for second language (L2) learners is because derived words are extremely widespread in English. Nation (2013) analysed the number of word family members in the British National Corpus (BNC) and Corpus of Contemporary American English (COCA) and found that the average number of derivatives in a word family increases as the word family frequency increases. He reported that the most frequent word families have the most derived forms. He found that the most frequent 1000- and 2000-word families consisted of 6.8, and 6.4 members per family, and that the most frequent 5000- to 6000-word families still were made up of 4.1 members per family. Therefore, in order to develop learners' ability to communicate effectively in English, there is value in developing their derivational knowledge. Furthermore, research on derivational

knowledge is valuable as it sheds light on how word lists (e.g., Brezina & Gablasova, 2015; Dang, Coxhead, & Webb, 2017; Nation 2016), vocabulary tests (Laufer, 2017; Belgar, 2010; Nation & Webb, 2011; Webb, Sasao, & Ballance, 2017), and language programs should be developed (Graves, Elmore, & Fitzgerald, 2019). It also has methodological implications because it provides an indication of the unit of counting that should be used when calculating the lexical coverage of a text or corpus (e.g., Webb & Macalister, 2013; Reynold, 2013).

Many studies have investigated receptive derivational knowledge (e.g., McLean, 2018; Nagy, Diakidoy, & Anderson, 1993; Qian, 2002; Tyler & Nagy, 1989; Ward & Chuenjundaeng, 2009). However, research investigating the extent to which L2 learners can produce derivatives is notably scarce (Nation, 2016). In fact, only one study has compared L1 and L2 productive derivational knowledge (Schmitt & Zimmerman, 2002). Although Schmitt and Zimmerman (2002) found that the L1 speakers had higher average raw scores than L2 learners on tests of productive knowledge of derivatives, the extent to which the L1 speakers and L2 learners' productive derivational knowledge differed was not examined. Moreover, the degree to which productive derivational knowledge of L2 learners at different institutional and vocabulary levels vary is unclear. Filling these gaps would provide further insight into L2 lexical development, and the appropriacy of (a) teaching and learning goals for learners at different proficiency levels, (b) vocabulary exercises that focus on the development of derivational knowledge, and (c) criteria for assessing lexical development.

The present study was designed to investigate L1 and L2 productive derivational knowledge. A decontextualized derivative recall test (Ishii & Schmitt, 2009) was used to assess L1 speakers' and L2 learners' productive derivational knowledge. The research expands on earlier research designs in two ways. First, it explicitly examines variation in L2 productive derivational knowledge by assessing L2 learners at different institutional levels (graduate, undergraduate, high school) and vocabulary levels (1000-5000). Second, the degree to which L1 and L2 productive knowledge differs was investigated by

analyzing the extent to which L2 learners at different levels produced derivatives in relation to L1 speakers.

2.2 Background

Derivational Knowledge

In Nation's (2013) word knowledge framework, productive derivational knowledge is described as the productive component of word parts, that is, a learner's ability to express the intended meaning of a word using an appropriate word part. Nation (2013) further explains that there are two types of knowledge involved in successful production of derivatives. First, a learner must know whether a derivational affix transforms the form of a base word that the affix is added to (e.g., *nature* to *natural*, *arrange* to *arrangement*). Second, a learner must know an appropriate derivational affix that can be added to the base word to express the intended meaning (e.g., *-ment* can be added to *arrange*, but *-tion* cannot be added to *arrange*). In research, productive derivational knowledge typically refers to as a learner's ability to produce and or use derivatives of a word (e.g., Leontjev, Huhta, & Mäntylä, 2016; Schmitt & Zimmerman, 2002). In L1 studies, the term productive derivational knowledge is not used frequently. L1 studies often refer to *morphological awareness*, which is a learner's ability to manipulate morphemes such as prefixes, suffixes, and root words to produce accurate derivative forms (Carlisle, 1995, 2000).

The Productive Derivational Knowledge of L1 Speakers

L1 research has shown that young L1 learners develop productive derivational knowledge incrementally over time. Carlisle (1996) investigated second and third graders' use of derivatives in spontaneous story writing. Carlisle found that the third graders were more likely to use derivatives in their writing compared to the second graders. However, third graders' production of derivatives was mainly limited to forms using common suffixes (e.g., *-ly*). She concluded that the period between the second and third-grade may be where L1 learners start developing the ability to produce derivatives. Similarly, Green et al (2003) examined third and fourth graders' written narratives to investigate if older

students produced more derivatives than younger students, and how the rates of accurate production changed over the course of the academic year. Green et al. also found that the older students produced more derivatives than the younger students. Moreover, they found that the older students produced derivatives more accurately. Their findings indicated that the rates of correct production of derivative forms for the fourth graders were 52.5% and 57.1% for the fourth graders, and 35.2% and 44% for the third graders in the fall and spring. Their findings were in line with Carlisle's (1996) study indicating incremental development of productive derivational knowledge over time.

Research has also shown that mastering the ability to produce accurate derivative forms can be challenging. McCutchen and Stull (2015) investigated whether fifth graders' ability to produce derivatives was facilitated by their ability to recognize correct forms of derivatives using a sentence combining task and a sentence completion task. McCutchen and Stull found that the fifth graders' ability to identify correct derivative forms uniquely predicted their performance on productive measures. Interestingly, however, they also found that the fifth graders' ability to recognize correct derivative forms was the significant predictor of the learners' morphological inventions (e.g., *mysterical** instead of *mysterious*, *solidize** instead of *solidify*). Their findings suggest that even after acquiring receptive derivational knowledge, L1 learners could not always produce derivatives accurately.

The extent to which more advanced L1 speakers have the ability to produce derivatives is unclear. However, there are several studies investigating receptive knowledge of L1 derivative forms with more advanced learners. Tyler and Nagy (1989) assessed college students' ($N = 12$) ability to identify well-formed derivatives. They found that college students outperformed fourth, sixth, and eighth graders. However, it is interesting to note that mean score of the well educated L1 speakers who took part in the study was 97% on the receptive test. Because receptive knowledge is acquired more easily than productive knowledge (Webb, 2007), we might expect educated native speakers to score 100% on a receptive test. Only one study by Schmitt and Zimmerman (2002) has investigated L1 productive derivational knowledge with university students.

Their findings revealed that L1 participants correctly produced 91.2% of derivatives in a contextualized derivative recall test.

In summary, research suggests that L1 productive derivational knowledge starts developing in the early elementary years and continues to develop through the remaining elementary years. L1 research also suggests that mastering productive derivational knowledge may take a long time (McCutchen & Stull, 2015). However, there is a lack of research with advanced L1 learners and a lack of clarity on what could be considered to be a level of mastery of productive derivational knowledge.

The Productive Derivational Knowledge of L2 Learners

Does productive derivational knowledge vary between L2 learners at different levels of proficiency?

Leontjev, Huhta, and Mäntylä (2016) explored productive derivational knowledge of EFL learners in Finland and Estonia with differing CEFR levels (Common European Framework of Reference). They found significant differences between B1-B2 and A2-B2 level groups on derivative recall measures (contextualized and decontextualized tests). Schmitt and Zimmerman (2002) investigated two advanced ESL learner groups that consisted of (1) graduate students in a master's degree program on English language teaching in the UK (MA-ELT), and (2) undergraduate and graduate ESL students in a pre-university program in the U.S. (ESL). Their findings indicated that the MA-ELT and the ESL groups successfully produced a derivative for each part of speech (noun, adjective, verb, adverb) in 42.9% and 12.7% of the cases for 16 target words, respectively. Together the studies suggest that L2 learners at different levels of proficiency are likely to have different degrees of productive derivational knowledge.

Although the studies by Leontjev, Huhta, and Mäntylä (2016) and Schmitt and Zimmerman (2002) provide some useful insight into the relationship between L2 learners' general proficiency level and productive derivational knowledge, there are a few limitations to the research. First, both studies tested relatively few words. Leontjev et al. (2016) tested learners' ability to produce derivatives of only 10 head words in the

decontextualized derivative recall test, and only 15 lexical items in the contextualized derivative recall test. Schmitt and Zimmerman (2002) investigated knowledge of only 16 head words. Research suggests that L2 lexical knowledge of words varies according to frequency of the word in English (Webb, Sasao, & Ballance, 2017), and that at least 30 items are needed to accurately measure knowledge of the words at a certain frequency level (Beglar & Hunt, 1999). Therefore, it may be necessary to include a much greater number of target items in order to provide an accurate assessment of productive derivational knowledge. Second, the findings of these studies may not be generalizable. Schmitt and Zimmerman (2002) only provided interpretation of mean scores to compare the two learner groups. It would therefore be useful to compare different groups of learners using inferential analyses in order to determine whether differences exist and the degrees to which learners' productive derivational knowledge vary. Although Leontjev et al. (2016) inspected the differences in the productive derivative recall scores between different learner groups using statistical analyses, they determined the participants' CEFR levels merely based on the senior secondary school curricula of the schools that the participants attended. Therefore, learners' proficiency levels were not determined by reliable measures and the interpretation of the results was difficult (Leontjev et al., 2016). Surprisingly, no study has explicitly investigated whether there are differences in L2 productive derivational knowledge between varying educational levels. It is useful to use institutional level as the grouping factor because it is likely to provide a relatively accurate representation of past learning experience.

