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Understanding Sustainable Development of English Vocabulary Acquisition: Evidence from Chinese EFL Learners

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Abstract: Vocabulary learning is often seen as an important but also difficult aspect of learning English as a foreign language (EFL). Thus, it is particularly important to promote the sustainable development of vocabulary acquisition. Many features of English words affect the sustainable development of vocabulary acquisition, including frequency, polysemy, word family, part of speech, and word length. The influence of most of these factors on vocabulary acquisition has been extensively explored in previous studies, but the effects of cognateness and lexicalization remain unclear. This is in part due to the measurement tool, the Vocabulary Size Test, which does not include enough cognates and non-lexicalized words to adequately represent the language used in authentic contexts. To better our understanding of the effect of word features in the context of Chinese EFL learners, the present study modified the Vocabulary Size Test by including additional 19 non-lexicalized words and 33 cognates and administered it to 527 Chinese non-English major sophomores. The results revealed that cognateness, frequency, and polysemy were positively correlated with vocabulary acquisition, whereas word length and lexicalization were negatively correlated with acquisition. Further, multiple regression analysis indicated that cognateness, polysemy, and frequency were the largest contributors to acquisition.

Keywords: cognateness; lexicalization; vocabulary acquisition; polysemy; frequency

1. Introduction

Learning English as a foreign language (EFL) is of critical importance for Chinese learners since English proficiency is essential for academic achievement and future career development [1]. Effective vocabulary learning is among one of the most important aspects for second language or EFL learners to increase their language proficiency [2] and having a large vocabulary size can contribute to better performance on reading, writing, speaking, and listening [3]. However, vocabulary learning ranks as one of the greatest challenges for English language learners [4,5]. For example, Chinese students start to learn English from Grade Three; however, with almost 10 years of learning, the pass rate of CET-4 (College English Test Band 4), which requires a mastery of a vocabulary size of 4500, is only 60% [6]. In other words, vocabulary learning remains a great challenge for Chinese EFL learners. In addition, many students reported that vocabulary learning was boring [7]. In the traditional English classroom, typical learning activities include reading, listening and doing exercises, and students have very limited time assigned to vocabulary

learning. In this regard, it is critical to promote Chinese EFL learners' sustainable development of English vocabulary acquisition. Several studies implemented different approaches to promote sustainable development of English skills. For example, Han, Geng and Wang [8] created an online environment for sustainable development of English reading skills. Kim and Pae [9] created a social psychological model for sustainable English learning among Korean EFL learners. Regarding learning difficulties in English vocabulary, it is important to understand what kinds of words are easy to learn, and what other kinds are difficult. Due to the limited time that students and teachers may have both in class and out of class, many may lack the awareness of those difficulties, leading to the inefficiency in vocabulary learning. Many studies have examined the features of English vocabulary affecting the sustainable development of vocabulary acquisition, including frequency [10,11], word length [12,13], polysemy [14,15], cognateness [11,16], lexicalization [17,18], word family [19,20], and part of speech [21,22]. However, there are some limitations within them, particularly related to the measures used.

Most prior studies investigating the features of English vocabulary affecting learning difficulties employed the instrument of Vocabulary Size Test (VST). The VST, including 140 test items, with 10 items selected from every 1000th frequency level, is designed to measure English learners' receptive vocabulary knowledge [23]. One major limitation of this instrument is that the Chinese bilingual version contains no non-lexicalized words (NL words) and only five cognates [12], which does not adequately represent the authentic language use. Due to this limitation of the measurement, studies investigating the effects of lexicalization and cognateness on Chinese EFL learners' English vocabulary learning are lacking, particularly studies on learners from mainland China. First, regarding cognateness, the actual number of cognates between Chinese and English is considerably large [24]. Cognates provide learners with a big advantage in learning the English vocabulary [11,25], but the contribution of cognateness to Chinese EFL learners' English vocabulary learning has not been explored. Second, as for lexicalization, NL words pose great challenges for EFL learners [18]. Specifically, most of the time, both teachers and students may not have the awareness of lexicalization, and thus, teachers might not pay much attention to NL words and provide elaboration of NL words. Besides the one caused by the measure, another limitation of those earlier studies is that none have comprehensively investigated all of the important features affecting vocabulary learning, especially in the context of Chinese EFL learners.

