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Roles of L1 and L2 Derivational Morphological Awareness in L2 Reading Through the Mediation of L2 Vocabulary Knowledge

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The present study aims to explore the direct and indirect contribution of L1 and L2 derivational morphological awareness of Korean EFL high school and university students to their reading comprehension in L2 through the mediation of L2 vocabulary knowledge by using structural equation modeling analysis. Eighty-five high school and eighty-two university students were assessed on their Korean L1 and English L2 derivational morphological awareness and English L2 reading comprehension and vocabulary knowledge. The results of the study present a significant direct contribution of L2 derivational morphological awareness and L2 vocabulary knowledge to L2 reading comprehension. The contribution of L2 derivational morphological awareness appeared larger than L2 vocabulary knowledge, which suggests a relatively more important role of the former than the latter in L2 reading comprehension. They also reveal a significant indirect contribution of L1 derivational morphological awareness via L2 derivational morphological awareness to L2 reading comprehension but not that of L2 derivational morphological awareness via L2 vocabulary knowledge. Findings from the study suggest potential benefits of cross-linguistic transfer of derivational morphological knowledge as well as of L2 derivational morphology intervention in L2 reading development.

Keywords: morphological awareness, reading comprehension, vocabulary knowledge, cross-linguistic transfer, second language, English as a foreign language

Introduction

L2 reading is influenced by diverse factors including reader variables such as L2 vocabulary knowledge or text variables such as topics and linguistic difficulty (Alderson, 2000). A reader factor which recently has gained attention is L2 morphological knowledge (Jeon, 2011; Kieffer & Lesaux, 2012; Zhang & Koda, 2012), as the role of L1 morphological awareness has been revealed in L1 reading (Carlisle, 2000; Ku & Anderson, 2003; Leong, 1989; Nagy, Berninger, & Abbott, 2006). Morphological awareness is readers' "conscious awareness of the morphemic structure of words and their ability to reflect on and manipulate that structure" (Carlisle, 1995, p. 194). It includes awareness of inflectional (e.g., the plural ending *-s* in *books*), derivational (e.g., the suffix *-ful* in the adjective form *useful* of the noun *use*), and compounding morphology (e.g., the combination of *green* and *house* in the word *greenhouse*).

According to Kuo and Anderson (2006), morphological awareness has a strong relationship with reading in three aspects. First, morphological awareness is related to metalinguistic capability since morphemes provide syntactic and semantic information as well as phonological information. Next, adult readers' mental lexicon is morphologically organized, which implies morphological awareness may expand efficient word storage. Third, morphological awareness may "provide readers additional insight into the writing system" (Kuo & Anderson, 2006, p. 163).

While morphological awareness includes awareness of inflectional, derivational, and compounding morphology, derivational morphological awareness has been recognized as a significant factor influencing word reading or reading comprehension in L1 and L2 (Carlisle, 2000; Jeon, 2011; Kieffer & Lesaux, 2012; Nagy et al., 2006). Its importance has also been reported in the study of vocabulary knowledge growth in L1 (Anglin, 1993; Carlisle & Fleming, 2003; Ku & Anderson, 2003). The majority of studies on the role of derivational morphological awareness in L1 reading have explored children's morphological awareness (Carlisle, 2000; Kirby, Deacon, Bowers,

Izenberg, Wade-Woolley, & Parrila, 2012). The results of such studies, however, may not be valid in L2 reading context due to differences between L1 and L2 readers in terms of ages, cognitive development, affective aspects, sociocultural context, and linguistic backgrounds.

Compared to L1 studies, a limited number of L2 studies have explored the role of derivational morphological awareness in L2 reading. They have mainly examined young learners or adolescents (Jeon, 2011; Koda, 2000; Lam, Chen, Geva, Luo, & Li, 2012; Wang, Ko, & Choi, 2009; Zhang & Koda, 2013). The previous studies have not provided conclusive evidence to reveal the contribution of L2 derivational morphological awareness to L2 reading comprehension nor explored the script-dependency of morphological awareness and the contribution of both L1 and L2 derivational morphological awareness to L2 reading. Older L2 learners with a highly developed understanding of the functions and distributional properties of derivational affixes in L1 may benefit from their L1 morphological awareness in understanding L2 morphology, which could lead to enhancing their L2 reading ability. The influence of L1 morphological experience on L2 morphological awareness has been suggested in Ramirez, Chen, Geva, and Luo's (2011) comparison of young Chinese and Spanish ESL learners. Cross-linguistic transfer of derivational morphological awareness has also been observed in alphabetic languages with rich derivational morphology, as the transfer of Spanish to English found in Ramirez, Chen, Geva, and Kieffer (2010). English and Korean are both alphabetic languages, rich in derivational morphology and have structurally and functionally comparable morphological systems, though English is a fusional (morphologically opaque) language and Korean is an agglutinative (morphologically transparent) language[1] (Koda, 2000; Marinova-Todd, Siegel, & Mazabel,

[1] Fusional and agglutinative languages are two ends of a continuum of synthetic language. A fusional language is morphologically opaque in that attachment of affixes to a morpheme causes phonological and orthographical alteration and a single affix may carry several meanings. On the other hand, an agglutinative language is morphologically transparent with fewer irregular forms. For example, the Korean language has a small number of irregular forms of conjugation and non-

2013; Payne, 1997). Therefore, the current study aims to examine the contribution of Korean L1 and English L2 derivational morphological awareness to English L2 reading of older learners, more specifically, Korean EFL high school and university students' derivational morphological awareness in both L1 and L2 to reading comprehension in L2. Moreover, the study explores the roles of L1 and L2 morphological awareness through the mediation of vocabulary knowledge, as the relation of morphological awareness and vocabulary knowledge in L1 and L2 reading has been suggested in previous research (Kieffer & Lesaux, 2012; Nagy, 2007; Zhang & Koda, 2012).