Does productive derivational knowledge vary between L2 learners with different levels of receptive vocabulary knowledge?

Research has indicated that there is a positive relationship between learners' vocabulary knowledge and their ability to produce derivatives. Schmitt and Meara (1997) tracked development of intermediate Japanese EFL learners' ability to produce different forms of 20 prompt words and found that the participants' derivative recall test scores and their scores on a test of vocabulary knowledge were correlated ($r = .27$ at Time 1 and $r = .35$ at Time 2). Ishii and Schmitt (2009) administered a decontextualized derivative recall test

to measure Japanese EFL learners' productive derivational knowledge of 15 words. They found that there was a strong positive relationship between the learners' derivative recall test scores and vocabulary knowledge scores ($r = .73$). The findings of these studies suggest that L2 learners' receptive vocabulary knowledge is likely associated with the L2 learners' productive derivational knowledge. However, research is yet to examine how productive derivational knowledge varies among L2 learners with differing levels of receptive vocabulary knowledge. Investigating productive derivational knowledge of learners at different vocabulary levels may better indicate appropriate lexical learning goals, as well as the types of exercises that are necessary for learners with different degrees of vocabulary knowledge.

To what extent do L1 speakers and L2 learners' productive derivational knowledge vary?

Surprisingly, only one study has investigated the productive derivational knowledge of both L1 speakers and L2 learners. Schmitt and Zimmerman (2002) investigated the productive derivational knowledge of L1 and L2 participants using a contextualized derivative recall test. The rates of successful production by the L1 speakers, L2 graduate students, and ESL students were 91.2%, 79%, and 54.7%, respectively. Unfortunately, the study did not directly compare the extent to which knowledge of the L1 and L2 participants varied. However, the variation in mean scores seems to suggest that the L1 participants have much greater knowledge than the L2 participants (Schmitt & Zimmerman, 2002). However, it would be useful to examine the degree to which L1 speakers and L2 learners' productive derivational knowledge varies using inferential analyses to get a much clearer picture of how this type of knowledge varies among different learners.

2.3 Present Study

The present study was designed to fill the gaps discussed above, and address several challenges commonly found in vocabulary teaching. First, a lack of time to teach words is an issue in the language classroom (Webb & Nation, 2017). Therefore, it is useful to have lexical benchmarks to gauge the progress of L2 learners. The present study aimed to

determine the extent that adult L1 speakers can produce derivatives in relation to L2 learners with different degrees of vocabulary knowledge, and at different institutional levels. Second, the extent to which teachers might expect their students to demonstrate L2 productive derivational knowledge remains unclear. Schmitt and Zimmerman's (2002) study highlighted L2 learners' inability to produce a derivative for each part of speech. However, L1 research indicated that productive derivational knowledge is difficult to master even for L1 speakers (e.g., McCutchen & Stull, 2015). Through investigating the knowledge of both L1 speakers and L2 learners, the present study aimed to identify the extent of productive derivational knowledge for L2 learners at different stages of lexical development. Moreover, greater clarity on L1 and L2 productive derivational knowledge should provide a better indication of how we should assess this type of knowledge. Lastly, the present study aimed to improve upon the methodological designs of the earlier studies. The current study tested ninety words chosen from the most frequent word levels in order to obtain a more accurate evaluation of L1 and L2 productive derivational knowledge.

Research Questions

The present study posed the following research questions.

- (1) To what extent can L1 English speakers produce the derivative forms of head words?
- (2) To what extent can learners of English produce the derivative forms of head words?
- (3) To what extent does productive knowledge of derivative forms vary between learners of English at different institutional levels, and how does each group compare to L1 English speakers?
- (4) To what extent does productive knowledge of derivative forms vary between learners of English with different degrees of receptive vocabulary knowledge, and how does each group compare to L1 English speakers?

2.4 Method

Participants

A total of 130 students participated in this study. One hundred and seven participants were L2 learners including graduate students enrolled in a Master's in TESOL program at a university in Canada ($n = 18$), and undergraduate ($n = 61$) and high school students ($n = 28$) learning EFL in Japan. The remaining 23 participants were university students in Canada with English as their L1. On average, the master's students, undergraduate, and high school students had studied English for 14.5 years ($SD = 5.76$), 8.3 years ($SD = 1.86$), and 6.32 years ($SD = 2.83$), respectively. The L2 learner participants completed the updated Vocabulary Levels Test (Webb, Sasao, & Ballance, 2017) and the results indicated that 22.4 % of the participants had mastered the 1000 word level, 30.8% had also mastered the 2000 level, and 4.7%, 4.7%, and 9.3% of the learners had also mastered the 3000, 4000, and 5000 word levels, respectively. The mastery of each level was determined using Webb et al.'s (2017) cutting points of 29/30 (97%) at the 1000, 2000 and 3000 levels, and 24/30 (80%) at the 4000 and 5000 levels. The remaining 28.1% of the learner participants did not achieve mastery of the 1000 level. In the current study, the vocabulary levels of learner participants were divided into four groups: (1) beginner (below the 1000 level) ($n = 30$), (2) elementary (1000 level) ($n = 24$), (3) intermediate (2000 level) ($n = 33$), and (4) advanced (3000-5000 level) ($n = 20$). These groups were set to distinguish between learners with different degrees of receptive vocabulary knowledge. Written consent was obtained from all participants prior to their taking part in the study.

Target Words

Ninety head words were selected from Nation's (2012) British National Corpus/Corpus of Contemporary American English (BNC/COCA) most frequent 1000-5000 word family lists. Selection of word families was based on four criteria. First, word families that contained less than three members were excluded, because this study aimed to investigate participants' ability to produce at least three different derivatives forms. Second, word families with polysemous head words (e.g., *admit* has multiple meanings; to confess, to

allow someone to enter a place) were excluded due to their intrinsic difficulty (Schmitt, 2010). Third, target words were selected according to their frequency of occurrence in Nation's (2012) BNC/COCA lists. Thirty words were selected from the 1000-word level, 30 were chosen from the 2000 level, and 30 words were chosen from 3000-5000 levels. Fourth, target words were randomly selected from the resulting lists. This procedure was taken to ensure a better representation of the whole without bias. The number of derivative forms for each target word is shown in Appendix B.

Research Instrument

The current study used a decontextualized derivative recall test (Ishii & Schmitt, 2009; Leontjev, Huhta, & Mäntylä, 2016; Schmitt & Meara, 1997) to measure the participants' knowledge for two reasons. First, this test was deemed most appropriate because the current study is solely interested in participants' ability to produce different forms of a head word, not the ability to use derivatives appropriately in context. Second, the decontextualized derivative recall test could control for other factors that may affect production of derivatives. For example, background information and the words encountered in context may influence the degree to which derivatives may be produced (Nation & Webb, 2011). L1 English speakers may benefit from contextual information as they tend to have stronger word association knowledge (Wolter, 2001), while contextual information may increase difficulty and make the test cognitively more demanding for L2 learners.

Prior to taking the test, participants were given written instructions explaining what to do along with explanations about nouns, adjectives, verbs and adverbs. Participants could also ask questions to clarify any grammatical concepts they did not understand. In the test, participants were given headwords and asked to write as many derivatives as possible and write them according to part of speech labels. When a derivative form cannot be produced for a particular word class, participants were asked to write an *X* in the applicable cell. Examples are shown below.