To our knowledge, this study is the first one to investigate the effect of lexicalization and cognateness on Chinese EFL learners' English vocabulary learning. With the findings of this study, we hope to fill the gap by creating a model to comprehensively depict Chinese EFL learners' vocabulary learning difficulties. In addition, with this study, we also aim to provide more empirical evidence to clarify some ambiguous issues in terms of the English vocabulary features affecting learning difficulty.

Therefore, the main goal of the present study was to investigate the effects of cognateness and lexicalization on Chinese EFL learners' vocabulary learning by adding adequate cognates and NL words in the VST. It is worth noting that the aim of adding cognates and NL words was to investigate the factors of cognateness and lexicalization, rather than create a new vocabulary size test measurement. The second goal was to comprehensively investigate how other word properties, that is, frequency, word length, part of speech, polysemy, and word family, affect English vocabulary learning since inconsistent findings remained. For example, some researchers proposed that word family had a significant effect on vocabulary learning [26], whereas others found null effect [19]. Taken together, this study tries to reveal the reasons why difficulties prevail in vocabulary learning and provide more empirical evidence within a different cultural context to enrich the understanding of this research topic. In the following section, major findings of prior studies on each of the factors of interest along with the theoretical framework guiding this study were reviewed in detail.

2. Literature Review

2.1. Theoretical Framework: Models of EFL Learners' Vocabulary Acquisition

Regarding the English vocabulary features affecting learning difficulties of vocabulary acquisition, previous studies have intended to create regression models to facilitate a clear understanding. One of the models was created by Willis and Ohashi [11]. In this model, cognateness, frequency, and word length in phoneme were included. The results showed that all the three variables had significant contribution to vocabulary acquisition. However, there are two limitations in this model. First, previous studies have demonstrated that other word properties had significant effects on vocabulary acquisition, such as word family, part of speech, lexicalization, and polysemy, but these important variables were not included in this model. Another limitation is, as acknowledged by the authors, this model was based on Japanese EFL students, and may not be applicable to Chinese EFL learners, especially for the factors of cognateness and lexicalization. Chinese and Japanese are two different languages, and some English words which are non-lexicalized in Japanese may be lexicalized in Chinese. Moreover, Japanese and Chinese have borrowed different words from English, so the effect of cognateness may be different on Chinese EFL learners. In sum, this model may not be appropriate to depict Chinese EFL learners' English vocabulary learning difficulties.

Another model was created by Reynolds et al. [12] which was based on Taiwanese English majors. The result showed that frequency, polysemy, and part of speech were the three main contributors to the model. There were also two limitations. First, this model tried to investigate all the important variables, which could comprehensively depict the learning difficulties. However, due to the fact that there were not enough cognates (only 4 cognates) and there were no NL words in the measurement, the effects of lexicalization and cognateness were not explored. Another limitation was that this model was based on Taiwanese English majors and may not be readily applicable to mainland Chinese EFL learners. First, students from different academic backgrounds may have different learning motivation and different English proficiency [27,28], which may lead to differences in vocabulary acquisition. The participants in this previous study were English majors, whereas participants in the present study are English minors. Second, different English educational backgrounds may also affect English learning [29,30]. There are significant differences in English teaching between mainland China and Taiwan, which may lead to different English vocabulary acquisition.

Therefore, the model created by Reynolds et al. [12] would serve as a theoretical framework guiding this study, which includes seven important variables, that is, cognateness, lexicalization, frequency, polysemy, part of speech, word length, and word family. With this theoretical framework, important factors can be comprehensively investigated. Findings on each of the variables would be reviewed in the following section.

2.2. Cognateness

Cognateness refers to the feature that a word shares similar form and definition in two languages [31]. In the context of Chinese and English, cognateness refers to a word sharing similar phonetic rather than alphabetic form, since these two languages are different in written form; that is, English is phonetic and Chinese is ideographic. For example, "pizza" has a high similarity of sound with its Chinese equivalent "pisa", and thus, it is a cognate. For second language learners, it is easier to acquire cognates due to the phonetic relatedness. Cognates seem to be more easily acquired and retained than non-cognates [32], even if the two languages do not share the same script [33,34]. Lado [25] proposed that the many cognates between Spanish and English words assisted the English learning for Spanish EFL learners. Even for those who had not learned English, they might recognize the cognates as well. Daulton [16] reported that the cognates not only facilitated

learning but also were more preferred than non-cognates in Japanese EFL learners' writing. In a similar manner, Willis and Ohashi [11] found that cognateness was the greatest contributor to Japanese EFL learners' English vocabulary acquisition in their model.