Morphological Awareness in L1 and L2 Reading

As factors affecting reading have been gaining more attention over the years, the unique contributions of morphological awareness on reading comprehension have widely been researched (Carlisle, 2000; Nagy et al., 2006). Studies in both alphabetical and non-alphabetical languages have illustrated that morphological awareness is a factor influencing reading in L1. The studies on an alphabetic language, English (e.g., Guo, Roehrig, & Williams, 2011; Kirby et al., 2012), have revealed that word structure awareness is closely related to defining and reading complex words, as shown in the relationship among children's English derivational words, word structure awareness, word reading ability and reading comprehension in Carlisle (2000). Studies in reading in Korean, another alphabetical language, have also shown that morphological awareness is related to reading (Cho,

neutral derivational suffixes. A word may have multiple morphemes (a stem with a few affixes), but each morpheme remains unchanged and it is easy to infer the meaning of the word from the morphemes (Payne, 1997). Morphological transparency is a relative concept. English is more morphologically opaque than Korean or Filipino but more morphologically transparent than Arabic or Chinese, in terms of the phonological structure of a derived word recoverable from its morphological structure (Saiegh-Haddad & Geva, 2008).

Chiu, & McBride-Chang, 2011; Kim, 2010). Cho et al. (2011), who examined 81 Korean children, found a close relationship between morphological awareness and the children's reading skills. Other alphabetical language studies such as French (e.g., Casalis, Deacon, & Pacton, 2011) and Dutch (e.g., Rispense, McBride-Chang, & Reitsma, 2008) also have supported the relationship between morphological awareness and reading in L1. Not only in alphabetical languages but also in non-alphabetical languages, such as Chinese, morphological awareness has been found to be essential in reading (Li, Anderson, Nagy, & Zhang, 2002; Wang, 1999). For example, Li et al. (2002) assessed 400 Chinese L1 first-graders' and 400 Chinese L1 fourth-graders' morphological awareness to examine its role in learning to read Chinese. Findings from the study illustrated that morphological awareness played a greater role than phonological awareness in Chinese L1 reading development.

Although a majority of existing L1 studies mainly deal with children, a few studies exploring older learners such as adolescents (middle- or high-schoolers) and adults (Guo et al., 2011; Kieffer, 2013; Nagy et al., 2006) have revealed similar results with studies of children, further suggesting the need for morphological awareness instruction. However, most of these studies have targeted learners with low proficiency, making it difficult to generalize the results to ordinary older learners. Hence, L1 studies of the relations between morphological awareness and reading comprehension seem limited to children with a focus on word-level reading, making results lopsided in terms of research subject selections and the level of reading assessed.

In comparison to the vast pool of L1 studies, the relations between morphological awareness and reading comprehension have not been a main research area of L2 studies. In addition to the scarce amount of L2 studies, another limitation of previous studies is that, similar to L1 research, L2 studies have usually tracked young learners or adolescents rather than adults (Cho & Tong, 2014; Jeon, 2011; Koda, 2000; Lam et al., 2012; Zhang & Koda, 2012). A few studies have dealt with L2 adult learners in passage-level

reading. Zhang and Koda (2012) examined advanced university-level Chinese EFL students with a focus on derivational morphology. The results revealed only the indirect contribution of L2 derivational morphological awareness to L2 passage-level reading through the mediation of vocabulary knowledge and the multiple mediations of vocabulary knowledge and lexical inferencing ability.

Despite the significance and rising interest in morphological awareness and reading comprehension in L1 and L2, the effect of learners' morphological awareness on L2 reading comprehension has yet to be further researched in consideration of learners' morphological awareness in L1 as well as in L2. In other words, only a limited amount of research (e.g., Cho & Tong, 2014; Wang et al., 2009) has examined the relations between learners' L1 and L2 morphological awareness and reading comprehension. Other studies on L1 or L2 morphological awareness have indicated that language itself could be one of the affecting variables in the relations between morphological awareness and reading comprehension (Carlisle, 2000; Marinova-Todd et al., 2013). Kuo and Anderson (2006) have stated that morphological awareness is language-specific; Carlisle (2000) pointed out language variations in terms of morphological transparency (the extent to which affixes cause phonological or orthographical changes) and productivity (the extent to which affixes can be attached to base words). Moreover, Marinova-Todd et al. (2013) have noted that the relationship between morphological awareness and reading tends to appear stronger in morphologically transparent languages, such as Kore86an, Filipino, and Persian, and have suggested that the morphological structure of the ESL or EFL language learners' L1 should be tested as well. Since children exposed to agglutinative (morphologically transparent) languages, such as Korean, would likely have different morphological awareness skills than those with orthographically fusional (morphologically opaque) language backgrounds like English, it would be necessary to examine L2 learners with different L1 backgrounds when comparing L2 reading. Marinova-Todd et al. (2013) have also stated that readers' L1 could have an effect on their L2 reading in

consideration of morphological awareness, though they have not measured L1 morphological awareness. It could thus be assumed that L1 morphological awareness affects L2 reading or that morphological awareness has a cross-linguistic effect on L2 learners. Studies on Korean EFL learners which explore the role of their Korean L1 morphological awareness in English L2 reading comprehension remain scarce. The majority of the cross-linguistic transfer studies on Korean students have dealt with young learners (e.g., Wang et al., 2009), except for Cho and Tong's (2014) study of Korean EFL ninth graders and their Korean, English, and Chinese abilities. Further studies are needed in consideration of Korean L1 and English L2 morphology in English L2 reading to shed light on the role of Korean EFL learners' L1 and L2 morphological awareness in their L2 reading comprehension.

In addition to language-related factors, including transparency and productivity of derivational morphology, researchers have also suggested high possibilities of cross-linguistic morphological awareness transfer and have illustrated it as an essential issue to be considered (Koda, 2000; Kuo & Anderson, 2006; Hayashi & Murphy, 2013; Marinova-Todd et al., 2013; Zhang, 2013). Specifically, Koda (2000) examined the effects of L1 processing experience on L2 morphological awareness in word reading with two groups of adult EFL learners of different L1 backgrounds. She investigated morphological awareness and word reading but did not manage to cover passage-level reading comprehension. According to the findings, the development of L2 morphological awareness seemed to be influenced by L1 morphology in specific and predictable ways. Evidence of morphological awareness transfer from one language to another was also found in a study by Wang, Cheng, and Chen (2006), who explored the contribution of morphological awareness in young Chinese ESL learners' Chinese-English acquisition in terms of reading ability. Furthermore, Cho and Lee (2010) investigated the cross-language transfer of morphological awareness in 107 young Korean EFL students and found that Korean morphological awareness predicts word reading in English. However, this study measured awareness of compounding morphology rather than derivational morphology. Researchers

have concluded the importance and necessity of further research considering cross-linguistic morphological awareness transfer due to the high possibility of the transfer, even across typologically different or linguistically distant languages (Hayashi & Murphy, 2013; Zhang, 2013). Nonetheless, few studies except for Cho and Tong (2014) have focused on the cross-linguistic transfer of derivational morphological awareness of older L2 learners, such as adolescents or adults, whose L1 morphological awareness has been highly developed and the effect of such a transfer in L2 passage-level reading comprehension.

