Introduction

The acquisition of vocabulary is an important part of learning a foreign language. McCarthy (1990) noted that no matter how well the learner learns the grammar and the sound of a language, without vocabulary they cannot understand others or express their own ideas in that language. This is because vocabulary is an essential building block of language and thus central to the language learning process. Previous studies have shown close relationships between vocabulary knowledge and the development of other language skills (e.g., Astika, 1993; Hirsh & Nation, 1992; Hu & Nation, 2000; Laufer & Nation, 1995; Nation, 2006; Qian, 1999; Stæhr, 2008). According to Chastain (1988), the lack of needed vocabulary is a constraint in learners' ability to get through to their ideas.

The number of words to be acquired in a new language can be overwhelming. According to Nation (1990, 2001), knowledge of around 3,000 high-frequency word families[1] is the threshold required to comprehend general English. Without this threshold, learners encounter problems understanding the language they are exposed to (Laufer, 1997). Read (2004) pointed out that second language learners are typically aware of the need to build an adequate vocabulary for effective communication in that language. But in fact, many learners feel concerned with the burden of vocabulary learning and frustrated in coping with the task of learning thousands of words that they do not use every day (Zolfaghardkhani & Moghadam, 2011). This is particularly true for learners who learn English for academic purposes. In order to comprehend about 98% coverage of the words used in the academic texts, learners need knowledge of 8,000 – 9,000 word families (Nation, 2006). What has to be noticed is that any claims made on the basis of these word family lists assume that a learner knows a base word such as *use* also knows *uses, useful* and other inflected or derived forms (Ward & Chuenjundaeng, 2009). It has been documented in several studies that knowledge of a base word did not mean that all the derivative forms were mastered (e.g., Schmitt & Meara, 1997; Schmitt, 1998, 1999). In other words, the vocabulary size necessary for learners to acquire may be considerably larger than such estimates if learners do not have derivational knowledge (remember that each word family contains several words).

How can learners manage to build and keep up a large amount of vocabulary in a short space of time? It is not possible for learners to learn all the vocabulary they need in a classroom situation. Current research, therefore, would suggest that learners need to be given explicit instruction of generative vocabulary strategies[2] in order to help learners to increase their ability to learn new words on their own

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[1] A word family is the base form of a word plus its inflected and derived forms made from affixes (Hirsh & Nation, 1992, p. 692). In English language, inflections include third person -s, plural -s, possessive -s, comparative -er, superlative -est, -ed, and -ing. Affixes includes -al, -able, -ation, -er, -ful, -ish, -ism, -ist, -ity, -ize, -less, -ly, -ment, -ness, -th, -y, in-, non-, pre-, re-, un-, etc.

[2] Generative vocabulary strategies adopted in this study refer to skills or techniques used to expand vocabulary size.

(Sökmen, 1997). One of the strategies that can support learners as they encounter in their independent studies across all disciplines is the use of morphological knowledge. Morphology is the study of language that deals with morphemes[3] and how they are combined to form words (Schmitt, 2000). Nagy and Anderson (1984) observed that knowledge of these combinational processes (or word-formation processes) opens up vast amounts of vocabulary to the learner (cited in Templeton, 2011/2012, p. 101). That is mainly because the majority of English words, particularly those in specific disciplines, have been constructed through the combination of morphemic units, that is, word roots, prefixes and suffixes (Green, 2008). For this reason, learners' ability to manipulate morphemic units may be an important aspect in vocabulary development.

There is some evidence to indicate significant interactions between the development of morphological knowledge and reading comprehension (e.g., Osburne & Mulling, 2001; Kieffer & Lesaux, 2007; Larsen & Nippold, 2007). However, many of these studies were conducted on native-speaker learners or learners whose native languages are closely related to English (e.g., Spanish). Research on EFL vocabulary acquisition, by contrast, has focused more on the extent of learners' morphological knowledge and its relationship with mental lexicon. Nevertheless, there is relatively less information available regarding the effectiveness of morphological instruction on vocabulary learning of EFL learners, especially whose native languages are not cognate to English. EFL learners often have little or no exposure to the target language outside the classroom and may need explicit instruction of morphological rules and constraints in order to raise their morphological awareness and develop their derivational knowledge to expand their vocabulary. The present study, therefore, examines the effects of morphological instruction on vocabulary acquisition in the EFL context.

Review of Literature

Despite the fact that linguists have been exploring morphology for a long time (Templeton, 2011/ 2012), a renewed focus on vocabulary in language learning and teaching over the last two decades has triggered a new interest in morphology and learners' morphological development among teachers and researchers. According to Ward and Chuenjundaeng (2009), language teachers who justify the value of teaching morphology look at two factors: a way to work out the meaning of unknown words when reading and a tool to learn and remember words. That is, apart from using word-part clues to work out the meaning of new unfamiliar words, learners may also use knowledge of roots, prefixes and suffixes to build and keep

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[3] Morpheme is the name for meaningful word parts that can be identified and put together to determine the meaning of an unfamiliar word (Carter, 1998). English words are constructed from two different types of morphemes – roots and affixes. Roots can be divided into free roots and bound roots. Affixes can be divided into prefixes and suffixes.

up new words.

First, studies have showed that learners who have morphological knowledge skills tend to have larger vocabulary repertoire. For example, in their one-year study investigating suffix knowledge of Japanese EFL learners, Schmitt and Meara (1997) found that the learners had quite insufficient knowledge of derivative and inflectional suffixes but reported that suffix knowledge has a relationship to overall size of the learner's vocabulary and general language proficiency.