It should be noted that some cognates have similar sounds but different meanings. These are called deceptive cognates and they may hinder learning since learners believe that they have acquired the English words but in fact the meanings they recognized are incorrect [25]. There are many deceptive cognates between Japanese and Chinese, suggesting that Chinese borrowed from Japanese the written form only, but not the definition. However, there are very few deceptive cognates between Chinese and English; instead, most cognates share the same definition and similar pronunciation. Therefore, deceptive cognates were not included in this study.

Some researchers cautioned that including cognates in the vocabulary size test might increase or even inflate the test takers' vocabulary size since they might choose the right answer just based on the phonetic or alphabetic cues rather than their real vocabulary knowledge [35,36]. However, Nation and Coxhead [37] noted that cognates were legitimate words in learners' second language use. Furthermore, Gyllstad, Vilkaitė, and Schmitt [38] have suggested not eliminating cognates from test measurements, because cognates are a reality that should be accounted for when measuring learners' vocabulary size. Thus, it is rational to include cognates in the vocabulary test.

2.3. Lexicalization

Lexicalization refers to the feature that a word has a parallel translation or a conventional equivalent expression in another language [17,18]. If an English word does not have an equivalent expression in Chinese, then this word is a non-lexicalized (NL) word. For example, the definition of the English word "tarn" is "a small lake in the mountains". When it is translated into Chinese, there is no equivalent term or fixed expression with the same meaning. Therefore, it is a NL word. Previous studies supported that lexicalization facilitates comprehension and learning of L2 vocabulary. For instance, in the study of Jiang [39], Chinese EFL learners were asked to determine the relatedness of English word pairs. The result showed that the score was higher on the English word pairs which had the same translation in Chinese than those with a different L1 translation. Similar results were also found in a replication study among Korean ESL learners by Jiang [40].

On the contrary, non-lexicalization can cause difficulties in vocabulary learning. Quite a few studies have supported that learning NL words demands more mental efforts than lexicalized words [17,18]. It is possible that without an equivalent expression, there is no fixed unit in learners' mental representation. Thus, learners may need to decode the meaning by comprehending an expression or a sentence, rather than an existing psychological representation. To illustrate this issue, Paribakht [41] found that Persian ESL learners were less successful in decoding NL words than lexicalized words, indicating that lexicalization can affect L2 vocabulary acquisition. Chen and Truscott [18] investigated the effect of lexicalization on incidental vocabulary learning among Taiwanese EFL learners, suggesting that it was very difficult to learn NL words, and even the increase in exposure frequency did not help acquisition at all. All of these studies implied that lexicalization was a critical factor influencing English vocabulary acquisition.

2.4. Frequency

Increasing the exposure of English words can assist vocabulary learning, indicating that frequency is an important factor for English vocabulary learning [42]. Many studies supported that frequency affected vocabulary acquisition [11,12]. For example, in Reynolds et al. [12], frequency was operationalized as BNC lemma frequency, and the result revealed that frequency was positively correlated with vocabulary acquisition and also a contributor to the model of English majors' vocabulary learning in Taiwan. In addition, Eckerth and Tavakoli [10] found that increasing word exposure frequency or word repetition was effective for incidental word learning. Similarly, Willis and Ohashi [11] also

found that frequency along with cognateness and word length could best predict Japanese EFL learners' learning difficulties of English vocabulary.

2.5. Polysemy

Polysemy is defined as the situation when a word has different but related meanings [43]. For example, the word "see" has 24 meanings, then it is a polysemous word. Previous studies showed inconsistent findings regarding the effect of polysemy on vocabulary learning. Some researchers proposed that the relatedness in meanings of polysemous words might help learners to learn [14,44]. However, other researchers suggested the hindering effect of polysemy [45]. It is possible that because polysemous words contain different meanings, it is difficult for EFL learners to figure out the exact corresponding meaning in a certain context. Learners may choose the meaning which is not correct in the context without realizing that [46,47].