Vocabulary knowledge has also been gaining attention as one of the mediating factors which may affect learners' reading comprehension in relation to learners' morphological awareness (Guo et al., 2011; Ramirez et al., 2010; Zhang & Koda, 2012). Guo et al. (2011) did not find a significant effect of morphological awareness on reading comprehension of English L1 university students via vocabulary knowledge, unlike L1 studies of children (Carlisle & Fleming, 2003; Leong, 1989). They measured awareness of inflectional morphology rather than derivational morphology, though the latter is assumed to be more significantly related to reading comprehension than the former in English (Carlisle, 2000; Kuo & Anderson, 2006). A few of the existing L2 studies have examined learners' L1 morphological awareness, L2 vocabulary knowledge, and L2 reading abilities. Specifically, Ramirez et al. (2010) examined the effect of L1 morphological awareness on L2 word reading and a cross-linguistic morphological awareness transfer from Spanish to English. Previous studies, however, have only studied the effect of L1 morphological awareness and vocabulary knowledge on L2 word reading, leaving the effect on passage-level reading comprehension yet to be discovered. Thus, further research using L2 passage-level reading comprehension is needed.

The relations between L2 morphological awareness, L2 vocabulary knowledge, and L2 reading have also been researched (Jeon, 2011; Kieffer & Lesaux, 2012; Lam et al., 2012; Qian, 1999). The influence of L2 morphological awareness on L2 vocabulary knowledge or L2 reading

comprehension has been of main interest. Jeon (2011) investigated the effects of L2 morphological awareness on the EFL reading comprehension of 10th graders in Korea. The results indicate that L2 morphological awareness has an effect on either L2 vocabulary knowledge or L2 reading comprehension and that L2 morphological awareness, especially derivational morphological awareness, plays a crucial role in L2 reading comprehension. This study did not explore the direct and indirect contribution of L2 morphological awareness in L2 reading using structural equation modeling (SEM). Previous studies have also mainly targeted children or adolescents, suggesting the necessity for further research that examines adult learners. As Anglin (1993) illustrated that morphology becomes more important as contact with academic texts increases, it is necessary that more attention be given to morphological awareness in L2 reading among older readers. Thus, the present study purposes to examine the direct and indirect contribution of L1 and L2 derivational morphological awareness to reading comprehension, mainly focusing on Korean EFL high school and university students.

Recently, an increasing number of L2 reading researchers have explored the direct and indirect roles of morphological awareness in consideration of L2 vocabulary knowledge. The effects of morphological awareness on vocabulary knowledge or L2 reading comprehension and cross-linguistic morphological awareness transfer have been researched (Kieffer & Lesaux, 2012; Zhang & Koda, 2012). Specifically, Kieffer and Lesaux (2012) examined 952 sixth grade students with diverse L1 backgrounds and found that L2 morphological awareness had a significant direct contribution to L2 reading comprehension and a significant indirect contribution to L2 reading comprehension via L2 vocabulary knowledge. However, the study still has limitations in that they did not explore the effect of L1 morphological awareness. Hence, the role of L1 morphological awareness on L2 reading comprehension via L2 morphological awareness or L2 vocabulary knowledge itself needs further investigation.

Although previous studies have attempted to study the direct and indirect roles of L2 morphological awareness on L2 reading comprehension using the

SEM, none of the studies examined all of the essential variables which should be considered in the relations of morphological awareness to reading comprehension. Since it has been noted from previous studies that both L1 and L2 morphological awareness can affect L2 reading comprehension or L2 vocabulary knowledge, the present study aims to examine the contributions of L1 and L2 derivational morphological awareness on passage-level L2 reading comprehension including the mediating effect of L2 vocabulary knowledge by using the SEM.

Research Method

Research Questions

The present study purposes to investigate the roles of L2 older learners' awareness of L1 and L2 derivational morphology in L2 reading comprehension and the mediation roles of L2 vocabulary knowledge. The study addresses the following research questions.

1) Does Korean EFL learners' derivational morphological awareness in L1 and L2 have a direct contribution to L2 vocabulary knowledge? Does their L1 derivational morphological awareness have an indirect contribution to L2 vocabulary knowledge through the mediation of L2 derivational morphological awareness?
2) Does Korean EFL learners' derivational morphological awareness in L1 and L2 have a direct contribution to L2 reading comprehension? Does their L1 and L2 derivational morphological awareness have an indirect contribution to L2 reading comprehension through the mediation of L2 vocabulary knowledge?

Participants

The subjects of the study included 168 Korean EFL students: 85 high school students (41 first-year and 44 second-year students) were recruited from a girls' high school and 83 first-year university students were recruited from two women's universities. These high school and university students were selected to ensure a wide range of L2 competence. They were categorized as 'older learners,' in comparison to 'younger learners,' which include primary- and middle-schoolers, assuming that the former would have more developed L1 morphological awareness than the latter. The university students were of diverse disciplines: humanities (26), social science (30), science (9), engineering (13), and art and physical education (5).

Measures

Derivational morphological awareness measures were constructed to assess relational, syntactic, and distributional knowledge in Korean L1 and English L2. Vocabulary measures were developed to assess English L2 vocabulary size and depth knowledge. Finally, an English L2 reading comprehension test was constructed.