Similarly, Mochizuki and Aizawa's (2000) study with Japanese learners showed that L2 learners' affix knowledge correlated with their vocabulary size. They identified five factors that might be responsible for EFL learners' affix acquisition order: loan words, instruction, frequency of affixes, frequency of words that contain a particular affix, and the poly-functional nature of affixes. Instruction, among other things, is the main concern of the present study.

In addition to Japanese EFL learners, Tabatabaei and Yakhabi's (2011) study conducted on Iranian EFL learners also showed a significant relationship between morphological awareness and vocabulary size of EFL learners. The results also indicated that the learners had better ability to use morphological information to distinguish word meanings than to create new words for objects or concepts. In other words, learners tend to use morphological information to facilitate their understanding and remembering of unfamiliar words but not forming new words that they have not encountered before.

The findings of the aforementioned studies have substantiated the importance of morphological knowledge in promoting vocabulary building, and supported the technique and teaching of morphological analysis as part of vocabulary instruction.

Second, the relationship between morphology and vocabulary development inspired a considerable amount of research on the role of morphology in developing reading comprehension. For example, Deacon and Kirby's (2004) four-year longitudinal study with the second, fourth and sixth native-English-speaking graders demonstrated that morphological knowledge contributes significantly to reading development, even after three years of the study.

Likewise, Kieffer and Lesaux (2007) claimed that the relationship between reading and morphology grew stronger as learners grew older. Their study with urban fourth- and fifth-graders in California showed that learners' understanding of morphology was a better predictor of reading comprehension than their vocabulary level. They found the relationship was the same for Spanish-speaking learners as for native English speakers. They also pointed out that this relationship was reciprocal, meaning that understanding morphology may help learners broaden their vocabularies, and vocabulary growth may improve learners' understanding of morphology.

White, Power and White's (1989) study argued that word-part analysis is

sufficient to understand affixed words that are morphologically transparent[4]. They elaborated that word-part knowledge enables learners to identify at least part of the meaning, thus assisting them in inferring or guessing the meaning of novel words they encounter in reading without resorting to a dictionary, even with no help from context. However, it should be noted here that the same effects do not apply when words are morphologically opaque[5]. According to Shu, Anderson, and Zhang (1995), most words in English fall in between transparency and opaque; but, fortunately, with a moderate help of context, most words are likely to be clear even though their meaning cannot be derived directly from the word parts.

Together, these above studies have revealed that applying morphological analysis as a strategy to uncover the meaning of new words is potential for promoting the development of reading proficiency. However, as mentioned earlier, EFL learners probably have difficulty to benefit from using morphological knowledge in their reading as much as native speakers, especially those whose native languages are not related to English. This is because they are probably not aware of this linguistic phenomenon. Interestingly enough, if EFL learners are given explicit instruction of morphemic units, they might be able to attack complex or novel words and in turn increase their vocabulary knowledge in particular and reading proficiency in general. However, there is little empirical evidence on the effect of explicit instruction of morphology in the EFL environment.

Finally, some researchers asserted that morphological information is a good memory aid. According to Farid (1985, as cited in Zolfaghardkhani & Moghadam, 2011), it is easier to remember the definitions of new word by analyzing the morphemic elements. Psycholinguistic research on word storage and retrieval has reported that words can be stored and recalled individually (as in rote learning) or through networks of related words or ideas (Zolfaghardkhani & Moghadam, 2011). For instance, morphological networks occur when words are learned along with the meaning of their parts. It is believed that this morphological process facilitates learners to remember new words much longer than they can remember by just learning unrelated word lists. An underlying assumption is that related words are stored nearer one another than unrelated, resulting in their more frequent use and likely retention.

From our review of the literature, it seems clear that morphological knowledge has an important role in facilitating vocabulary knowledge and thus reading comprehension. It is a fact that morphological complex words occur with increasing frequency in school-based reading materials as learners progress through schooling (Nippold & Sun, 2008). The challenge of the process of vocabulary acquisition increases as more complex words are encountered. For

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[4] Words are morphologically transparent if the meaning of the whole words can be derived from the meaning of its morphological units.

[5] Words are morphologically opaque if the components contribute almost nothing to the meaning.

Chinese-speaking EFL learners at university level, the difficulty of vocabulary acquisition most likely lies in lack of an efficient acquisition method that could help enlarge vocabulary and keep longer vocabulary across content areas. The present study was inspired by the researcher's knowledge of the lack of efficient vocabulary instruction and learning strategies among university level learners of English.

Present Study

To address university-level EFL learners' need for a more effective and efficient method for learning new words across content areas, the primary goal of the present study is to generate insights related to vocabulary instruction by evaluating the effects of morphological instruction for use in the EFL classroom. To accomplish this goal, the following five specific research questions were formulated:

1. To what extent do EFL learners enlarge their morphological knowledge and vocabulary size after morphological instruction?
2. What is the relationship between morphological knowledge and vocabulary retention[6] of EFL learners?
3. What is the relationship between morphological knowledge and success in lexical inferencing[7] of EFL learners?
4. What is the relationship between vocabulary knowledge and success in lexical inferencing of EFL learners?
5. Does morphological knowledge predict EFL learners' vocabulary acquisition and lexical inferencing ability?

Method

Participants

The initial sample consisted of 68 students. All of the participants were Chinese-speaking EFL students studying English as their major within the age range of 19 to 25 of both males and females at a private university in the north-western part of Taiwan. All of them needed to read English language textbooks during their courses of study. While most of them had limited business backgrounds, they were preparing the TOEIC[8] (Test of English for International Communication) for satisfying the language proficiency requirement for graduation. In order to score well on the test, most of the students needed to increase specialized business and technical vocabulary as much, as quickly, as possible. In

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[6] In this study, vocabulary retention is referred to as the ability to recall or remember words after an interval of time.