Headwords	Noun	Adjective	Verb	Adverb
art	<i>art, artist</i>	<i>artistic</i>	X	<i>artistically</i>
arrange	<i>arrangement arranger</i>	<i>arranged</i>	<i>arrange</i>	X
possible	<i>possibility impossibility</i>	<i>possible impossible</i>	X	<i>possibly</i>

Scoring methods

The current study examined participants' responses using two different scoring methods. In the first scoring method, participants were awarded a point for each derivative form that was produced correctly. A similar approach was taken in Schmitt and Meara's (1997) study investigating EFL learners' knowledge of suffixes. The current study is unique in that participants were asked to write prefixed words as well as suffixed words. The number of possible derivatives for each head word was determined by consulting the Longman Dictionary of Contemporary English (<https://www.ldoceonline.com/>), the Cambridge Dictionary (<https://dictionary.cambridge.org/>), and the Collins English Dictionary (<https://www.collinsdictionary.com/>). The total number of possible derivatives of the 90 target words was 621 in this scoring method. This scoring method is labeled as Scoring Method 1 henceforth.

The second scoring method was adapted from earlier studies (Ishii & Schmitt, 2009; González-Fernández & Schmitt, 2019; Schmitt, 1999) and awarded a point if participants were able to produce a derivative correctly for each part of speech. For example, Ishii and Schmitt (2009) scored produced derivative forms out of 60 (15 target words x 4 parts of speech), and Schmitt (1999) scored his test out of 180 (45 target words x 4 parts of speech). One aspect that differentiates the current study's scoring method from these earlier studies is that a point was not awarded for recognizing non-existence of a derivative form. That is, participants in the current study were not awarded a point when they wrote an X in an applicable cell (e.g., X in a cell for a verb form of *art*). Because the current study does not seek to inquire about participants' ability to recognize nonexistence of a certain part of speech of a word, the cases in which there was no

commonly used part of speech of a head word were disregarded for the purpose of awarding points. The second scoring method, therefore, calculated scores with the maximum score being 316 as there were 44 cases in which there were no derivations for a particular part of speech. This scoring method is labeled as Scoring Method 2 henceforth. Scoring Methods 1 and 2 were also calculated without the participants' responses to the head words that were used as prompt words.

Procedure

The test was divided into three sections with thirty head words in each section. Each section contained 10 words from the 1000-word level, 10 words from the 2000-word level, and 3-4 words from each of the 3000-, 4000-, and 5000-word levels. Participants were given as much time as they needed to complete the test. The test was typically completed in 40-90 minutes. The written instructions were given in English. Japanese EFL learners were able to ask questions about how to complete the test and receive explanations in Japanese.

Analyses

Statistical analyses were conducted using R studio (R Core Team, 2019). The descriptive statistics (means, standard deviations, minimum and maximum scores) were examined to answer the first and second research questions. For the third and fourth research questions, a series of one-way analyses of variance (ANOVA) were conducted with decontextualized recall test scores obtained in Scoring Methods 1 and 2 being the dependent variables and learners' institutional levels (i.e., MS = Master Students, JUS = Japanese University Students, JHS = Japanese High School Students, and the L1 speaker group) and VLT levels (i.e., below 1000 level, 1000 level, 2000 level, and 3000-5000 levels, as well as the L1 speaker group) being between-participants factors. Kolmogorov-Smirnov Test of normality indicated that the participants scores obtained using Scoring Methods 1 and 2 were normally distributed in each group ($p > .05$) when the vocabulary levels and institutional levels were used as grouping factors. Welch's ANOVAs as well as Games Howell's post hoc tests were performed due to inequalities in the number of participants in each group and unequal variances in the distributions of the scores in each

group. The scores calculated without the head words were presented in the descriptive statistics only as these scores were not normally distributed and the variances were not equal for each participant group.

2.5 Results

The first and second research questions asked to what extent L1 English speakers and L2 learners of English produce derivative forms of head words. Tables 1, 2, and 4 present descriptive statistics of the scores obtained using Scoring Methods 1 and 2 by different grouping factors. Scoring Method 1 presents the number of derivatives that participants produced out of all possible forms (max. = 621). Scoring Method 2 presents the number of correct derivative forms with one point given for each part of speech (max. = 316). When the head words were excluded, the total scores for Scoring Methods 1 and 2 were 531 and 275¹.

In answer to the first two research questions, the descriptive statistics indicate that the L1 English speakers and the L2 learner participants successfully produced on average 39.77% and 25.01% of all possible derivatives in the decontextualized derivative recall test, respectively (Scoring Method 1). The results also indicate that 32.12% and 14.92% of derivatives were produced by the L1 English speakers and the L2 learner participants respectively when the head words were excluded from the analysis in Scoring Method 1. The L1 English speakers and the L2 learner participants successfully produced at least

¹ There were 316 cases for which participants would have been able to produce a derivative (Scoring Method 2). After excluding the responses to the 90 headwords, 41 cases were eliminated from the total score because these headwords were the only form for the part of speech. (e.g., *neutral* is the only adjective in this family). There were 49 cases where other forms existed for the parts of speech of the eliminated head words. For example, even after taking *art* out, there were other noun forms that could have been produced like *artist*. Thus these 49 cases remained in the analysis. Because of this the maximum score of Method 2 without head words is 275.

one derivative form for each part of speech of the headwords in 70.59% and 47.08% of the instances, respectively (Scoring Method 2). When the head words were excluded from the analysis in Scoring Method 2, the rates at which the L1 English speakers and L2 English learner participants produced appropriate derivatives decreased to 58.76% and 34.65%, respectively.

Table 1 Descriptive statistics of decontextualized derivative recall test between L1 English speakers and learners of English

	NS (<i>n</i> = 23)			NNS (<i>n</i> = 107)		
	<i>M</i>	<i>SD</i>	<i>Min-Max</i>	<i>M</i>	<i>SD</i>	<i>Min-Max</i>
Scoring Method 1						
Raw score	246.96	53.03	160-354	155.72	46.78	62-278
%	39.77	8.54	25.77-57.0	25.01	7.53	10.0-44.77
Without head words						
Raw score	164.17	48.71	94-265	77.03	38.81	11-187
%	32.12	9.31	18.22-50.47	14.92	7.43	2.28-35.67
Scoring Method 2						
Raw score	223.09	38.42	145-278	148.77	40.39	64-235
%	70.59	12.16	45.89-87.96	47.08	12.78	20.25-74.37
Without head words						
Raw score	185.7	38.63	127-247	109.5	36.72	38-198
%	58.76	12.23	40.19-78.16	34.65	11.62	12.03-62.66

Note: NS = Native Speaker participants, and NNS = Non-native Speaker participants. The maximum scores for Scoring Methods 1 and 2 are 621 and 531. Without head words the maximum scores for these methods were 316 and 275.

The third research question asked whether the ability to produce derivatives of the head word varies among the masters, university, and high school L2 groups, and the L1 speaker group. To answer this question, a series of Welch's ANOVAs on the scores obtained using Scoring Methods 1 and 2 were conducted. The descriptive statistics are shown in Table 2.

Table 2 Descriptive statistics of decontextualized derivative recall test by institutional levels

	MS (<i>n</i> = 18)			JUS (<i>n</i> = 61)			JHS (<i>n</i> = 28)		
	<i>M</i>	<i>SD</i>	<i>Min-Max</i>	<i>M</i>	<i>SD</i>	<i>Min-Max</i>	<i>M</i>	<i>SD</i>	<i>Min-Max</i>
Scoring Method 1									
Raw score	210.89	33.69	146-278	159.56	33.25	74-244	111.89	36.96	62-209
%	33.39	5.43	23.51-44.77	25.69	5.36	11.92-39.29	18.02	5.95	10.0-33.66
Without head words									
Raw score	125.00	32.18	54-187	78.66	28.06	26-157	42.64	27.28	11-121
%	24.62	5.22	13.66-35.67	15.12	5.35	4.93-30.17	8.24	5.21	2.28-23.15
Scoring Method 2									
Raw score	193.00	24.88	140-235	153.05	29.49	74-234	111.00	35.47	64-203
%	61.08	7.87	43.33-74.37	48.43	9.33	23.42-74.05	35.13	11.22	20.25-64.24
Without head words									
Raw score	154.39	22.26	106-198	112.00	26.32	49-186	75.18	29.41	38-156
%	48.86	7.04	33.54-62.66	35.44	8.33	15.51-58.86	23.79	9.31	12.03-49.37

Note: MS = Masters Students; JUS = Japanese University Students; JHS = Japanese High School Student

The first analysis was conducted with the scores calculated in Scoring Method 1 being the dependent variable. Welch's ANOVA realized significant differences in the mean scores between different groups of participants, Welch's $F(3, 47) = 47.899, p < .001$; partial $\eta^2 = 0.75$; CI [.58-.84]. Post-hoc comparisons using Games-Howell's test (Table 3) indicated that there were significant differences between all three institutional levels ($p < .001$). Cohen's d scores indicated a large effect size between the masters and university student groups ($d = 1.52$; CI [.96-2.11]), the masters and high school student groups ($d = 2.94$; CI [1.94-3.59]), and the university and high school student groups ($d = 1.43$; CI [.89-1.87]). The differences between the L1 speaker and university student groups ($p < .001$; $d = 1.65$; CI [1.62-2.79]), and the L1 speaker and high school student groups ($p < .001$; $d = 2.55$; CI [2.19-3.81]) were significant. The difference between the master's students and the L1 speakers was not significant ($p = .055$; $d = .68$; CI [.14-1.43]).