Measures of derivational morphological awareness

Derivational morphological awareness measures included an independent measure of relational, syntactic, and distributional knowledge, since derivational morphological knowledge comprise three kinds of knowledge: relational, syntactic, and distributional (Kuo & Anderson, 2006; Tyler & Nagy, 1989).[2] A set of three measures was constructed in Korean L1 as well

[2] Relational knowledge refers to "the ability to recognize the stem of morphologically complex words and understand the relationship between the stem and the suffix," for example, the understanding that the stem of *teacher* is *teach*. Syntactic knowledge is the ability to recognize the "part-of-speech produced by derivational suffixes" (Kuo & Anderson, 2006, p. 166), that is, understanding "the syntactic

as English L2. A real word segmentation task, that is, extracting the base from a derived word (Casalis & Louis-Alexandre, 2000), was constructed to assess the relational knowledge of derivational morphology. It was adapted from a decomposition task in Carlisle (2000). For instance, the stem *improve* is identified in the given derived word *improvement*. The L2 task contained 40 derived words selected from 140 derived words on the basis of the vocabulary list of the national secondary school English curriculum (MEST, 2011), the National English Ability Test, high school English textbooks, and the list of the 5,000 most frequent words (www.wordfrequency.info/top5000.asp). The derived words selected were reviewed by two high school English teachers and two freshmen English course instructors to examine their students' awareness of the suffixes as well as the difficulty of the words. The derived words with the suffix *-ify* were excluded since they are beyond high school English. Forty derived words were selected by controlling the proportion of two classes of derivational suffixes (neutral or non-neutral).

Twenty derived words had neutral suffixes and twenty derived words had non-neutral suffixes. The two classes of suffixes are differentiated by their degree of productivity or constraint, phonological or orthographical alteration, and semantic transparency. Neutral suffixes such as *-ful* and *-ly* are assumed easy to learn since they do not cause phonological changes in the stem including stress and vowel changes; they are frequently used and attached to a wide range of words (high productivity); and the meaning of the derived word is predictable from that of the stem (semantic transparency) (Carlisle, 2000; Kuo & Anderson, 2006; Tyler & Nagy, 1989). Non-neutral suffixes such as *-ity* and *-tion* are assumed to be difficult to learn because they cause form or phonological alteration and they are often semantically less transparent, less frequently used, and attached to a limited number of base words. The Korean version of the segmentation task also contained 40

information encoded in derivational suffixes" (Kuo & Anderson, 2006, p. 167). Distributional knowledge is the ability to understand "how affixes are constrained by the syntactic category of the stems they attach to" (Kuo & Anderson, 2006, p. 166). For example, it is the knowledge that the suffix *-ful* attaches to nouns such as *use*, *harm*, and *wonder* but not to verbs such as *agree*, *paint*, and *swim*.

derived words with suffixes such as *-ggun* (similar to *-er* in English) and *-lop* (similar to *-ful* in English). The words were selected by controlling their degree of productivity or constraint and word frequency (Gwak, 2011; Kim, 2003); however, the selection criteria were different from those for the English derived words because of linguistic system variations. The majority of the suffixes were the ones that do not cause phonological or orthographical alteration. For scoring, if the base was extracted from the given derived word correctly in an item, one point was given. A half point was given for misspelled answers. In the item of *conclusion*, for example, one point was given for the correct answer such as *conclude*, while a half point was given for a misspelled answer such as *concluse*. The maximum score in each language was 40.

The second measure was a sentence grammatical judgment task to assess the syntactic knowledge of derivational morphology, adapted from Nagy, Diakidoy and Anderson (1993). The task consisted of 40 sentences with a derived word underlined, which needed to be judged as grammatical or ungrammatical. Twenty sentences were grammatically correct; the other twenty were ungrammatical because of the syntactically wrong usage of a derived word such as *skillful* in the sentence *The skillful for cooking should be practiced*. The grammatically correct and incorrect sentences were randomly ordered. For the English L2 task, the suffixes and the derived words were selected with the criteria used for the segmentation task: word frequency and syllable length, semantic transparency, and phonological or orthographical alteration. The difficulty of the task was controlled by balancing the portion of neutral and non-neutral suffixes. Each item consisted of an English sentence with a derived word and the Korean translation to provide the meaning of the given sentence since the task targeted assessing the syntactic knowledge of derivational morphology rather than understanding the meaning of the sentence. The Korean version was parallel to the English version; it was created through the same procedure. It contained 40 sentences including 20 sentences with the correct or incorrect usage of derivational morphology, respectively. For example, the following

sentence is ungrammatical because of the syntactically wrong derived word. The underlined derived word must be an adjective with the suffix *-ha* (*-ha-n*), not an adverb with the suffix *-hi*. For scoring, one point was given for a correct answer. The maximum score of the L1 or L2 task was 40.

> 타지에서는 돈 없는 가난히 신세가 될 수 있다.
> Taji-eyseo-neun don eop-neun ganan-hi sinsey-ga deoyl su it-da.
> In foreign countries, we can easily become poor.

The third measure was a word production task to assess the distributional knowledge of derivational morphology. It required writing all the derived words for the prompt word with the given suffixes presented in alphabetical order. It was adapted from a task constructed in Schmitt and Meara (1997). The English version included 20 prompt words provided with 16 suffixes including the neutral suffixes *-able*, *-er*, *-ful*, and *-ly* and the non-neutral suffixes *-al*, *-ity*, *-ive*, and *-tion*. The prompt words such as *use* and *direct* were selected with a consideration of the number of their derived words. The responses of the task were scored by giving two points for each correct derived word and deducting one point for each incorrect derived word (e.g., *agreely*) and a half point for a misspelled derived word (e.g., *inventer*). The derived words with more than one suffix such as *carelessness* were excluded in scoring. The maximum score was 142 points. The Korean version was parallel to the English version. The maximum score was 136 points. As in the English version, the responses of the Korean version were scored by giving two points for each correct derived word and deducting one point for each incorrect derived word (e.g., 변덕꾼 *byeondeok-ggun* for 변덕쟁이 *byeondeok-jaengi*) and a half point for a misspelled derived word (e.g., 장난꾸러미 *jangnan-ggureomi* for 장난꾸러기 *jangnan-ggureogi*). The derived words with a Sino-Korean suffix which has the same spelling with a Korean suffix such as *-gi* were excluded in scoring such as 장난기 *jangnan-gi* (meaning playfulness).

Measures of L2 vocabulary size and depth knowledge

Two types of vocabulary knowledge tests were developed to measure the size and depth of L2 vocabulary knowledge. The measure of vocabulary size was a 10-minute definition task of 50 L2 words in which the meaning of each word must be written in an L1 word. The words were selected from Nation's Vocabulary Levels Test (1990) with a reference to the vocabulary list of the national secondary school English curriculum (MEST, 2011) such as *fill*, *integrate*, *offer*, and *restrict*. Their difficulty was examined by the two high school English teachers and the two freshmen English course instructors who reviewed the words of the morphological awareness tasks. For scoring, one point was given for each correct answer; the maximum score was 50 points. If an incorrect part of speech was written, for example, the meaning of the verb *restrict* was written in an L1 noun form, a half point was given. No point was deducted for a spelling error which did not cause a meaning change such as 고채 *gochae* for 고체 *gochey* as the meaning of *solid*.