[7] In this study, lexical inferencing is defined as making informed guesses as to the meaning of a word in light of all available morphological cues in combinations with the learner's general knowledge of the word.

[8] The TOEIC test measures test takers' ability to use English in daily business situations.

this regard, the participants under study were considered to have similar learning motivation that could impact learning performance. This also explains why they were selected for the study.

As a means to control language proficiency that might also affect performance, all of the participants were given a vocabulary pretest before the teaching experiment. The pre-test was divided into three parts, each having 50 multiple-choice items. The items on the first and second parts were affixes[9] and vocabulary words that would be learned in the experiment, whereas those on the third part were words that would be used in a lexical inferencing test at the end of the experiment (see Appendix A for an overview of the test format). Attendance was another important control factor in the study. As a result, 51 homogeneous students, who knew less than 20% of the affixes and vocabulary words on the pretest and had attendance over 80%, were selected for the experiment. The selection criteria were used with an attempt to reduce non-instructional effects to the minimum and to include enough students to allow for quantitative analysis. In brief, the students' learning motivation and initial vocabulary knowledge was close to each other.

Teaching materials

For class instruction, the following teaching materials were employed:

Target affixes: Two hundred and twelve word parts (consisting of 44 prefixes, 48 roots and 120 derivational suffixes[10]) were chosen as target affixes for the teaching experiment. The key criterion was that they were frequent word parts used in forming many business words. More specifically, a selected affix should at least suggest two or more words that are commonly used in business communication. A great number of suffixes were included because English contains many derivational suffixes which have the same function (e.g., suffixes -ant, -ee, -ent, -er, -or, -ese, -ess, -ist, etc. are all used to derive person nouns). The target affixes were grouped into prefixes, roots and suffixed, and listed as headwords in the handouts printed for the students. Headwords with similar meaning were listed together as an entry in the list (see below for an example).

Target words: A total of 513 business words were selected and adapted as target words from Huang (2011)[11]. The number of target words was determined to provide each headword two or more examples. The words were presented along with their phonetic symbols, word classes and Chinese counterparts. Example sentences were not given in the handouts because the study aimed to concentrate on

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[9] In this study, affix is used as an umbrella term that includes prefixes, root words, and suffixes and interchangeably with word-part.

[10] Suffixes that carry grammatical information are called inflectional suffixes, such as -ed, -ing and -s. Those that carry lexical information are derivational, such as -ism, -logy and -ful .

[11] This is a vocabulary book, which focuses on advanced words and expressions that students are likely to come across in the TOEIC. The vocabulary items cover the 13 topics that all TOEIC test questions are created on.

the effect of morphology. The following is an example of an entry in the handouts:

counter-, countra-, countro- = **against**
☐ counteract [ˌkaʊntɚˋækt] v. 對...起反作用, 中和; 對抗
☐ counterfeit [ˋkaʊntɚˌfɪt] v. a. n. 偽造; 偽造的, 假冒的; 仿製品
☐ counterpart [ˋkaʊntɚˌpɑrt] n. 極相像的人(或物); 對應的人(或物)
☐ contrary [ˋkɑntrɛrɪ] n. a. 相反; 相反的, 對立的
☐ contrast [ˋkɑnˌtræst] v. n. 對照, 對比
☐ contradict [ˌkɑntrəˋdɪkt] v. 與...矛盾, 與...抵觸; 否認; 反駁
☐ controversy [ˋkɑntrəˌvɝsɪ] n. 爭論, 爭議
☐ controversial [ˌkɑntrəˋvɝʃəl] a. 有爭議的

The above exemplified entry includes three headwords (i.e., prefixes) and eight target words.

Test materials

Affix knowledge test: The knowledge test was designed to measure the students' affix knowledge after the instruction. The multiple choice format was used and the multiple candidates were in English (e.g., contra- (A) not (B) against (C) together (D) close). The students were asked to choose the right meaning to go with each affix (e.g., (B) against) (see Appendix A for a partial test). The test consisted of 50 items, including 20 prefixes, 25 roots and 5 derivational suffixes discussed in the class (see Appendix B). The number of items selected for the test was determined by the amount of meaning they often carry in a word. For example, root words are considered to carry the word's overall or direct meaning and thus more test items were selected. By contrast, suffixes most often just change a word's part of speech although some add extra meaning to the word.

Vocabulary acquisition test: In the main-test, vocabulary acquisition[12] was assessed with 100 multiple-choice questions (50 in the pre-test), in which the students were asked to choose the right English words out of the four choices to go with each Chinese item (e.g., 有爭議的 (A) controversial (B) exploit (C) disclose (D) distract). In other words, it was a test of receptive vocabulary knowledge, in which the students had to match L1-L2 translation equivalents (see Appendix A for a partial test). All of the test words were chosen from the handouts. However, the test words differed in the degree of morphological complexity and transparency (see Appendix C).

Word inferencing test: The inferencing test consisted 50 less frequent words

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[12] In this study, the test simply measured students' vocabulary knowledge that involves memory retention of the meanings of English words in their own language. Thus, vocabulary retention was regarded as the acquisition of new words.

(see Appendix D) that were not found in the learning handouts but made of at least one of the target affixes. Recall from the above that only students who knew less than 20% of the words on the pretest were included in the study. Specifically, the pre-test result of the 51 students included in the study showed that they knew less than 10% of the 50 words on the test prior to the instruction. In the word-meaning inferencing test, the students were requested to tackle these unfamiliar words based on their morphological knowledge. They were asked to select their Chinese equivalents or translations for the English words inferred (e.g., counterclaim (A) 申訴 (B) 合約 (C) 述說 (D) 反訴) (see Appendix A for a partial test). The test evaluated the students' ability to derive the meaning of novel words they encounter without resorting to context and a dictionary. In particular, it intended to determine if the students could infer or figure out the meaning of unknown words by making use of familiar word parts that they learned in the experiment.