Table 3 Post-Hoc tests between groups of participants at different institutional levels on decontextualized derivative recall test

	<i>CI.95</i>					
	<i>Mdiff</i>	Lower	Upper	<i>t</i>	<i>df</i>	<i>p</i>
Scoring Method 1						
JHS <NS	-135.06	-170.19	-99.93	-10.33	38.11	<.001
JHS <MS	-99.0	-127.38	-70.61	-9.36	38.84	<.001
JUS <NS	-87.40	-119.70	-55.10	-7.38	28.78	<.001
JUS <MS	-51.33	-75.96	-26.70	-5.70	27.53	<.001
JHS <JUS	-47.66	-69.44	-25.89	-5.83	47.83	<.001
MS <NS	-36.06	-72.65	0.52	-2.65	37.60	.055
Scoring Method 2						
JHS <NS	-112.09	-139.94	-84.24	-10.73	45.44	<.001
JHS <MS	-82.00	-105.79	-58.21	-9.21	43.59	<.001
JUS <NS	-70.04	-94.02	-46.05	-7.91	32.29	<.001
JHS <JUS	-42.05	-62.57	-21.52	-5.47	44.83	<.001
JUS <MS	-39.95	-58.83	-21.07	-5.73	32.44	<.001
MS <NS	-30.09	-56.76	-3.41	-3.03	37.84	.022

Note: Mdiff = Mean score difference. MS = Master's Students; JUS = Japanese University Students; JHS = Japanese High School Students; NS = Native Speakers

The second analysis was conducted with the scores calculated in Scoring Method 2 being the dependent variable. Welch's ANOVA realized the presence of significant differences in the mean scores between the groups, $F(3,49) = 48.534, p < .001$; partial $\eta^2 = 0.75$; CI [.58-.84]. Post-hoc comparisons using Games-Howell's test (Table 3) indicated that there were significant differences between all three institutional levels ($p < .001$). Cohen's d scores indicated a large effect size between the masters and university student groups ($d = 1.61$; CI [.83-.1.97]), the masters and high school student groups ($d = 3.30$; CI [1.77-3.37]), and the university and high school student groups ($d = 1.43$; CI [.84-1.82]). The differences between the L1 speaker, university, and high school groups were also significant ($p < .001$). Cohen's d scores indicated a large effect size between the L1 speaker and university student groups ($d = 1.82$; CI [1.59.-2.75]), the L1 speaker and high school student groups ($d = 2.92$; CI [2.22-3.85]). A significant but slightly smaller difference was realized between the masters and L1 speaker groups ($p = .022$; $d = .78$; CI [.25-1.54]).

The fourth research question examined whether the ability to produce derivatives of the head words varies between L2 learners with different degrees of receptive vocabulary knowledge (below 1000 level = beginner, 1000 level = elementary, 2000 level = intermediate, and 3000-5000 levels = advanced) and the L1 speaker group. The descriptive statistics of the decontextualized derivative recall test by VLT levels is shown in Table 4.

Table 4 Descriptive statistics of decontextualized derivative recall test by Vocabulary levels

	Beginner (<i>n</i> = 30)			Elementary (<i>n</i> = 24)			Intermediate (<i>n</i> = 33)			Advanced (<i>n</i> = 20)		
	<i>M</i>	<i>SD</i>	<i>Min-Max</i>	<i>M</i>	<i>SD</i>	<i>Min-Max</i>	<i>M</i>	<i>SD</i>	<i>Min-Max</i>	<i>M</i>	<i>SD</i>	<i>Min-Max</i>
Scoring Method 1												
Raw score	114.73	37.50	62-206	143.58	32.88	83-211	166.88	26.58	74-211	213.35	31.86	146-278
%	18.48	6.04	9.98-33.17	23.12	5.29	13.37-33.98	26.87	4.28	11.92-33.98	34.36	5.13	23.51-44.77
Without head words												
Raw score	44.40	29.31	11-119	65.33	25.61	20-126	84.79	21.17	41-102	127.20	30.56	57-187
%	8.58	5.59	2.28-22.58	12.57	4.89	3.80-24.10	16.28	4.02	7.78-23.72	24.99	4.90	17.46-35.67
Scoring Method 2												
Raw score	112.10	32.51	64-184	139.29	29.02	83-201	159.73	23.90	72-203	197.05	24.67	140-235
%	35.47	10.29	20.25-58.23	44.08	9.18	26.27-63.61	50.55	7.56	22.78-64.24	62.36	7.81	44.30-74.37
Without head words												
Raw score	76.83	29.18	38-146	99.71	24.87	53-155	117.42	20.87	56-156	157.15	20.91	128-198
%	24.31	9.24	12.03-46.20	31.55	7.87	16.77-49.05	37.16	6.60	17.72-49.37	49.73	6.62	40.51-62.66

Note: The maximum scores for Scoring Methods 1 and 2 are 621 and 531. Without head words the maximum scores for these methods were 316 and 275. Beginner = below 1000 level, Elementary = 1000 level, Intermediate = 2000 level, Advanced = 3000-5000 level.

The first analysis was conducted with the scores calculated in Scoring Method 1 being the dependent variable. Welch's ANOVA realized significant differences in the mean scores of the decontextualized derivative recall test between the groups, Welch's $F(3, 57) = 39.874, p < .001$; partial $\eta^2 = 0.68$; CI [.50-.78]. Post-hoc comparisons using Games-Howell's test indicated that there were significant differences between learners with different levels of receptive vocabulary knowledge (Table 5). The advanced level group outperformed the intermediate, ($d = 1.46$; CI [.98-2.25]), elementary ($d = 2.19$; CI [1.39-2.89]), and beginner ($d = 3.09$; CI [1.98-3.57]) level groups ($p < .001$). Significant but slightly smaller differences were realized between the elementary and beginner level groups ($p = .032$; $d = .88$; CI [.25-1.37]), as well as between the intermediate and elementary level groups ($p = .049, d = .88$; CI [.24-1.34]). The differences between the L1 English speakers and the intermediate ($d = 1.51$; CI [1.36-2.67]), elementary ($d = 1.95$; CI [1.60-3.10]), and beginner ($d = 2.50$; CI [2.15-3.73]) level groups were all significant ($p < .001$). No significant difference was found between the advanced level group and the L1 English speakers ($p = .100$; $d = .63$; CI [.13-1.37]).

The second analysis was conducted with the scores calculated in Scoring Method 2 being the dependent variable. Welch's ANOVA realized the presence of significant differences between the groups, Welch's $F(4, 58) = 44.513, p < .001$; partial $\eta^2 = 0.75$; CI [.60-.83]. Post-hoc comparisons using Games-Howell's test indicated that there were significant differences between groups with different vocabulary levels (Table 5). The advanced level group outperformed the intermediate ($d = 1.17$; CI [.75-1.96]), elementary ($d = 2.34$; CI [1.37-2.87]) and beginner level ($d = 3.44$; CI [2.05-3.66]) groups ($p < .001$). Significant but slightly smaller differences were realized between the elementary and beginner level groups ($p = .017$; $d = .94$; CI [.31-1.44]). The difference between the intermediate and elementary level groups was not significant ($p = .053$; $d = .86$; CI [.23-1.32]). The differences between the L1 speaker group and the beginner ($d = 2.89$; CI [2.33-3.97]), elementary ($d = 2.18$; CI [1.69-3.23]), and intermediate ($d = 1.65$; CI [1.40-2.72]) level groups were significant ($p < .001$). No significant difference was found between the L1 speaker group and the advanced level group ($p = .076$; $d = .68$; CI [.17-1.41]).