2.6. Word Length

Word length can be measured in three dimensions: letter, syllable, and phoneme [11]. In general, previous studies supported that word length can affect the acquisition and retention of English vocabulary. For example, Reynolds et al. [12] found that word length in phoneme was a main contributor to the model of learning difficulties of English vocabulary among Taiwanese English majors. Additionally, in the study of Willis and Ohashi [11], word length in phoneme predicted the learning difficulty of Japanese EFL learners. There are other studies investigating the effect of word length in special populations. For example, Nickels and Howard [13] investigated the effect of word length on word production among people with Aphasia and found that the number of syllables had a significant effect on the accuracy of word production.

2.7. Word Family

Word family refers to the number of family members under a certain head word, including the head word itself, and its inflected or derived forms [12]. Words in a same family share similar meanings and forms. With enough input of language, learners can develop morphological awareness [48]. This is especially true for Chinese children, who develop morphological awareness at a very young age [49]. With the development of morphological awareness, English learners can master the building devices of English vocabulary, that is, the formation rule of words [20]. This implies that when learners acquire one word, they may also know other members under the same word family. For example, if students know "help", they may infer the meaning of "helpful", "helpless", and "helplessness", thus increasing the exposure of word item will facilitate vocabulary learning [26]. If a word has more word family members, then the family members under the same head word will be more likely to be exposed in reading contexts, which indicates that the word which has more family members can be easier to acquire and retain.

Recently, however, emerging studies have questioned whether EFL learners have the ability to associate the head words with their inflections [19,50]. For example, Ward and Chuenjundaeng [19] investigated this issue among Thai college students and found that even advanced learners lacked this ability. If second language learners cannot associate different tokens under the same word family, then the factor of word family may not affect vocabulary acquisition. Further, some researchers questioned the validity of many studies which measured frequency based on word family, rather than word lemma frequency [51,52], proposing that measuring frequency based on word family may not be appropriate since learners lack the ability of associating family members under the same family. In sum, the effect of word family on the learning difficulty of English vocabulary should be further explored.

2.8. Part of Speech

Researchers proposed that certain types of words tend to be easier to learn than other types. For example, Laufer [43] argued that nouns and verbs were easier to learn than adjectives and adverbs. The effect of part of speech was also supported by some empirical studies [53]. For example, in Kweon and Kim [22]'s study, Korean English learners were required to read literary texts and then their knowledge of vocabulary was measured. The result revealed that nouns were easier to retain than verbs and adjectives. In response to the findings, some researchers tried to investigate the reasons why that happened. For example, in Marinellie and Johnson [21]'s study, 30 upper-grade primary students were required to provide definitions of nouns and verbs, which were later graded on content description and grammatical form (syntax). They found no significant difference between nouns and verbs in content description. However, for grammatical form, the scores of nouns were significantly higher than verbs. The authors suggested that learning verbs may demand more mental effort than nouns because the definition of verbs was more complex than nouns.

However, regarding the factor part of speech, there were also inconsistent findings. For example, in Reynolds et al. [12]'s study, based on the test score of the Vocabulary Size Test, there was no significant difference in effects among nouns, verbs, and adjectives, whereas in the sequential regression analysis, nouns made a significant contribution to the model. In sum, the effect of part of speech on English vocabulary acquisition is still worthy of further investigation.

In sum, the above section reviewed the theoretical framework for the current study, along with the seven important variables that may affect English vocabulary acquisition and retention. Based on the literature review above, the following research questions were proposed in the present study:

1. Do the variables of cognateness and lexicalization affect English vocabulary acquisition and retention among mainland Chinese learners?
2. Do other factors (frequency, word length, part of speech, polysemy, and word family) mentioned above show an effect?
3. What are the contributions of each variable?

3. Method

3.1. Participants

The participants were 527 non-English major sophomores (328 females, 62.2 %; mean age 19.24; SD = 0.12) from a large university in Southwestern China. All of the participants have learned English for at least ten years. This public comprehensive university ranks Top 3 in this region, which is a less developed province in China. Their majors cover finance (20.5%), economics (21.6%), accounting (10.4%), international trade (9%), computer science (8.5%), human resources (9%), and hotel management (20.7%).