The measure of vocabulary depth knowledge was constructed on the basis of Read's (1993, 1998) Word Associates Test (WAT), which measures two aspects: word meaning and word collocation. It was a 20-minute test of 30 items. Each item contained one stimulus word, which was an adjective, a box of four adjectives from which one to three synonyms needed to be selected, and another box of four nouns from which one to three nouns could collocate with the target adjective, as shown below.

3. *Funny*

① comic ② humorous ③ mild ④ wise	⑤ books ⑥ jokes ⑦ nation ⑧ poverty

29. *Adjacent*

① close ② genuine ③ nearby ④ private	⑤ plans ⑥ property ⑦ silence ⑧ suburbs

The directions specified four correct choices per item but not the number

of correct choices per box. The word meaning subtest had a total of 58 correct answers; the word collocation subtest had that of 62 answers. In scoring, one point was given for each answer marked; each correct answer was awarded one point; and one point per incorrect answer or answer unmarked was deducted. For example, if three answers were marked and two of the answers were correct, three points were given for the three answers marked; two points were given for the two correct answers; one point was deducted for the incorrect answer; and one point was deducted for an answer unmarked, totaling a score of three. The maximum score per item was 8 points; the maximum score of the word meaning subtest for the 30 items was 116 points and that of the word collocation subtest was 124.

L2 reading comprehension test

A multiple-choice reading comprehension test was constructed to measure L2 reading ability including inferential (e.g., identifying the gist and filling in the missing information) and factual understanding skills. It consisted of 20 four-choice questions: four factual understanding questions and 16 inference questions. It contained 15 passages, 92 to 229 words, with an average length of 140.67 words. The passages were selected from the national English tests from 2006 to 2011; however, the questions were constructed for the present study. The test consisted of 11 passages with one question per passage, three passages with two questions per passage, and one passage with three questions. The difficulty of the test was examined by the two high school and university English instructors. It was a 20-minute test. For scoring, one correct answer was awarded one point; the maximum score was 20.

Data Collection and Analysis Procedures

The tests were administered over two days. First, the three types of the L2 derivational morphology awareness tasks were administered. These were followed by the L1 tasks. On the second day, the two vocabulary tests and the

reading comprehension test were administered.

The tests were scored by two research assistants, who were English Education MA students. Scoring reliability was calculated for the open-ended task or test: L1 and L2 derivational morphological awareness measures of relational and distributional knowledge and the test of L2 vocabulary size and depth knowledge. The reliability ranged from .914 to .999.

The data of the study was analyzed by calculating correlations between all the observed variables such as L2 morphological awareness of relational knowledge and using the structural equation modeling (SEM) method. SEM analysis was conducted to estimate the direct and indirect contributions of L1 or L2 derivational morphological awareness to L2 reading comprehension and the mediation effect of vocabulary knowledge. A two-step modeling approach was used with AMOS 20.0: the measurement model and the structural model. The measurement model designates the relationships between latent variables (unobserved variables) and observed variables (indicators). In the study, four latent variables were hypothesized: L1 and L2 derivational morphological awareness, L2 vocabulary knowledge, and L2 reading comprehension ability. Each latent variable consisted of its own observed variables (see Table 1 and Figure 1). The model was tested using confirmatory factor analysis to verify whether the observed variables were adequate indicators of the latent variables, for example, whether L2 vocabulary size was a good indicator of L2 vocabulary knowledge. The structural model identifies the relationship among latent variables to describe whether a significant relationship exists between the variables (McDonald & Ho, 2002). In the study, the model was assessed to investigate relationships – direct, indirect and total relationships – among the four latent variables.

Results and Discussion

Descriptive Statistics and Correlation Analysis

As a preliminary step, descriptive statistics, including the means and standard deviations of the observed variables, were examined. Then the correlations among the variables were investigated (see Table 1). The correlations were all positive; those among the L2 variables were high.

TABLE 1
Descriptive Statistics and Correlations of the Observed Variables

		1	2	3	4	5	6	7	8	9	10	11
1	L2 DMA-R	—										
2	L2 DMA-S	.565***	—									
3	L2 DMA-D	.533***	.720***	—								
4	L1 DMA-R	.023	.108	.118	—							
5	L1 DMA-S	.331***	.207**	.244**	.016	—						
6	L1 DMA-D	.139	.286***	.310***	.286***	.160*	—					
7	L2 VS	.492***	.602***	.657***	.138	.121	.342***	—				
8	L2 VDsyn	.415***	.539***	.625***	.115	.191*	.289***	.721***	—			
9	L2 VDcollocation	.380***	.516***	.585***	.123	.173*	.328***	.672***	.913***	—		
10	L2 RFactU	.405***	.613***	.566***	.144	.173*	.337***	.561***	.545***	.560***	—	
11	L2 RInfU	.490***	.678***	.742***	.164*	.126	.345***	.756***	.680***	.664***	.652***	—
M		37.32	34.28	57.20	34.22	37.86	67.38	25.39	74.14	83.60	2.67	8.91
SD		2.68	5.67	17.30	4.23	2.07	13.90	14.92	21.26	24.60	1.04	3.87
Maximum score		40	40	142	40	40	136	50	116	124	4	16

Note. L2 DMA-R = L2 derivational morphological awareness of relational knowledge; L2 DMA-S = L2 derivational morphological awareness of syntactic knowledge; L2 DMA-D = L2 derivational morphological awareness of distributional knowledge; L1 DMA-R = L1 derivational morphological awareness of relational knowledge; L1 DMA-S = L1 derivational morphological awareness of syntactic knowledge; L1 DMA-D = L1 derivational morphological awareness of distributional knowledge; L2 VS = L2 vocabulary size; L2 VDsyn = L2 vocabulary depth

knowledge (word meaning); L2 VDcollocation = L2 vocabulary depth knowledge (word collocation); L2 RFactU = L2 factual understanding; L2 RInfU = L2 inferential understanding. * $p < .05$, ** $p < .01$, *** $p < .001$