Table 5 Post-Hoc tests between groups of participants at different levels of receptive word knowledge, and L1 English speakers on decontextualized derivative recall test

	<i>Mdiff</i>	<i>CI.95</i>		<i>t</i>	<i>df</i>	<i>p</i>
		Lower	Upper			
Scoring Method 1						
Beginner < NS	-132.22	-169.46	-94.98	-10.17	37.84	<.001
Elementary < NS	-103.37	-140.48	-66.26	-7.99	36.46	<.001
Beginner < Advanced	-98.62	-126.69	-70.55	-9.98	45.10	<.001
Intermediate < NS	-80.10	-114.87	-45.29	-6.68	29.75	<.001
Elementary < Advanced	-69.77	-97.69	-41.85	-7.13	41.01	<.001
Beginner < Intermediate	-52.15	-75.50	-28.79	-6.31	51.76	<.001
Intermediate < Advanced	-46.47	-70.90	-22.04	-5.47	34.74	<.001
Advanced < NS	-33.61	-71.33	4.12	-2.55	36.73	.100
Beginner < Elementary	-28.85	-55.95	-1.75	-3.01	51.52	.032
Elementary < Intermediate	-23.30	-46.50	-0.09	-2.86	43.07	.049
Scoring Method 2						
Beginner < NS	-110.98	-139.37	-82.60	-11.13	42.97	<.001
Beginner < Advanced	-84.95	-107.93	-61.97	-10.48	47.10	<.001
Elementary < NS	-83.80	-112.22	-55.37	-8.41	40.94	<.001
Intermediate < NS	-63.36	-89.36	-37.36	-7.02	33.78	<.001
Elementary < Advanced	-57.76	-80.83	-34.69	-7.14	41.98	<.001
Beginner < Intermediate	-47.63	-68.10	-27.16	-6.57	52.92	<.001
Intermediate < Advanced	-37.32	-57.07	-17.57	-5.40	39.23	<.001
Beginner < Elementary	-27.19	-50.90	-3.48	-3.24	51.33	.017
Advanced < NS	-26.04	-53.88	1.81	-2.68	37.94	.076
Elementary < Intermediate	-20.44	-41.03	-0.16	-2.82	43.65	.053

Note: *Mdiff* = Mean score difference. Beginner = below 1000 level, Elementary = 1000 level, Intermediate = 2000 level, Advanced = 3000-5000 level.

2.6 Discussion

This study examined the extent to which L2 learners of English and L1 English speakers could produce derivative forms of head words. The research expanded on earlier studies by comparing productive knowledge of derivatives among groups of L2 participants at different institutional levels and with different degrees of receptive vocabulary knowledge. The extent to which different learner groups were able to produce derivative forms was also compared to an L1 English speaker group to determine whether they differ in their productive knowledge of derivative forms.

In answer to the first research question, the results showed that the L1 English speakers produced 39.77% of all possible derivative forms, and 32.12% of all possible derivative forms when head words were excluded. The research also revealed that the L1 English speakers produced at least one derivative for each part of speech of the head words in 70.59% of the instances and 58.76% of the instances when the head words were excluded. The results for L1 English speakers are surprising considering that all of the head words were chosen from the most frequent 5000 word families and these target words should have been well known. It might also have been expected that some L1 participants would have perfect scores on the test. This did not occur. In fact, the maximum scores on the test by L1 participants were 57% and 87.96% in Scoring Method 1 and 2, respectively. This suggests that demonstrating productive knowledge of derivative forms is challenging even for L1 English speakers. Earlier studies investigating productive knowledge of derivatives have often highlighted L2 learners' lack of productive knowledge of derivatives (Schmitt & Meara, 1997; Schmitt & Zimmerman, 2002). However, the results of the current study showed that demonstration of this knowledge is also difficult for L1 speakers. This is important to note for both researchers and practitioners because expecting a L2 learner to get a perfect score on this type of test may in turn mean that they expect the learners to perform better than L1 speakers.

In answer to the second research question, the results revealed that the L2 learners produced 25.01% of all possible derivative forms and 14.92% of all possible derivative forms when the head words were excluded. Second, the findings showed that the L2

learners produced at least one derivative for each part of speech of the head words in 47.08% of the instances and 34.65% of the instances when the head words were excluded. These results are in line with earlier studies showing that L2 learners had limited productive knowledge of derivatives (Ishii & Schmitt, 2009; Schmitt & Meara, 1997; Schmitt & Zimmerman, 2002). The L2 learner participants' mean percentage scores for correct responses for each part of speech (47.08%) was consistent with studies that used a similar scoring method (37%; Ishii & Schmitt, 2009, 51.64%; González-Fernández & Schmitt, 2019). In the current study, Scoring Method 1 indicated much lower scores (25.01%) than earlier research using a similar scoring method (47%; Schmitt & Meara, 1997). This is likely because in Schmitt and Meara's study, inflectional suffixes (*-ed*, *-ing*, and *-s*) were also scored as correct.

When the head words were excluded, the L2 learner group scored 10.09% and 12.43% lower than the scores obtained in Scoring Methods 1 and 2. As was the case with the L1 English speaker group, these results indicate that L2 learner participants typically did not produce other derivative forms for the same part of speech as the head words (e.g., *artist* rather than *art*). In comparison to the L1 English speakers, however, the learner participant group show this tendency slightly more acutely. If production of derivative forms is affected by factors such as frequency of derivative forms, it might not be surprising that the learners were less able to produce other less frequent forms of derivatives because their lexical knowledge is not likely to be as extensive as that of the L1 English speakers.

The third and fourth research questions looked at whether there was a progression in the development of productive knowledge of derivative forms among learners at different institutional levels (Research question 3) and with different degrees of receptive vocabulary knowledge (Research question 4). In answer to the third research question, the results showed that there were significant differences in productive knowledge of derivative forms among learners at different institutional levels. In all comparisons regardless of the scoring method, the differences were statistically significant between the different L2 institutional levels. The results showed that on average the masters, university, high school student groups produced 211, 160, and 112 derivatives for the 90

target items, respectively (Scoring Method 1). The results also revealed that when responses were scored according to part of speech, on average the masters, university, and high school student groups produced 193, 153, and 111 derivatives respectively (Scoring Method 2). These results suggest that there is a developmental progression in the ability to produce derivative forms across institutional levels, and that this progression in knowledge tends to develop over time.

In comparison to the native speakers of English, the results indicated that on average the master's group, university group, and high school group produced about 36, 87, and 135 less derivatives respectively for the 90 target items (Scoring Method 1). The results also indicated that the master's group, the university group, and the high school group provided derivatives for about 31, 70, 122 less instances, respectively, compared to the L1 speaker group (Scoring Method 2). It is important to note that the master's students' performance was statistically equivalent to that of the L1 speaker group.

In answer to the fourth research question, the results revealed significant differences in productive knowledge of derivatives among learners at the different vocabulary levels. All comparisons between groups of L2 learners with different receptive vocabulary knowledge were statistically significant regardless of the scoring method. On average, the advanced, intermediate, elementary and beginner level groups produced 213, 167, 144, and 115 derivatives, respectively (Scoring Method 1). When the responses were scored according to part of speech the advanced, intermediate, elementary and beginner level groups produced 197, 160, 139, and 112 derivatives, respectively (Scoring Method 2) These results also indicate that there is a progression in the ability to produce derivative forms as receptive vocabulary knowledge increases.

In comparison to the L1 speaker group, the results showed that the advanced, intermediate, elementary, and beginner level groups produced 26, 63, 84, and 111 fewer derivative forms, respectively. When responses were scored according to part of speech, the findings revealed that the advanced, intermediate, elementary, and beginner groups produced 31, 87, 135 fewer correct responses compared to the L1 speaker group.

The comparisons between the most proficient L2 learner groups (masters students, students with vocabulary knowledge of at least the 3000-word level) and the L1 group contrast the literature on productive knowledge of derivative forms. Discussion of this topic has typically suggested that L2 learners' productive knowledge of derivative forms is poor (Ishii & Schmitt, 2009; Schmitt & Meara, 1997; Schmitt & Zimmerman, 2002). This argument is typically based on Schmitt and Zimmerman's (2002) comparison of the descriptive statistics for the L1 and L2 learners in that study. However, the findings of the present study indicate that the differences in the ability to produce derivatives between the most proficient L2 learners and the L1 speakers may not be as large as had been considered. In fact, the results show that it is also possible that some L2 learner's productive knowledge of derivative forms can exceed that of L1 learners. The analyses revealed that the minimum score for a participant in the L1 group (25.77%) was below the means of the master's group (33.39%) and the 3000-5000 group (34.36%). Moreover, the maximum score for a L2 participant (44.77%) was higher than the mean (39.77%) for the L1 group. Moreover, further inspection of the results revealed that 72% of the master's students and 70% of the advanced vocabulary level learners were within one standard deviation from the mean of the L1 speakers (Scoring Method 1) and 70% of learners in both the master's students and the advanced vocabulary level learners were within one standard deviation from the mean of the L1 speakers (Scoring Method 2). A 2-SD threshold has been used widely as an indicator of near-nativelike proficiency (e.g., Abrahamsson, 2012) with a 1-SD threshold considered as a stricter benchmark for near-nativelike ability (Saito, 2019). Therefore, these results suggest that it is possible for L2 learners to develop productive knowledge of derivatives that is as strong as that of L1 speakers.