3.2. Instrument

The measurement instrument used in this study was a modified version of the Vocabulary Size Test (VST, bilingual Mandarin paper-based version). The original VST [23], containing 140 items, is a test designed to measure Chinese EFL learners' vocabulary size. The unit of frequency in VST is based on word family. The vocabulary size of the test takers is calculated by multiplying 100 by the total number of correct responses. To reach our goal of investigating the variables of cognateness and lexicalization, additional 52 items (33 cognates and 19 NL words) were added to the VST, resulting in 192 items in total. Appendix A contains a sample of the original VST items, and Appendix B contains a sample of added items. We discussed how the added cognates and NL words were selected in detail in the next section of operationalization of word properties.

The added test items were compiled following the rules of how the original VST was designed. Those rules include: (1) the stem of the test items consists of very simple words to ensure minimal difficulty for test takers to read the stems, (2) the stem does not provide

any context or implication for the tested words, (3) the stem provides an example of correct use of the tested item, (4) the stem indicates the part of speech used in the sentence, thus avoiding the meaning of a homograph or a very different sense, (5) the correct choices allocated to A, B, C or D are spread evenly across the test, (6) the distractors are of the same part of speech as the tested items, (7) the meaning of the distractors are sensibly fit in the stem, (8) clues such as the length of choices, general versus specific are avoided to discourage choosing strategies.

The items in the original VST were arranged following the frequency order, with low frequency words set in the latter part of the test, which might lead to test takers' giving up on the latter part of the test. Therefore, to ensure participants completed the whole test, in this study, items with different levels of frequency were mixed in a random order, with high frequency and low frequency words roughly spreading evenly across the test. The full version of the revised test was piloted among 20 participants before the formal study. None of the participants reported problems with the test, such as unknown words in the stems, ambiguous meaning of the stems, or tendency of choosing the right answer by strategies rather than vocabulary knowledge.

3.3. Procedure

The test was administered in a classroom setting. Before the test, the students were told that their vocabulary size would be measured by this test, and they were required to complete the test in 50 min. For confidentiality, participants were allocated with a number instead of reporting their real name.

3.4. Operationalization of Word Properties

3.4.1. Frequency

The operational definition of frequency was based on two corpora: BNC (British National Corpus: https://www.english-corpora.org/bnc/ (accessed on 1 July 2020)), and COCA (Corpus of Contemporary American English: https://www.english-corpora.org/coca/ (accessed on 1 July 2020)). Both corpora are widely used in the literature, and one distinct difference between them is that frequency in BNC is word family frequency whereas that in COCA is word lemma frequency.

3.4.2. Word Length

Word length was measured in three ways: number of letters, number of phonemes, and number of syllables. For example, the item "see" has 3 letters, 2 phonemes, and 1 syllable. All of the 192 items were coded based on the Online Dictionary: https://www.merriam-webster.com/ (accessed on 1 July 2020).

3.4.3. Lexicalization

In this study, 19 NL words were selected. All of them were checked by various online dictionaries, including https://www.merriam-webster.com (accessed on 1 July 2020), https://dictionary.cambridge.org/ and https://en.wiktionary.org/wiki/Wiktionary:Main_Page (accessed on 1 July 2020). The definitions of these selected NL words were also checked by 6 native Chinese speakers, and all of them agreed that there were no equivalent expressions in Chinese for the 19 NL words. For example, the meaning of "tarn" is "a small lake in the mountain", and there is not an equivalent expression in Chinese. We balanced other word properties of interest, such as frequency and word length, and matched the ratio of part of speech in the VST, that is, the percentage of nouns, verbs and adjectives are 70%, 16%, and 14% respectively. The properties of the 19 NL words were shown in Table 1. NL words were coded as 1, otherwise 0.

Table 1. The Properties of the 19 NL Words.