L2 derivational morphological awareness of relational, syntactic, and distributional knowledge was significantly correlated with each other and all the other variables, except for L1 derivational morphological awareness of relational knowledge. No significant correlation was found between L2 and L1 derivational morphological awareness of relational knowledge. The correlations among L1 derivational morphological awareness of relational, syntactic, and distributional knowledge were not as high as those of L2 derivational morphological awareness measures. L1 derivational morphological awareness of relational knowledge was significantly correlated with L1 derivational morphological awareness of distributional knowledge and L2 inferential understanding, while L1 derivational morphological awareness of distributional knowledge was significantly correlated with all the variables except for L2 derivational morphological awareness of relational knowledge. L1 derivational morphological awareness of syntactic knowledge was significantly correlated with the other variables except for L1 derivational morphological awareness of relational knowledge, L2 vocabulary size, and L2 inferential understanding. L2 vocabulary size and depth knowledge were significantly correlated with each other; the correlation between the two variables of L2 vocabulary depth knowledge was very high. The three variables of L2 vocabulary knowledge had a significant correlation with the other variables except for L1 derivational morphological awareness of relational knowledge. L2 factual and inferential understanding had a significant correlation with all the variables, except for L1 derivational morphological awareness of relational and syntactic knowledge.

Confirmatory Factor Analysis

For confirmatory factor analysis, a four-factor measurement model was devised as shown in Figure 1. The first and second latent variables were L1 and L2 derivational morphological awareness; each variable had three observed variables: derivational morphological awareness of relational, syntactic, and distributional knowledge. L1 derivational morphological awareness of syntactic knowledge was eliminated from the analysis because its measurement error was large. Thus, L1 derivational morphological awareness had two observed variables, namely L1 derivational morphological awareness of relational knowledge and distributional knowledge. The third latent variable, L2 vocabulary knowledge, included three observed variables: vocabulary size, word meaning, and word collocation. The fourth latent variable was L2 reading comprehension, which had two observed variables: factual and inferential understanding.

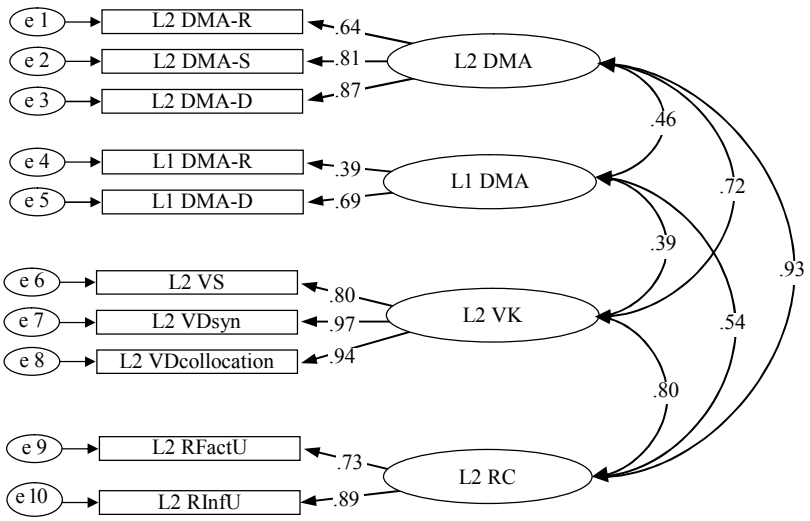

Figure 1. Measurement model with factor loadings in standardized regression weights.

Table 2 shows the factor loadings, *t*-value and R^2 of each observed variable in terms of standardized regression estimates for the measurement model. For L2 derivational morphological awareness, the three variables were found to be well loaded on the latent variable: L2 derivational morphological awareness of relational knowledge (β = .637, p < .001); L2 derivational morphological awareness of syntactic knowledge (β = .814, p < .001); and L2 derivational morphological awareness of distributional knowledge (β = .869,

TABLE 2
Parameter Estimates of the Measurement Model for Confirmatory Factor Analysis

Paths			β	p	R^2
L2 DMA-R	←	L2 DMA	.637	< .001	.41
L2 DMA-S	←	L2 DMA	.814	< .001	.66
L2 DMA-D	←	L2 DMA	.869	< .001	.76
L1 DMA-R	←	L1 DMA	.387	.014	.15
L1 DMA-D	←	L1 DMA	.694	< .001	.48
L2 VS	←	L2 VK	.796	< .001	.63
L2 VDsyn	←	L2 VK	.972	< .001	.94
L2 VDcollocation	←	L2 VK	.940	< .001	.88
L2 RFactU	←	L2 RC	.894	< .001	.80
L2 RInfU	←	L2 RC	.730	< .001	.53

Note. L2 DMA-R = L2 derivational morphological awareness of relational knowledge; L2 DMA-S = L2 derivational morphological awareness of syntactic knowledge; L2 DMA-D = L2 derivational morphological awareness of distributional knowledge; L1 DMA-R = L1 derivational morphological awareness of relational knowledge; L1 DMA-S = L1 derivational morphological awareness of syntactic knowledge; L1 DMA-D = L1 derivational morphological awareness of distributional knowledge; L2 VS = L2 vocabulary size; L2 VDsyn = L2 vocabulary depth knowledge (word meaning); L2 VDcollocation = L2 vocabulary depth knowledge (word collocation); L2 RFactU = L2 factual understanding; L2 RInfU = L2 inferential understanding.

$p < .001$). L2 derivational morphological awareness explained about 41% of the variance in relational knowledge, 66% of the variance in syntactic knowledge, and 76% of the variance in distributional knowledge. The factor loading of L1 derivational morphological awareness of relational and distributional knowledge was $\beta = .387$ and $\beta = .694$, respectively. L1 derivational morphological awareness explained about 15% and 48% of the variances in these two observed variables. L2 vocabulary size ($\beta = .796$, $p < .001$), L2 word meaning ($\beta = .972$, $p < .001$), and L2 word collocation ($\beta = .940$, $p < .001$) were well loaded on L2 vocabulary knowledge. L2 vocabulary knowledge explained about 63% of the variance in vocabulary size, 94% of the variance in word meaning, and 88% of the variance in word collocation. L2 factual understanding was found to be well loaded for L2 reading comprehension with a factor loading of $\beta = .894$. L2 reading comprehension explained about 80% of the variance of L2 factual understanding. The factor loading for L2 inferential understanding was $\beta = .730$; 53% of its variance was explained by the latent variable.