The different test formats in the present study and Schmitt and Zimmerman (2002) may at least partially explain why no significant difference was observed between the most proficient L2 learner groups and the L1 speaker group. The present study measured L1 and L2 knowledge with a decontextualized test while Schmitt and Zimmerman (2002) compared L1 and L2 knowledge using a contextualized test. L2 vocabulary is often learned without context through language-focused learning (Webb &

Nation, 2017), whereas L1 vocabulary is typically acquired through repeated encounters with words in context (Biemiller & Slonim, 2001). Therefore, L2 learners might have been more familiar with the test format that was used in this study, and this may have had a positive effect on their performance.

2.7 Implications

The findings provide some evidence that gaining productive knowledge of all derivative forms of a target word may not always be necessary. The present study showed that even L1 English speakers might be unable to produce many derivations. This indicates that some derivative forms may not be as useful for speech and writing as others. It might then be most useful for practitioners to select specific derivatives to introduce with target words rather than introducing all of their different derivative forms. One of the most common problems that practitioners have in teaching vocabulary is that there are too many words to teach in a limited amount of classroom time (Webb & Nation, 2017). It is therefore important to consider the usefulness of each derivative form. Given that the value of a word is typically indicated by its frequency (Dang & Webb, 2016; Nation & Waring, 1997; Zipf, 1949), it might be useful for teachers to check the frequency information of derivations online in corpora such as Mark Davies' Corpus of Contemporary American English (site: <https://www.english-corpora.org/coca/>) to get a better indication of the value of teaching the derivatives. Wordlists that have adapted word families as the unit of counting should be used with caution because some of the infrequent derivatives will not be as valuable for production as others.

The findings also indicated that learners who achieved higher levels of vocabulary knowledge were significantly better at producing derivations. This suggests that instruction may need to be tailored to the level of the learners. To achieve this, it may be useful to diagnose learners' vocabulary levels at the beginning of a program in order to provide the most appropriate teaching materials for a particular learner group. For example, the beginner, elementary, and intermediate vocabulary level learners in this study had the most difficulty in producing derivatives. This may be because they did not have a strong understanding of the regularities of English word formation (McCutchen &

Stull, 2015; Tyler & Nagy, 1989). Thus, explicit instruction of derivational rules may be particularly useful for lower level L2 learners. It may also be useful to assess the extent to which learners know derivational morphology receptively. The Word Part Levels Test (Sasao & Webb, 2017) is a useful diagnostic test that was designed to assess different degrees of receptive derivational knowledge.

The similarity in productive derivational knowledge of the most proficient L2 learners and the L1 speakers suggests that there may be little need for advanced learners to explicitly focus on developing productive knowledge of unknown derivatives. Instead there may be more value in developing this knowledge through encountering the different forms of words in L2 input. It may also be useful for teachers to ensure that advanced L2 learners are able to successfully use the derivative forms that they know in meaning-focused output activities.

Another implication of the results is that it may be more useful to elicit knowledge of derivative forms in context than out of context. The results of the present study indicated that producing derivatives without context was challenging for both L1 and L2 participants. This suggests that activities such as word parts tables in which students must fill in charts according to the different parts of speech of words may be unnecessarily difficult. Having students learn and produce derivative forms in context may enhance their ability to produce them when needed, because the presence of context may help to cue recall (van den Broek, Takashima, Segers, & Verhoeven, 2018).

2.8 Limitations and Future Research

There are three limitations to the present study. First, the results indicated that the test format was demanding. The findings showed that no L1 speakers had perfect scores on the test. The reason why advanced participants were unable to recall a lot of derivatives might have been because the test format did not provide enough information to trigger memory retrieval (van den Broek et al., 2018). The much higher scores on a contextualized derivative recall test by the L1 participants in Schmitt and Zimmerman's (2002) study indicate that the presence of context may help to cue recall of derivatives. It would be useful for future studies to investigate how the presence of contextual

information affects L1 and L2 learners' performance on a productive derivative recall test.

The second limitation is that the current study only provided a comparison of the mean scores between different participant groups (i.e., institutional and vocabulary levels). Although differences were observed in the mean scores, it is likely that other variables such as frequency (Ellis, Donnell, & Römer, 2015), and knowledge of affixes (Tyler & Nagy, 1989) affected production of derivatives. It was beyond the scope of the present research to examine these variables. However, it would be useful to examine the relationships between different factors and productive knowledge of derivative forms.

A third direction for future research would be to investigate the developmental trajectory of productive derivational knowledge in relation to other aspects of vocabulary knowledge such as form-meaning connection and collocation. Research indicates that vocabulary knowledge is acquired incrementally and that activities vary in the degree to which they contribute to different aspects of vocabulary knowledge (Webb, 2002). It would be useful to investigate the degree to which learners have receptive and productive derivational knowledge of high frequency words in relation to knowledge of form-meaning connection and collocation. This would shed greater light on L2 lexical development.

2.9 Conclusion

The present study found that L1 speakers could produce more derivatives than L2 learners. However, the most proficient L2 learners' ability to produce derivatives was statistically equivalent to that of L1 speakers. This suggests that it is possible for L2 learners to develop productive derivational knowledge that is as strong as that of L1 speakers. The findings also suggest that there is a developmental progression in the ability to produce derivative forms across institutional levels, and that this progression in knowledge tends to develop over time. Moreover, the research indicates that productive derivational knowledge is likely to increase together with receptive vocabulary knowledge. However, with relatively little research on L2 productive knowledge of derivatives, further research is warranted.

Chapter 3

3 Conclusion

This chapter provides a review of the findings, limitations and topics for future research. and implications.

3.1 Review of the findings

To what extent do L1 speakers have productive derivational knowledge?

The results revealed that L1 speakers did not produce more than half of the possible derivatives. The findings indicated that L1 speakers produced approximately 40% of all possible derivative forms, and 32% of all possible derivative forms when head words were excluded. The results also showed that L1 speakers produced at least one derivative for each part of speech of the head words in about 71% of the instances and 59% of the instances when the head words were excluded. These findings suggest that even L1 English speakers were not able to demonstrate complete knowledge of derivatives in this test.

To what extent do L2 learners have productive derivational knowledge?

In comparison, L2 learners produced approximately 25% of all possible derivative forms and 15% of all possible derivative forms when the head words were excluded. Furthermore, the findings indicated that L2 learners produced at least one derivative for each part of speech of the head words in approximately 47% of the instances and 35% of the instances when the head words were excluded. Looking at the result of all L2 learners as a whole, the findings of this study were in line with Schmitt and Zimmerman's (2000) findings, which indicated that L1 speakers have greater productive derivational knowledge than L2 learners.

To what extent does the productive derivational knowledge of L2 learners at differing institutional levels vary, and how does each group compare to L1 speakers?

The findings indicated that there were significant differences among L2 learners at different institutional levels, and between the L1 speaker group and the undergraduate

and high school groups. However, no significant difference was identified between the master's student group and the L1 speaker group.

To what extent does the productive derivational knowledge of L2 learners at differing vocabulary levels vary, and how does each group compare to L1 speakers?

In answer to the fourth research question, the results indicated that there were significant differences among the L2 learners at different vocabulary levels except between the 1000 and 2000 levels. When each vocabulary level group was compared to the L1 speaker group, the differences were all significant, except between the 3000-5000 level and the L1 speaker group.

3.2 Future Research

While this study provided some insight into L1 speakers' and L2 learners' productive derivational knowledge, there are a few limitations to this study. First, the test format the present study used might leave room for improvement in terms of its ecological validity. Second, the present study investigated the mean differences between different groups of participants only. These limitations leave some opportunities for future research.