Word Length (Number of Letters)	Part of Speech	Frequency (in BNC)
4 short words (≤4 letters)	13 nouns (68%)	11 high frequency words (≥100)
3 medium words (5–6 letters)	4 verbs (21%)	
12 long words (≥7 letters)	2 adjectives (11%)	8 low frequency words (<100)

3.4.4. Cognateness

As suggested by Silva and Otwinowska [54], the number of cognates in the vocabulary test should be proportional to the number of cognates in the learners' L1. Hence, 33 cognates were selected from Zhang et al. [55] and Shi [24]. Similarly to the added NL words, we balanced word length and matched the ratio of part of speech in the VST. The properties of the added 33 cognates are shown in Table 2. All of the added items were also checked by the dictionaries http://www.hydcd.com/ (accessed on 1 July 2020) and http://dict.revised.moe.tw/cbdic/ (accessed on 1 July 2020). In addition, phonological similarity was rated by 50 native Chinese speakers with a 7-point Likert-scale from 1 to 7, with 1 representing no similarity and 7 representing very high similarity. The similarity of all the added 33 items is presented in Table 3. Cognates were coded as 1, otherwise 0.

Table 2. The Properties of the 33 Cognates.

Word Length (Number of Letters)	Part of Speech	Frequency (in BNC)
10 short words (≤4 letters)	22 nouns (67%)	4 low frequency words (<100)
12 medium words (5–6 letters)	6 verbs (18%)	17 medium frequency words (100–1000)
11 long words (≥7 letters)	5 adjectives (15%)	12 high frequency words (>1000)

Table 3. Descriptive Statistics of the Similarity of 33 Cognates.

N	Range	Minimum	Maximum	*Mean*	*SD*
33	3.72	2.84	6.56	4.93	0.83

3.4.5. Word Family

The data of word family were coded based on Nation's word family lists [56]. For example, the word family of "hacker" includes "hacker" itself, "hack", "hacked", "hackers", "hacking" and "hacks", thus the number of its word family is 6.

3.4.6. Polysemy

The data of polysemy were coded based on the WordNet (http://wordnetweb.princeton.edu/perl/webwn (accessed on 1 July 2020)). For example, the coding of the word "cartoon" for the property of polysemy is 3 since it could have 3 meanings in different contexts (WordNet, 2021).

3.4.7. Part of Speech

The part of speech of all the tested items was coded according to the context in the test stems. The original VST contains 98 nouns (70%), 22 verbs (16%), and 20 adjectives (14%). The part of speech in the 52 added items is displayed in Table 4.

Table 4. The Part of Speech in the 52 Added Items.

	Noun	**Verb**	**Adjective**
N	35	10	7
Percentage	67%	19%	13%

3.4.8. Item Facility

Item facility was the dependent variable in this study. Item facility refers to the average score of all respondents on a certain item. If a participant gave correct answer to a certain item, it would be scored 1, otherwise it was scored 0. For example, the average score on the word "carnation" was 0.87 among 527 participants, then the IF for this item was 0.87.

4. Data Analysis

The data were analyzed using SPSS 25.0. Descriptive statistics and correlations were obtained. Further, multiple regression modeling was employed. Since BNC frequency and COCA frequency is highly correlated, only BNC frequency entered the model. Results showed that frequency, polysemy, cognateness, word length in letter, and lexicalization were significantly correlated with IF, thus these variables were chosen to enter the model.

5. Results

5.1. Descriptive Statistics of Participants' Vocabulary Size

The modified VST in the present study was highly reliable (Cronbach alpha = 0.847) [57]. The respondents' estimated vocabulary sizes ranged from 4100 to 12,100, with a mean of 6391 words (SD = 1104), median of 6200, and mode of 6200.

5.2. Correlations

Table 5 shows the correlations between word features and IF. Cognateness has the strongest correlation with IF, followed by polysemy and frequency. Lexicalization and word length in letter are negatively correlated with IF. There are no significant correlations between IF and word family, or between IF and part of speech.

Table 5. Correlations between Variables.