The relations of L1 and L2 derivational morphological awareness, L2 vocabulary knowledge, and L2 reading comprehension were hypothesized in a model shown in Figure 2. Regarding the model fit of the measurement model, the chi-square of the measurement model was found to be 63.5 with 29 degrees of freedom. All other fit indices were acceptable, indicating that the model was plausible: Goodness of Fit Index (GFI) (.93), Comparative Fit Index (CFI) (.97), Normed Fit Index (NFI) (.94),[3] and Root Mean Square Error of Approximation (RMSEA) (.08). RMSEA was larger than .06 (the index level for good fit), but smaller than .10, which suggests poor fit (Hu & Bentler, 1999). It indicated relatively satisfactory fit.

[3] GFI, CFI, and NFI are an analysis of model fit examining fit between the hypothesized model and the observed covariance matrix or the discrepancy between the hypothesized model and the data. They range from 0 to 1, with larger values indicating better fit; a value of over .9 is generally acceptable model fit (Hu & Bentler, 1999).

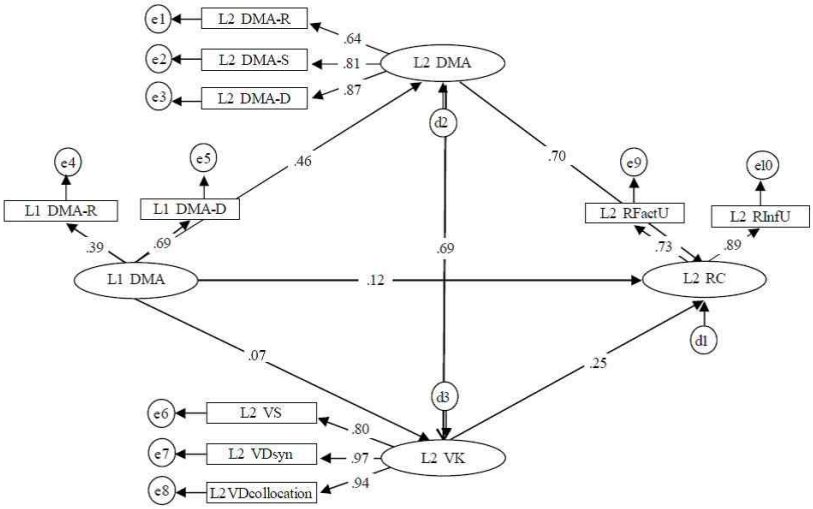

Figure 2. The structural model for the relationships among L1 and L2 derivational morphological awareness, L2 vocabulary knowledge and L2 reading comprehension.

Structural Equation Modeling Analysis

To examine whether the four latent variables had significant relationships, structural equation modeling analysis was performed. The adequacy of the structural model was investigated. Model fit indices, including GFI (.93), CFI (.97), NFI (.94), and RMSEA (.08) were found to fall within the desirable range, as mentioned before.

The structural equation modeling analysis revealed that L2 derivational morphological awareness was directly linked to L2 vocabulary knowledge (β = .690, p < .001), as shown in Table 3. This result supports the relation of derivational morphological awareness to vocabulary development reported in L1 studies (Anglin, 1993; Carlisle, 2000; Carlisle & Fleming, 2003) and L2 studies (Cho & Tong, 2014; Jeon, 2011; Kieffer & Lesaux, 2012; Zhang

TABLE 3
Parameter Estimates of the Structural Model

			Direct Effects			Indirect Effects		Total Effects	
Predictors			*β*	*p*	R^2	*β*	*p*	*β*	*p*
L2 VK					.53				
	←	L1 DMA	.070	.506		.319	.004	.389	.004
	←	L2 DMA	.690	.000				.690	.000
L2 DMA					.23				
	←	L1 DMA	.463	.022				.463	.022
L2 RC					.91				
	←	L1 DMA	.116	.218		.421	.002	.537	.004
	←	L2 DMA	.698	.000		.175	.194	.872	.023
	←	L2 VK	.253	.003				.253	.003

Note. L2 DMA = L2 derivational morphological awareness; L1 DMA = L1 derivational morphological awareness; L2 VK = L2 vocabulary knowledge; L2 RC = L2 reading comprehension.

& Koda, 2012). As suggested in Kuo and Anderson (2006), L2 derivational morphological awareness may enhance word storage in L2, which leads to an increase of L2 vocabulary knowledge. L1 derivational morphological awareness was directly linked to L2 derivational morphological awareness (β = .463, p < .05), which suggests a transfer of Korean L1 derivational morphological awareness to English L2 derivational morphological awareness, as the cross-linguistic transfer illustrated in L2 studies of Koda (2000), Ramirez et al. (2010), and Zhang (2013). L1 derivational morphological awareness did not have a significant direct effect on L2 vocabulary knowledge (β = .070, p = .506). That is, the relationship between L1 derivational morphological awareness and L2 vocabulary knowledge was statistically insignificant. However, it had a significant indirect contribution to L2 vocabulary knowledge through the mediation of L2 derivational morphological awareness (β = .319, p < .005). The total effect was significant (β = .389, p < .005). L1 and L2 derivational morphological awareness

together explained 53% (R^2 = .53) of the variance of L2 vocabulary knowledge. This finding implies that L2 vocabulary learning can benefit from L1 as well as L2 derivational morphological awareness.

As for L2 reading comprehension, L1 and L2 derivational morphological awareness and L2 vocabulary knowledge together explained 91% (R^2 = .91) of the variance. L2 derivational morphological awareness had a significant direct contribution to L2 reading comprehension (β = .698, p < .001), as noted in L1 and L2 studies (Kieffer & Lesaux, 2012; Ku & Anderson, 2003; Nagy et al., 2006). However, no indirect contribution was observed (β = .175, p = .194), unlike Kieffer and Lesaux (2012) and Zhang and Koda (2012). The total effects of L2 derivational morphological awareness on L2 reading comprehension was significant (β = .872, p < .05). The significant effect of L2 derivational morphological awareness to L2 reading comprehension may be accounted for by the fact that derivational suffixes help understand L2 text since they provide the meaning and syntactic information of derived words present in the text, as Nagy (2007) stated for the relations of derivational morphological awareness to reading comprehension in L1.