First, it would be useful for future studies to investigate the extent to which test formats affect learners' production of derivatives. One reason why the advanced learner groups were able to perform relatively well in the test may have been because they had learnt English in an EFL context where words are commonly learnt through decontextualized practices. Because learners may perform better in a test format that they are familiar with (Webb, 2008), learners' experience might have positively influenced the results of the test. Conversely, perhaps L1 speakers were not able to come up with the derivative forms in the decontextualized test because they were not used to producing derivative forms of words out of context. Therefore, it would be useful to investigate whether decontextualized and contextualized test formats affect L1 speakers' and L2 learners' performance in producing derivatives in future research. This type of research may provide further pedagogical and methodological implications.

Another direction for future research would be to investigate the factors that affect production of derivatives. For example, the extent to which L1 and L2 learners have receptive knowledge of derivatives (McCutchen & Stull, 2015; Tyler & Nagy, 1989) and the frequency of base words and derivatives (Ellis, Römer, & O'Donnell, 2016; Ford, Davis, & Marslen-Wilson, 2010) may affect the production of derivatives.

3.3 Implications

In light of the findings summarized above, several pedagogical implications were presented in Chapter 2. The findings of this study may be useful for language teachers to consider when teaching derivatives of words and assessing L2 learners' knowledge of derivatives appropriately. The findings are also useful for researchers because they reveal (a) that we should not expect L1 or L2 learners to achieve perfect scores on a decontextualized productive derivation recall test, (b) that productive knowledge of L2 derivation may follow a similar developmental pathway as L1 development, and (c) that L2 learners can achieve a similar amount of productive derivation knowledge as L1 learners.

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Appendices

Appendix A: Western ethics approval



Date: 20 February 2019

To: Dr. Stuart Webb

Project ID: 112807

Study Title: An Investigation of Productive Derivational Knowledge

Application Type: NMREB Initial Application

Review Type: Delegated

Full Board Reporting Date: 01/Mar/2019

Date Approval Issued: 20/Feb/2019 09:48

REB Approval Expiry Date: 20/Feb/2020

Dear Dr. Stuart Webb

The Western University Non-Medical Research Ethics Board (NMREB) has reviewed and approved the WREM application form for the above mentioned study, as of the date noted above. NMREB approval for this study remains valid until the expiry date noted above, conditional to timely submission and acceptance of NMREB Continuing Ethics Review.

This research study is to be conducted by the investigator noted above. All other required institutional approvals must also be obtained prior to the conduct of the study.

Documents Approved:

Document Name	Document Type	Document Date	Document Version
Debriefing Form	Debriefing document	17/Dec/2018	1
Derivative Production Test 1 (without contextual clues)	Other Data Collection Instruments	17/Dec/2018	1
Derivative Production Test 2 (with contextual clues)	Other Data Collection Instruments	17/Dec/2018	1
Letter of Information For Learners of English	Written Consent/Assent	18/Feb/2019	3
Letter of Information For Speakers of English	Written Consent/Assent	05/Feb/2019	2
Questionnaire	Paper Survey	17/Dec/2018	1
Recruitment Poster For Participants	Recruitment Materials	05/Feb/2019	2
Verbal Recruitment Script for Learners of English	Oral Script	05/Feb/2019	2
Vocabulary Levels Test	Other Data Collection Instruments	17/Dec/2018	1
Word Part Levels Test	Other Data Collection Instruments	17/Dec/2018	1

Documents Acknowledged:

Document Name	Document Type	Document Date	Document Version
Procedure of the study	Supplementary Tables/Figures	17/Dec/2018	1

No deviations from, or changes to the protocol should be initiated without prior written approval from the NMREB, except when necessary to eliminate immediate hazard(s) to study participants or when the change(s) involves only administrative or logistical aspects of the trial.

The Western University NMREB operates in compliance with the Tri-Council Policy Statement Ethical Conduct for Research Involving Humans (TCPS2), the Ontario Personal Health Information Protection Act (PHIPA, 2004), and the applicable laws and regulations of Ontario. Members of the NMREB who are named as Investigators in research studies do not participate in discussions related to, nor vote on such studies when they are presented to the REB. The NMREB is registered

Appendix B: The number of derivative forms for each target word

Frequency	Target words	Number of derivative forms				Total
		Noun	Adjective	Verb	Adverb	
1000-word level						
	art	3	2	0	1	6
	depend	5	3	1	2	11
	arrange	2	1	1	0	4
	girl	2	2	0	1	5
	forget	1	3	1	2	7
	protect	5	3	1	1	10
	child	4	3	0	1	8
	history	3	2	0	1	6
	health	2	2	0	2	6
	possible	2	2	0	2	6
	real	5	4	1	3	13
	computer	2	0	1	0	3
	accept	2	3	1	2	8
	truth	3	4	0	3	10
	prepare	2	3	1	0	6
	beauty	2	1	1	1	5
	nature	4	3	1	3	11
	imagine	1	6	1	2	10
	probably	2	2	0	2	6
	excite	1	4	1	2	8
	hope	3	2	1	2	8
	educate	3	4	1	1	9
	consider	2	2	2	1	7
	human	4	1	1	2	8
	relate	3	3	1	1	8
	science	2	2	0	1	5
	danger	1	2	1	1	5
	discover	2	1	1	0	4
	nation	7	3	2	1	13
	suggest	2	2	1	1	6
Subtotal within 1000 word-level		82	75	23	42	222
2000-word level						
	tradition	3	1	0	1	5
	theater	2	1	0	1	4
	identity	2	2	1	0	5
	alter	1	2	1	0	4
	measure	3	5	1	2	11
	indicate	2	1	1	1	5
	active	4	1	1	1	7
	intense	3	2	1	2	8
	vary	6	4	1	3	14

polite	2	2	0	2	6
wise	2	2	0	2	6
western	4	3	1	0	8
industry	4	3	1	2	10
appreciate	1	3	1	2	7
military	4	3	1	1	9
faith	3	3	0	2	8
advice	3	3	1	1	8
observe	2	3	1	1	7
operate	2	2	1	1	6
capable	2	2	0	1	5
adapt	3	2	1	0	6
pleasant	2	3	1	3	9
introduce	1	1	1	0	3
legal	4	2	1	2	9
technology	2	1	0	1	4
success	3	3	1	2	9
oppose	2	4	1	0	7
popular	3	2	1	1	7
decorate	2	1	1	1	5
forgive	1	2	1	1	5
Subtotal within 2000 word-level	78	69	23	37	207
3000-word level					
formal	3	2	1	2	8
differ	2	1	2	1	6
publish	2	3	1	0	6
persuade	2	1	1	1	5
communicate	2	2	1	0	5
inspire	1	5	1	0	7
universe	6	2	1	1	10
behavior	4	1	1	1	7
neutral	2	1	1	1	5
academy	4	2	0	1	7
Subtotal within 3000-word level	28	20	30	38	66
4000-word level					
obsess	1	3	1	2	7
sincere	3	2	0	2	7
fatal	3	2	0	2	7
tangle	2	3	3	0	8
refine	2	2	1	0	5
diagnose	3	3	2	1	9
authentic	2	2	1	2	7
mercy	3	3	0	3	9
mediate	2	0	1	0	3
decisive	1	4	1	2	8
Subtotal within 4000 word-level	22	24	34	48	70

5000-word level					
interrogate	2	2	1	1	6
anatomy	2	2	0	1	5
plausible	2	2	0	2	6
botany	2	2	0	1	5
dispense	3	2	1	0	6
conclusive	1	2	1	2	6
commend	1	2	1	0	4
medicate	1	2	1	1	5
microscope	2	2	0	1	5
mystic	3	2	2	1	8
Subtotal within 5000 word-level	19	20	7	10	56
Total number of derivatives	229	208	73	111	621

Appendix C: Decontextualized derivative recall test

Derivative Production Test

In order to use a word to tell what you want to say, you must use an appropriate form of a word. In this test, you are asked to produce different forms of 90 English head words. In this test, you are asked to produce noun, adjective, verb, and adverb forms of a word. Here are some examples of word classes (drawn from Sasao and Webb, 2017).

- (1) *Noun*: house (My house is **old**.); water (they drink **water**.)
- (2) *Adjective*: young (He is **young**.); new (This is a **new** book.)
- (3) *Verb*: know (I **know** her.); talk (They **talk** a lot.)
- (4) *Adverb*: too (She likes it **too**.), often (He **often** plays football.)

Here is a sample question. You are asked to write each word class of *happy*. **Please write down as many forms as possible. Please indicate X when you think a word does not have a particular part of speech.**

	Noun	Adjective	Verb	Adverb
Happy				

The answers are shown below.