In scoring, each word correctly chosen is worth one point. Thus, the maximum possible score is 50 for the affix knowledge test, 100 for the vocabulary acquisition test, and 50 for the lexical inferencing test.

Procedure

The experiment consisted of 12 morning weekly sessions with the participant selection pre-test and an introduction of basic concepts and rules of morphology in the first week, and the performance tests in the last week. Thus, the actual training sessions were 10 weeks.

A regular training session was divided into three sections: (1) a teacher-led lesson on target affixes and words, (2) an exercise in breaking down words into meaningful parts and (3) a review activity asking the students to come up with other words that could be spelled using the target affixes just learned. Each section lasted about 45 minutes.

All teaching was done by the researcher and entirely focused on morphological analysis. To ensure the students were engaged in the learning tasks, they were asked to turn in their exercises at the end of class to be graded (simply for motivational purpose and thus was not analyzed in the present study).

Moreover, as a way to expand the students' morphological size, they were encouraged to make a guess or assumption of what an unfamiliar word-part meant based on the L1 translation of the target word presented in the handouts. For example, referring back to the exemplified entry above for the prefix "counter", the students were invited to venture a guess for the meaning of "feit" after they learned that "counteract" means to "act against something in order to reduce its force or neutralize it" and when they knew the Chinese (L1) equivalents for the (L2) word "counterfeit". Consequently, engaged students might learn more morphological items than less engaged students because they would not learn only those affixes listed as headwords in the handouts but also others embedded in words they were learning.

Results

In order to answer the research questions, the data analysis involved three steps. First, internal consistency was assessed to ensure the reliability of the above research materials, and then descriptive analyses were performed to describe the students' level of vocabulary development through explicit morphological instruction in terms of affixes acquired, words retained and word inferencing ability developed. In the second step, Pearson's correlation analyses were conducted to examine the relationships between: (a) affix knowledge and vocabulary retention, (b) affix knowledge and word inferencing success, and (c) vocabulary retention and word inferencing success. Finally, a statistical regression was conducted to determine if affix knowledge can predict performances on vocabulary retention and lexical inferencing.

Morphological instruction and morphological knowledge

To answer the first research question concerning the overall effects of morphological approaches to helping learners increase their morphological knowledge and vocabulary size, descriptive analyses were done from the answers obtained in each of the above measuring tests.

Before analyzing the data for the first research question and to ensure the reliability of the test materials, Cronbach's alpha reliability tests were carried out to assess the homogeneity of the test items used in measurement of the students' affix knowledge, vocabulary acquisition and word inferencing. The results were satisfactory. Cronbach's α coefficients for the affix knowledge test, vocabulary acquisition test and word inferencing test were .88, .95 and .69 respectively. This indicates that the scores obtained were highly reliable. Although Cronbach's α value for the inferencing test was lower (than conventionally accepted .70), it is considered acceptable in the study because the scale of "Crobach's α if item deleted" shows that the values of Cronbach α for each individual item were quite equal and the removal of any individual items will not increase the α value to a higher level. The lower α value can probably be attributed to the claim that inferencing test investigates students' actual practices in the inferencing process, which involves using various knowledge sources ranging from morphology, phonology, word association, cognates, etc. (De Bot, Paribakht & Wesche, 1997). Note that Cronbach's α will generally be low for all items if the data is multi-dimensional.

Following the reliability tests, descriptive statistics were calculated to describe the students' performance on the three tests after the 10-week morphological program as displayed in Table 1. As Table 1 shows, the means of affix test, vocabulary test and inferencing test are 28.51 (57%), 71.04 (71%) and 18.86 (38%) respectively. It reveals the minimum scores for these three test are 12 (24%), 31 (31%) and 8 (16%), while the maximum scores are 46 (92%), 98 (98%) and 30 (60%) respectively. The students thus had acquired or remembered approximately 121 (212*.57) affixes and 364 (513*.71) words in 10 weeks. The results also

showed that they could handle about 38% unknown words.

Table 1 Descriptive statistics for test results

	N	Minimum	Maximum	Mean	Std. Deviation
Affix Knowledge	51	12	46	28.51	8.828
Vocabulary Retention	51	31	98	71.04[a]	18.079
Word Inferencing Ability	51	8	30	18.86	5.299

a. Recall the number of test items is 100 (not 50) and thus the mean should be divided by 2 (i.e., 35.52) for comparison with the means of the other two tests.

Table 2 shows that the students scored higher on all sections of the main-test than of the pre-test, for a mean increase of 41% overall. Recall that only students who knew less than 20% of the target affixes and words were included in the study. The results suggest that the students not only acquired many target affixes and vocabulary words after the training program but also had the ability to guess the meaning of unfamiliar words using morphological units of meaning, even without using context clues and a dictionary.

Table 2 Percentage of gained knowledge after morphological instruction

	Pre-Test (%)	Main-Test (%)	Gain (%)
Affix Knowledge	14	57	43
Vocabulary Retention	19	71	52
Word Inferencing Ability	9	38	29
Mean	14	55	41

Morphological knowledge and vocabulary retention

To evaluate the relationship between affix knowledge and vocabulary acquisition and answer the second research question, a Pearson's correlation coefficient was computed to evaluate the relationship between affix knowledge and vocabulary learned. The result identified a clear statistically significant relationship between morphological knowledge and vocabulary retention ($r = .799$, $p < .001$). It is a positive relationship as presented in Table 3 below. Thus, the higher the affix knowledge is the better the vocabulary retention will be.