L1 derivational morphological awareness was indirectly related to L2 reading comprehension through L2 derivational morphological awareness (β = .421, p < .005), though no significant direct relationship was found (β = .116, p = .218). The total effect was also significant (β = .537, p < .005). This finding suggests that Korean EFL readers with high Korean L1 derivational morphological awareness would have good English L2 derivational morphological awareness, contributing to English L2 reading comprehension. It might be attributable to the shared morphological features of Korean and English, though they are classified as a morphologically transparent or opaque language, respectively. Cho and Tong (2014) also showed the relation between Korean derivational morphological awareness and English reading comprehension.

For the relationship between L2 reading comprehension and L2 vocabulary knowledge, a direct effect was revealed (β = .253, p < .005), as noted in Kieffer and Lesaux (2012) and Zhang and Koda (2012). L2 vocabulary

knowledge was also found as a significant predictor of L2 reading ability in Kang, Kang and Park's (2012) study of Korean EFL high school students. However, L2 derivational morphological awareness had more powerful influence than L2 vocabulary knowledge. The results did not reveal a significant indirect relationship between L2 derivational morphological awareness and L2 reading comprehension through the mediation of L2 vocabulary knowledge, unlike Kieffer and Lesaux (2012) and Zhang and Koda (2012), which measured both vocabulary size and depth knowledge as in the present study. Guo et al. (2011) also found no significant contribution of L1 inflectional morphological awareness to L1 reading comprehension of English L1 university students through L1 vocabulary knowledge. Variations of the roles of derivational morphological awareness and vocabulary knowledge in reading comprehension revealed in previous L1 and L2 studies and the present study may be attributable to different measures used in the studies. The present study measured the three types of derivational morphological knowledge, while the previous L2 studies (e.g., Kieffer & Lesaux, 2012; Zhang & Koda, 2012) mainly dealt with relational knowledge.

Conclusion and Implications

The present study tested a hypothesized model of the direct and indirect contributions of L1 and L2 derivational morphological awareness to L2 reading comprehension with the mediation of L2 vocabulary knowledge. The results of the study reveal that L2 derivational morphological awareness had a direct effect on L2 reading comprehension. L1 derivational morphological awareness was indirectly related to L2 reading comprehension through the mediation of L2 derivational morphological awareness. L2 vocabulary knowledge had a significant relationship with L2 derivational morphological awareness and reading comprehension. Yet, it did not significantly mediate the effect of both L1 and L2 derivational morphological awareness to L2 reading comprehension.

The significant role of L2 high school and university learners' L1 and L2 derivational morphological awareness in L2 reading comprehension supports the close association of morphological awareness and L2 reading comprehension in L2 learners whose first language such as Korean is morphologically transparent, as stated in Marinova-Todd et al. (2013) or assumed in the morphological transparency hypothesis, in which morphological awareness is predicted to be more closely related to reading in a morphologically transparent language than in a morphologically opaque one (Saiegh-Haddad & Geva, 2008). The more powerful influence of L2 derivational morphological awareness than L2 vocabulary knowledge further suggests the crucial role of derivational morphological awareness in reading comprehension. These findings imply the potential benefit of derivational morphology intervention in L2 reading, especially for L2 learners with morphologically transparent L1 backgrounds (e.g., Korean EFL learners), which can enhance the understanding of semantic and syntactic information of L2 derived words, assisting the comprehension of L2 text. Such intervention would be more effective for older L2 learners including high school and university students with more developed derivational morphological awareness, supporting the increasing important role of morphological awareness in academic reading of older readers (Anglin, 1993). Due to the L2 pedagogical focus on guessing the meaning of vocabulary in context, explicit instruction on L2 word formation or rules has been neglected. L2 derivational morphological awareness should be promoted as a cognitive strategy in L2 classrooms, as suggested in Oz (2014).

The direct effect of L1 derivational morphological awareness on L2 derivational morphological awareness illustrates a cross-linguistic transfer of L2 high school and university learners' derivational morphological awareness from L1 to L2. Since these results might have resulted from the shared morphological features of the two languages (alphabetic languages with rich derivational morphology), further studies should explore the role of L1 derivational morphological awareness on L2 derivational morphological awareness and L2 reading comprehension in languages which have more

distinctively different morphological structures or word formation rules.

The cross-linguistic transfer of derivational morphological awareness and the relationship of L1 derivational morphological awareness with L2 vocabulary knowledge and reading comprehension also suggest that L2 learners can benefit from their L1 morphological knowledge in L2 learning. L2 learners with highly developed L1 morphological knowledge should be trained to utilize such knowledge as a cognitive strategy in L2 vocabulary learning.

They should not be instructed to directly match L1 morphemes to L2 words; rather, they should be trained to use their L1 morphological knowledge in order to facilitate learning the functions of L2 morphemes such as derivational affixes, ultimately learning L2 vocabulary and reading.

Different findings of the current study and previous studies (Kieffer & Lesaux, 2012; Zhang & Koda, 2012) about the role of L2 derivational morphological awareness might have been driven by the types of derivational morphological knowledge measured. This study measured all three types, while the previous studies measured one or two types, lacking a detailed discussion of derivational morphological knowledge. Future studies of derivational morphological awareness thus should be based on a solid linguistic basis by specifying the definition of derivational morphological knowledge and employ appropriate measures to assess the awareness of such knowledge.

The present study has explored the role of L2 derivational morphological awareness in L2 reading comprehension of high school and university students. However, it has not researched its developmental process and longitudinal changes in contributing to L2 reading comprehension. Derivational morphological awareness in L1 appears to be acquired late because of the complexity of derivational morphology; the acquisition undergoes a long development process (Kuo & Anderson, 2006). L1 studies have stated third or fourth graders start learning word formation and semantic and syntactic properties of derived words and gradually develop their derivational morphological knowledge through high school education (Kuo & Anderson, 2006; Nagy et al., 1993). Derivational morphological awareness

explains the variance in reading comprehension increasingly with age (Carlisle, 2000). Thus, L2 studies further need to investigate the effects of derivational morphological awareness on reading comprehension longitudinally or across different proficiency levels to shed light on the developmental shift of its contribution.

The main limitation of the study is only one hypothesized model tested for the contribution of L1 and L2 derivational morphological knowledge to L2 reading comprehension through the mediation of L2 vocabulary knowledge. It has explored only unidirectional relations. Further studies should explore whether their relations are unidirectional or reciprocal, since the acquisition of derivational morphological knowledge can lead to the development of reading skills or vice versa, as Kuo and Anderson (2006) suggested.

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