	Noun	Adjective	Verb	Adverb
Happy	<i>happiness</i> <i>unhappiness</i>	<i>happy</i> <i>unhappy</i>	X	<i>happily</i>

There are three sections in this test. Each test contains 30 words. You may take a break after each section.

Section 1

Time:

Participant number:

		Noun	Adjective	Verb	Adverb
1	art	art artist artistry	artistic arty	X	artistically
2	depend	dependent dependence dependency independence independency	dependable dependent independent	depend	dependably independently

		Noun	Adjective	Verb	Adverb
3	arrange	arrangement arranger	arranged	arrange	X
4	tradition	tradition traditionalist traditionalism	traditional	X	traditionally
5	theater	theater theatrically	theatric	X	theatrically
6	identity	identification identity	identifiable unidentified	identify	X
7	formal	formality informality formalization	formal informal	formalize	formally informally
8	differ	difference differentiation	different	differ differentiate	differently
9	interrogate	interrogation interrogator	interrogative interrogatory	interrogate	interrogatively
10	girl	girl girlhood	girly girlish	X	girlishly
11	forget	X	forgetful forgettable unforgettable	forget	forgetfully unforgettably

		Noun	Adjective	Verb	Adverb
12	protect	protection protector protectionism protectionist protectiveness	protected unprotected protective	protect	protectively
13	alter	alteration	alterable unalterable	alter	X
14	measure	measure measurement measurer	measurable immeasurable unmeasurable measured unmeasured	measure	measurably immeasurably
15	indicate	indication indicator	indicative	indicate	indicatively
16	publish	publisher publishing	published unpublished publishable	publish	X
17	obsess	obsession	obsessive obsessional obsessed	obsess	obsessionally obsessively
18	anatomy	anatomy anatomist	anatomic anatomical	X	anatomically
19	child	child childhood childlessness childishness	childish childless childlike	X	childishly
20	history	history historian prehistory	historic historical	X	historically

		Noun	Adjective	Verb	Adverb
21	active	act action activity inactivity	active	act	actively
22	intense	intensity intenseness intensification	intensive intense	intensify	intensively intensely
23	persuade	persuasion persuasiveness	persuasive	persuade	persuasively
24	sincere	sincerity insincerity sincereness	sincere insincere	X	sincerely insincerely
25	health	health healthfulness	healthy unhealthy	X	healthily unhealthily
26	possible	possibility impossibility	possible impossible	X	possibly impossibly
27	vary	variable variance variant variety variability variation	variable invariable various varied	vary	variably invariably variously
28	polite	politeness impoliteness	polite impolite	X	politely impolitely
29	communicate	communication communicator	communicative uncommunicative	communicate	X

		Noun	Adjective	Verb	Adverb
30	plausible	plausibility implausibility	plausible implausible	X	plausibly implausibly

This is the end of Section 1. You may take a ten-minute break.

Section 2

Time:

Participant number:

		Noun	Adjective	Verb	Adverb
1	real	realism realist reality unreality realization	real unreal realistic unrealistic	realize	really realistically unrealistically
2	computer	computer computerization	X	computerize	
3	accept	acceptance acceptation	acceptable unacceptable accepted	accept	acceptably unacceptably
4	wise	wisdom wiseness	wise unwise	X	wisely unwisely
5	western	west western westerner westernization westerly	western westernized westerly	westernize	X
6	industry	industry industrialist industrialism industrialization	industrial industrialized industrious	industrialize	industrially industriously

		Noun	Adjective	Verb	Adverb
7	inspire	inspiration	inspirational inspiring uninspiring inspired uninspired	inspire	X
8	fatal	fatalism fatalist fatality	fatal fatalistic	X	fatalistically fatally
9	botany	botany botanist	botanic botanical	X	botanically
10	truth	truth untruth truthfulness	true untrue truthful untruthful	X	truly truthfully untruthfully
11	prepare	preparation preparedness	prepared unprepared preparatory	prepare	X
12	appreciate	appreciation	appreciable appreciative unappreciative	appreciate	appreciably appreciatively
13	military	military militant militarism militarist	military Militaristic militarize	militarize	militarily
14	faith	faith faithfulness unfaithfulness	faithful unfaithful faithless	X	faithfully unfaithfully
15	tangle	tangle entanglement	entangled untangled tangled	entangle untangle tangle	X

		Noun	Adjective	Verb	Adverb
16	refine	refinement refinery	refined unrefined	refine	X
17	dispense	dispensation dispensary dispenser	dispensable indispensable	dispense	X
18	beauty	beautician beauty	beautiful	beautify	beautifully
19	nature	nature naturalist naturalism naturalness	naturalistic natural unnatural	naturalize	naturally unnaturally naturalistically
20	imagine	imagination	imaginable unimaginable imaginary imaginative unimaginative unimagined	imagine	imaginably imaginatively
21	advice	advisability advice adviser/advisor	advisable inadvisable advisory	advise	advisedly
22	universe	universe universalism universality university universalist universalization	universalistic universal	universalize	universally
23	diagnose	diagnosis misdiagnosis diagnostic	undiagnosed misdiagnosed diagnostic	diagnose misdiagnose	diagnostically
24	conclusive	conclusion	conclusive inconclusive	conclude	conclusively inconclusively

		Noun	Adjective	Verb	Adverb
25	probably	probability improbability	probable improbable	X	probably improbably
26	excite	excitement	excitable excited exciting unexciting	excite	excitedly excitingly
27	observe	observer observation	observable unobservable observational	observe	observably
28	operate	operation operator	operational operative	operate	operationally
29	capable	capability incapability	capable incapable	X	capably
30	authentic	authenticity unauthenticity	authentic inauthentic	authenticate	authentically unauthentically

This is the end of Section 2. You may take a ten-minute break.

Section 3

Time:

Participant number:

		Noun	Adjective	Verb	Adverb
1	hope	hope hopefulness hopelessness	hopeful hopeless	hope	hopefully hopelessly
2	educate	education educationalist/ educationist educator	educated uneducated educational educative	educate	educationally

		Noun	Adjective	Verb	Adverb
3	consider	consideration reconsideration	considerable considered	consider reconsider	considerably
4	adapt	adaptability adaption adaptor	adaptable adapted	adapt	X
5	pleasant	pleasantry pleasure	pleasant unpleasant pleased	please	pleasantly unpleasantly pleasingly
6	introduce	introduction	introductory	introduce	X
7	behavior	behavior misbehavior behaviorism behaviorist	Behavioral	behave	behaviorally
8	mercy	mercy mercifulness mercilessness	merciful unmerciful merciless	X	mercifully unmercifully mercilessly
9	commend	commendation	commendatory commendable	commend	X
10	human	human humanism humanity inhumanity	inhuman	humanize	humanly inhumanly
11	relate	relation relative relationship	related unrelated relative	relate	relatively

		Noun	Adjective	Verb	Adverb
12	science	science scientist	scientific unscientific	X	scientifically
13	legal	legality illegality legalization legalese	legal illegal	legalize	legally illegally
14	technology	technology technologist	technological	X	technologically
15	success	success succession successor	successful unsuccessful successive	succeed	successfully unsuccessfully
16	neutral	neutrality neutralization	neural	neutralize	neutrally
17	mediate	mediation mediator	mediate	X	X
18	medicate	medication	medical medicated	medicate	medically
19	danger	danger	endangered dangerous	endanger	dangerously
20	discover	discoverer discovery	discoverable	discover	X

		Noun	Adjective	Verb	Adverb
21	oppose	opposition opposite	opposed unopposed opposing opposite	oppose	X
22	decisive	decision	decisive decided undecided indecisive	decide	decisively indecisively
23	microscope	microscope microscopy	microscopic microscopical	X	microscopically
24	nation	nation nationalism nationalist national nationality nationalization nationhood	national nationalistic nationalized	nationalize	nationally
25	suggest	suggestion suggestiveness	suggestive suggestible	suggest	suggestively
26	popular	popularity unpopularity popularization	popular unpopular	popularize	popularly
27	decorate	decoration decorator	decorative	decorate	decoratively
28	forgive	forgiveness	forgiving unforgiving	forgive	unforgivably
29	academy	academy academic academia academician	academic unacademic	X	academically

		Noun	Adjective	Verb	Adverb
30	mystic	mystic mysticism mystification	mystical mystic	mystify demystify	mystically

This is the end of Section 3.

This is the end of the test.

Curriculum Vitae

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