Morphological knowledge and lexical inferencing

A Pearson's correlation was also performed to gauge what relationship exists between affix knowledge and lexical inferencing success in order to answer the third research questions. The result revealed that lexical inferencing ability had a significant correlation with the students' morphological knowledge ($r = .691$, $p < .001$), as indicated by Table 3. That is, the students' performance in lexical inferencing was positively correlated with their morphological knowledge.

Vocabulary knowledge and lexical inferencing

At the same time, a Pearson's correlation was run to determine the relationship between vocabulary retention and lexical inferential performance. This was used to answer the fourth research question. As shown in Table 3, a positive relationship was observed (r = .607, p < .001). Compared with the correlation of affix knowledge to vocabulary retention (r = .799) and inferential success (r = .691), the correlation between vocabulary retention and inferential success is weaker. However, the three correlation coefficients are all positive, meaning that these different aspects of lexical knowledge skills can reinforce each other.

Table 3 Pearson correlation coefficients for affix knowledge, vocabulary retention and lexical inferencing ability

	Affix Knowledge	Vocabulary Retention	Word Inferencing
Affix knowledge	1	.799	.691
Vocabulary retention	.799	1	.607
Word Inferencing	.691	.607	1

Morphological knowledge in predicting lexical retention and inferencing

Following the above correlation analyses, a statistical regression was done to see to what extent morphological knowledge can predict performances on vocabulary retention and lexical inferencing in order to answer the last research question. The results of regression analyses showed that the students' morphological knowledge significantly explained 63.8% of variation in their vocabulary retention scores (R^2 = .638, F (1, 49) = 86.357, p < .001) and 47.7% in lexical inferencing scores (R^2 = .477, F (1, 49) = 44.700, p < .001), as shown in Table 4 below. This suggests that morphological knowledge is a better predictor of vocabulary retention than of lexical inferencing success.

Table 4 Regression analyses for the predictability of affix knowledge

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	F Change	df 1	df 2	Sig. F Change
Affix - Retention	.799[a]	.638	.631	10.988	86.357	1	49	.000
Affix - Inferencing	.691[a]	.477	.466	3.871	44.700	1	49	.000

a. Predictors: (Constant), Affix

In summation, based on the obtained statistical parameters, it can be

concluded that morphological training can improve affix knowledge, vocabulary retention and lexical inferencing ability. The development of morphological knowledge is significantly related to both vocabulary retention and lexical inferencing success, but greater with inferential success, whereas the explanatory power of morphological knowledge is stronger for vocabulary retention than lexical inferencing success.

Discussion

The present study aimed to look at the potential of morphological teaching and learning for improving vocabulary retention and lexical inferencing ability. According to the results of the descriptive statistics (see Table 1), the highest mean score was seen in the vocabulary acquisition test (M = 35.52, 71%), the second highest mean score lied in the affix knowledge test (M = 28.51, 57%) and the lowest mean score was obtained on the word inferencing test (M = 18.86, 38%). As mentioned earlier, the students' initial knowledge was close to each other before the instruction and less than 20% of test items in all sections of the pre-test. On average, their overall performance improved from 14% to more than 55% (up about 41%). In other words, the students had achieved overall vocabulary gains after the 10-week morphological training based on the mean scores. Unexpectedly, the students could remember more vocabulary words (71%) than morphological word-parts (57%) despite the fact that vocabulary words are more complex in structure than morphological units. It is assumed, thus, that word length and structure complexity alone cannot explain the ease of vocabulary acquisition.

Compared to the students' performance on vocabulary retention, their performance of word inferencing was less satisfactory with regard to their inferential success rate. Even though the students were successful in guessing only 38% of unfamiliar words (an average 29% increase from the pre-test to the main-test, shown in Table 2), it can be deemed to be satisfactory because the achievement was gained without the help of context clues and dictionaries. Words in isolation, overall, give no clues to guess from context. Being provided with only possible Chinese counterparts for each test item on the test, the students probably utilized morphological information they had learned during the program or guessed randomly with no knowledge of the answer. However, random guessing does not often help to achieve such level of correct answers. At this point, it might be posited that with proper morphological training, learners can, to some or more extent, learn to use morphological clues to infer the meanings of unknown words. In addition, as White, Power and White (1989) argued, some English words are more morphological opaque than others and thus morphological effects may be weaken when words are morphologically opaque.

Furthermore, through Pearson's correlation analyses, significant correlation relationships between affix knowledge, vocabulary acquisition and inferential success were found. The correlation coefficients of affix knowledge to vocabulary

acquisition and inferential success were .799 and .691 respectively (see Table 3 above). The results demonstrate that raised morphological knowledge was associated with an increase in the number of words remembered and the degree of inferential success. This partially confirms the findings of Schmitt and Meara (1997), Mochizuki and Aizawa (2000) and Kieffer and Lesaux (2007) that learners increase their morphological knowledge in proportion to their overall size of vocabulary. Recall from the above that the vocabulary acquisition test measured the students' memory retention of the meanings of English words in their own language. Thus, the strong correlation between affix knowledge and vocabulary gains likewise indicates that knowledge of morphological units might be used as mnemonics devices or reinforcement techniques in facilitating vocabulary acquisition and retention.

The Pearson's results also showed correlation between vocabulary retention and inferential success (r = .607). However, compared to the degree of correlation between affix knowledge and word inferential success (r = .691), the strength of the relationship was weaker between vocabulary level and inferential success (r = .607). This implies that the development of morphological knowledge probably leads to a level of inferential success that is superior to that can be achieved when vocabulary size is increased. This finding echoes Kieffer and Lesaux's (2007) discovery that learners' understanding of morphology is a better indication of reading comprehension than their vocabulary level. In other words, increasing morphological knowledge can contribute more than increasing vocabulary size to enhance the lexical inferencing success of EFL learners, which in turn may lead to better reading comprehension.

Lastly, when regression analyses were performed, it was found that morphological knowledge could be a better predictor of vocabulary retention (R^2 = .638) than of lexical inferencing success (R^2 = .477). Again, this is an indication that morphological information may be employed by learners as mnemonic devices by reducing words to smaller units or using the lexical features of those word parts. By contrast, it seems to require a good deal more effort or time for learners to combine morphological information for unknown words. That is, it seems easier for learners to break words up into smaller units of meaning for memorization than put together morphological units to ascertain the meaning of novel words. This manifests that deducing and inducing are two separate and distinct processes of morphological knowledge. This finding partly supports the result in Tabatabaei and Yakhabi's (2011) study showing that learners have better ability to use morphological information to distinguish meanings for different words than to create new words. However, as Shu, Anderson, and Zhang (1995) stated, the difficulty of lexical inferencing can probably be eased or overcome when more textual contexts are provided in the disambiguation process. These results, therefore, suggest that mere holding of morphological units in mind may not be readily translated into learners' morphological skills in inferring unknown words.

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For that reason, explicit morphological training on word-level inferencing may be necessary to help learners overcome difficulties in inferring word meanings. This is an important finding of the present study that has not been discussed much in existing literature.

On the whole, the results highlight the importance of morphological knowledge in facilitating EFL learners' vocabulary acquisition and the necessity of integrating word-level inferencing training into morphological instruction.

Conclusion

As the findings of the study show, morphological instruction contributes to the development of learners' vocabulary growth in general and, thus, plays an important role within the context of EFL learning environment requiring generative vocabulary strategies to expand vocabulary size. Specifically, the findings suggest that morphological knowledge can directly and indirectly promote vocabulary retention and lexical inferencing success. When their morphological knowledge increases, learners are likely to remember and recall words more effectively and efficiently. Interestingly, morphological knowledge does not readily transform into lexical inferencing ability. Thus, in order for learners to take full advantage of morphological information embedded in unknown words, explicit morphological training on word- level inferencing is required.

For pedagogical purposes and future research, the following propositions can be concluded from this study:

First of all, learning any language involves acquiring a large amount of vocabulary. Working on determining word meanings is a skill which is necessary for learners if they are to deal effectively with the vast amount of newly encountered words. Therefore, it is considered useful for EFL learners to put time and efforts into morphological study, which was supported by the findings of the study. Because of the positive correlations found in the study, learners who improve their morphological knowledge are likely to improve their vocabulary retention and success in lexical inferencing. Thus, implication for the teacher is that, with limited class time and limited exposure to English, learners are in need to increase their ability to learn new words on their own. Integrating morphology into vocabulary instruction can enhance learners' vocabulary development by generating more words from those students know already.

Next, for teaching and learning to be effective, it should be noted that no strategies can be fixed for all time. The previous literature has shown that meaning of some words cannot be derived directly from the word parts. The findings of the study also show that learners seem to have problem using morphological clues to uncover the meaning of all newly encountered words. That means that the effects of morphology can vary depend on the morphological transparency of words although morphological knowledge can be used as a useful tool for vocabulary development at large. This therefore leads to the assumption that the use of

morphological information in remembering words or guessing novel words is probably more effective with morphologically transparent words but less effective with opaque words. However, future research needs to verify this by comparing performance on morphologically simple and complex words. Future research can also investigate how morphological analysis is related to other strategies in affecting learners' learning and remembering of vocabulary in order to provide a better understanding of the nature of morphology and its place in vocabulary acquisition.

Vocabulary knowledge involves not only perceiving the form of words but also using words to express meaning. It is understandable that learners' receptive vocabulary is larger than their productive vocabulary. Thus, the focus of the present study on the effects of morphology in retrieving the meaning of English words limits the generability of the findings. Effective vocabulary instruction should include both receptive and productive knowledge of a word. In order to provide useful insights for morphological instruction, a goal of future research could also be an examination of how morphology affects the development of receptive and productive skills of vocabulary.

Finally, the findings of the study only hold true when the short term retention of words are considered. Vocabulary development is a long lasting process. Thus, it is another limitation of this study that the interval between the intensive, morphologically programmed instruction and performance tests was too short, which might have caused bias in the interpretation of the results. Although the study proved that the use of morphological knowledge improves learners' short-term memory in vocabulary retention, we cannot assume the same effects on their long-term memory. In this regard, it is more desirable to conduct longitudinal studies so as to capture the time effects of morphology in facilitating vocabulary acquisition.

The findings of this study clearly indicate the importance of morphology in vocabulary gains. These findings are in line with the findings of the previous research regarding morphological acquisition and comprehension. In order to explore fully the range of morphological effects in EFL vocabulary acquisition and make appropriate recommendations for pedagogical purposes, more future studies in this line of research are necessary.

References

Astika, G. G. (1993). Analytical assessment of foreign students' writing. *RELC Journal, 24,* 61-72.

Carter, R. (1998). *Vocabulary: Applied linguistics perspectives.* New York: Routledge.

Chastain, K. (1988). *Developing second language skills.* Florida: Harcourt Brace.

De Bot, K., Paribakht, T. S., & Wesche, M. B. (1997). Toward a lexical processing model for the study of second language vocabulary acquisition: Evidence from ESL reading. *Studies in Second Langauge Acquisition, 19,* 309-329.

Deacon, S. H., & Kirby, J. R. (2004). Morphological awareness: Just "more phonological"? The roles of morphological and phonological awareness in reading development. *Applied Psycholinguistics, 25,* 223-238.

Green, T. M. (1990). *The Greek and Latin roots of English.* New York: Ardsley House.

Hirsh, D., & Nation, I. S. P. (1992). What vocabulary size is needed to read unsimplified texts for pleasure? *Reading in a Foreign Language, 8,* 689-696.

Hu, M., & Nation, I. S. P. (2000). Unknown vocabulary density and reading comprehension. *Reading in a Foreign Language, 13,* 403-430.

Huang, A. (2011). *Advanced words and idioms for the new TOEIC test.* Taipei: Pearson.

Kieffer, M. J., & Lesaux, N. K. (2007). Breaking down words to build meaning : Morphology, vocabulary, and reading comprehension in the urban classroom. *The Reading Teaching, 61,* 134-144.

Larsen, J. A., & Nippold, M. A. (2007). Morphological analysis in school-age children: Dynamic assessment of a word learning strategy. *Language, Speech, and Hearing Services in Schools, 38,* 201-212.

Luafer, B. (1997). The lexical plight in second language reading : Words you don't know, words you think you know, and words you can't guess. In J. Coady, & T. Huckin (Eds.), *Second Language Vocabulary Acquisition* (pp. 20-34). Cambridge: Cambridge University Press.

Laufer, B., & Nation, I. S. P. (1995). Vocabulary size and use: Lexical richness in L2 written production. *Applied Linguistics, 16,* 307-322.

McCarthy, M. (1990). *Vocabulary.* Oxford: Oxford University Press.

Mochizuki, M., & Aizawa, K. (2000). An affix acquisition order for EFL learners: An exploratory study. *System, 28,* 291-304.

Nation, I. S. P. (1990). *Teaching and learning vocabulary.* New York: Heinle and Heinle.

Nation, I. S. P. (2001). *Learning vocabulary in another language.* Cambridge: Cambridge University Press.

Nation, I. S. P. (2006). How large a vocabulary is needed for reading and listening? *The Canadian Modern Language Review, 63,* 59-82.

Nippold, M. A., & Sun, L. (2008). Knowledge of morphologically complex words:

A developmental study of oder children and young adolescents. *Language, Speech, and Hearning in Schools, 39,* 365-373.

Osburne, An. G., & Mulling, S. S. (2001). Use of morphological analysis by Spanish L1 ESOL learners. *IRAL, 39,* 153-159.

Qian, D. D. (1999). Assessing the roles of depth and breath of vocabulary knowledge in reading comprehension. *The Canadian Modern Language Review, 56,* 283-307.

Read, J. (2004). Research in teaching vocabulary. *Annual Review of Applied Linguistics, 24,* 146-161.

Schmitt, N. (1998). Tracking the incremental acquisition of second language vocabulary: A longitudinal study. *Language Learning, 48,* 281-317.

Schmitt, N. (1999). The relationship between TOEFL vocabulary items and meaning, association, collocation, and word class knowledge. *Language Testing, 16,* 189-216.

Schmitt, N. (2000). *Vocabulary in language teaching.* Cambridge: Cambridge University Press.

Schmitt, N., & Meara, P. (1997). Researching vocabulary through a word knowledge framework: Word associations and verbal suffixes. *Studies in Second Language Acquisition, 19,* 17-36.

Stæhr, L. S. (2008). Vocabulary size and the skills of listening, reading and writing. *The Language Learning Jouranl, 36,* 139-152.

Sökmen, A. J. (1997). Current trends in teaching second language vocabulary. In N. Schmitt, & M. McCarthy (Eds.), *Vocabulary: Description, acquisition and pedagogy* (pp. 237-257). Cambridge: Cambridge University Press.

Shu, H., Anderson, R. C., & Zhang, H. C. (1995). Incidental learning of word meanings while reading: A Chinese and American cross-cultural study. *Reading Research Quarterly, 30,* 76-95.

Tabatabaei, O., & Yakhabi, M. (2011). The relationship between morphological awareness and vocabulary size of EFL learners. *English Language Teaching, 4,* 262-273.

Templeton, S. (2011/2012). Teaching and learning morphology: A reflection on generative vocabulary instruction. *Journal of Education, 192,* 101-107.

Ward, J., & Chuenjundaeng, J. (2009). Suffix knowledge: Acquisition and applications. *System, 37,* 461-469.

White, T. S., Power, M. A., & White, S. (1989). Morphological analysis: Implications for teaching and understanding vocabulary growth. *Reading Research Quarterly, 24,* 283-304

Zolfagharkhani, M., & Moghadam, R. G. (2011). The effect of etymology instruction on vocabulary learning of upper-intermediate EFL Iranian learners. *Canadian Social Science, 7,* 1-9.

Appendix A Test Formats for the Pre-Test and Main-Test

The affix knowledge test: (partial)

(   )   1.   contra- (A) not (B) against (C) together (D) close

(   )   2.   fore- (A) before (B) for (C) near (D) sure

(   )   3.   inter- (A) in (B) inside (C) between (D) turn

(   )   4.   -lect- (A) choose (B) language (C) knowledge (D) subject

(   )   5.   -scrib- (A) hear (B) speak (C) read (D) write

(   )   6.   -feit- (A) bend (B) make (C) work (D) fact

(   )   7.   -spect- (A) pull (B) push (C) hear (D) look

(   )   8.   -logy (A) knowledge (B) action (C) manner (D) amount

(   )   9.   -ster (A) people (B) parts (C) towards (D) qualities

(   )   10.   -ery (A) a collection of things (B) secure against (C) in a certain manner (D) suitable for

The word acquisition test: (partial)

(   )   1.   協調 (A) adjust (B) modify (C) verify (D) coordinate

(   )   2.   推翻 (A) overtime (B) override (C) depress (D) disclose

(   )   3.   呈現 (A) present (B) predict (C) foresee (D) foresight

(   )   4.   進展 (A) aggress (B) congress (C) progress (D) regress

(   )   5.   面臨 (A) combat (B) comply (C) confront (D) compromise

(   )   6.   與...矛盾 (A) counteract (B) contrary (C) contrast (D) contradict

(   )   7.   擔保品 (A) antitrust (B) concession (C) collateral (D) obligation

(   )   8.   仿製品 (A) despise (B) delinquent (C) insolvency (D) counterfeit

( ) 9. 折舊 (A) oppress (B) depreciation (C) disperse (D) diverse

( ) 10. 支出 (A) splendid (B) venture (C) evacuate (D) expenditure

The word inferencing test: (partial)

( ) 1. benediction (A) 好處 (B) 祝福 (C) 說明 (D) 優秀

( ) 2. surfeit (A) 表面 (B) 服從 (C) 代替 (D) 過量

( ) 3. confection (A) 集會 (B) 調製 (C) 聚集 (D) 團結

( ) 4. postscript (A) 附筆附錄 (B) 心得 (C) 後者 (D) 補充說明

( ) 5. inordinate (A) 沒道理 (B) 控制內 (C) 下訂單 (D) 無節制的

( ) 6. insubordinate (A) 屬下 (B) 追隨者 (C) 不順從的 (D) 不滿意

( ) 7. chatter (A) 說話遮者 (B) 告密者 (C) 喋喋不休 (D) 大聲抱怨

( ) 8. delimit (A) 限定 (B) 無限定 (C) 縮小 (D) 加大

( ) 9. precept (A) 尊重 (B) 認知 (C) 預計 (D) 先行

( ) 10. dispel (A) 驅散 (B) 放棄 (C) 迫使 (D) 抵制

Appendix B Affixes Tested in the Main-Test

1.	ad-	21.	-lect-	41.	-not-
2.	a-	22.	-pel-	42.	-mort-
3.	contra-	23.	-gress-	43.	-nov-
4.	fore-	24.	-scribe-	44.	-frag-
5.	inter-	25.	-leg-	45.	-ver-
6.	de-	26.	-nom-	46.	-ium
7.	counter-	27.	-dict-	47.	-logy
8.	com-	28.	-vert-	48.	-ster
9.	pro-	29.	-struct-	49.	-er
10.	medi-	30.	-cept-	50.	-ery
11.	circum-	31.	-mit-		
12.	trans-	32.	-cide-		
13.	ob-	33.	-bene-		

14.	e-	34.	-crat-
15.	per-	35.	-feit-
16.	sur-	36.	-fic-
17.	sub-	37.	-ordin-
18.	dis-	38.	-port-
19.	post-	39.	-sepct-
20.	col-	40.	-limin-

Appendix C Vocabulary Words Tested in the Main-Test

1.	compliment	36.	collateral	71.	domestic
2.	principle	37.	counterfeit	72.	factor
3.	bookkeeping	38.	controversial	73.	aggressive
4.	idle	39.	depreciation	74.	manufacture
5.	meter	40.	deficit	75.	delegation
6.	code	41.	discrepancy	76.	medium
7.	vain	42.	dispose	77.	commission
8.	surcharge	43.	division	78.	remit
9.	hurdle	44.	expand	79.	nominate
10.	devise	45.	expenditure	80.	portable
11.	coordinate	46.	exempt	81.	prescription
12.	walkout	47.	exhibition	82.	prospect
13.	pending	48.	forecast	83.	aspect
14.	override	49.	incentive	84.	structure
15.	present	50.	impose	85.	contact
16.	progress	51.	inevitable	86.	maintenance
17.	inferior	52.	intercom	87.	tenant
18.	defect	53.	intervention	88.	transaction
19.	subsidiary	54.	monopoly	89.	transparent
20.	confront	55.	unemployment	90.	vacancy
21.	contradict	56.	obscure	91.	venue
22.	extend	57.	obsolete	92.	inventory
23.	agent	58.	reinforce	93.	verify
24.	replacement	59.	credit	94.	advert
25.	compel	60.	subcontract	95.	consultant
26.	democratic	61.	subscribe	96.	candidate
27.	eliminate	62.	surpass	97.	apprentice
28.	manipulate	63.	beneficiary	98.	premise
29.	abrupt	64.	biocide	99.	maturity
30.	adjust	65.	perceive	100.	fragile
31.	annual	66.	circulate		
32.	antibiotic	67.	inclusive		

33.	bifacial	68.	corporation
34.	compatible	69.	credential
35.	consignment	70.	verdict

Appendix D Vocabulary Words Inferred in the Main-Test

1.	mediator	21.	delimit	41.	colloquial
2.	transgress	22.	denote	42.	manicure
3.	propel	23.	immortal	43.	egress
4.	nominee	24.	precept	44.	elect
5.	obstruct	25.	susceptible	45.	intermittent
6.	emit	26.	renovation	46.	manumit
7.	avert	27.	conserve	47.	auditorium
8.	ecocide	28.	dispel	48.	stationery
9.	commemorate	29.	specious	49.	prankster
10.	monocrate	30.	fragment	50.	dissect
11.	legislator	31.	apposite		
12.	circumscribe	32.	depose		
13.	benediction	33.	perennial		
14.	surfeit	34.	forefront		
15.	confection	35.	adhere		
16.	postscript	36.	apolitical		
17.	inordinate	37.	contravention		
18.	insubordinate	38.	controvert		
19.	inscribe	39.	counterclaim		
20.	chatter	40.	coeducation		