	IF	**Fre BNC**	**Fre COCA**	**Phonemes**	**Word Family**	**Cog**	**Syllables**	**Letters**	**Polysemy**	**Lex**	**Noun**	**Verb**	**Adj**
IF	1												
Fre BNC	0.24 **	1											
Fre COCA	0.23 **	0.99 **	1										
Phonemes	−0.13	−0.16 *	−0.16 *	1									
Word Family	0.03	0.22 **	0.23 **	0.00	1								
Cog	0.58 **	0.00	−0.00	−0.06	−0.09	1							
Syllables	−0.10	−0.15 *	−0.15 *	0.85 **	−0.03	−0.01	1						
Letters	−0.18 *	−0.17 *	−0.17 *	0.92 **	0.06	−0.12	0.83 **	1					
Polysemy	0.28 **	0.45 **	0.46 **	−0.21 **	0.41 **	−0.05	−0.25 **	−0.22 **	1				
Lex	−0.20 **	−0.06	-0.05	0.16	0.07	−0.17 *	0.15 *	0.16 *	0.01	1			
Noun	−0.01	−0.07	−0.07	0.12	−0.36 **	0.02	0.07	0.09	−0.23 *	−0.01	1		
Verb	0.04	0.13	0.13	−0.22 **	0.38 **	0.00	−0.24 *	−0.20 *	0.33 *	0.05	−0.65 *	1	
Adj	−0.02	−0.05	−0.04	0.07	0.08	−0.03	0.16 *	0.09	−0.05	−0.04	−0.63 *	−0.18 *	1

Note: Fre BNC = Frequency in BNC; Fre COCA = Frequency in COCA; Cog = Cognateness; Lex = Lexicalization. * $p < 0.05$; ** $p < 0.01$.

5.3. Multiple Regression Model

A multiple regression model was fitted using the sequential regression procedure to investigate the effects of various word features on IF (see Table 6). Similar methods were used in previous studies [12]. Variables were consecutively entered based on the correlation strength with IF (those with larger correlation coefficients were entered first). The final model (Model 3) consisted of 3 predictor variables: cognateness, polysemy, and frequency (BNC) ($F = 49.535$, $df = 3$, $p = 0.000$). Previous studies suggested that variables such as BNC frequency, Phonemes and Cognateness were the most significant predictor variables for the VST score [11]. However, the present study showed that Cognateness added the most explanatory power to the model ($r^2 = 0.334$), followed by Polysemy ($r^2 = 0.095$), and frequency ($r^2 = 0.013$). Model 3, which included 3 variables, accounted for 44.1% of the total variance in VST scores ($r = 0.664$, $r^2 = 0.441$). Based on this model, high frequency polysemous cognates would be the type of words that are more likely to be acquired by Chinese EFL learners.

Table 6. Multiple Regression Model Using a Sequential Regression Procedure.

Model	r	r^2	r^2 Change	Cognateness β	Polysemy β	BNC β	Lexicalization β	Letter β
1	0.578	0.334	0.334 ***	0.578 ***				
2	0.655	0.429	0.095 ***	0.593 ***	0.308 ***			
3	0.664	0.441	0.013 *	0.591 ***	0.250 ***	0.127 *		
4	0.671	0.451	0.009	0.575 ***	0.254 ***	0.120	−0.098	
5	0.672	0.451	0.000	0.573 ***	0.250 ***	0.118	−0.095	−0.018

Note: Model 1 predictors: cognateness, Model 2 predictors: cognateness, polysemy, Model 3 predictors: cognateness, polysemy, BNC, Model 4 predictors: cognateness, polysemy, BNC, lexicalization, Model 5 predictors: cognateness, polysemy, BNC, lexicalization, letter, * $p < 0.05$; *** $p < 0.001$.

6. Discussion

6.1. Answer to Research Questions 1 and 2

This study investigated seven important word features which might affect English vocabulary acquisition and retention. The results showed that cognateness, frequency, and polysemy were positively related to vocabulary acquisition, whereas lexicalization and word length in letter were negatively related to acquisition. In addition, the variables of word family and part of speech had no significant effect on vocabulary acquisition.

First and foremost, cognates were found to be easier to learn in the present study. It is worth mentioning that this result was inconsistent with Milton and Daller [58] and Milton [59]. One possible reason for this inconsistency was that in Milton [59] and Milton and Daller [58], the cognateness was coded as the proportion of letters in common in two languages, whereas in the present study, the cognateness was coded as a binary variable. We also rated the phonetic similarity and showed that all the cognates had high phonetic similarity. In other words, it is easy for Chinese EFL learners to discern cognates in this study. Nevertheless, this result was consistent with the finding from Willis and Ohashi [11]. Modern Chinese Mandarin borrows a great number of words from English [24], and these words have phonetic similarity, which facilitates vocabulary learning. Similarly, English has borrowed words from Chinese as well, such as "lychee", "bok choy" and "wok". Both these two types of cognates share similar pronunciation and the same meaning between the two languages. Thus, EFL learners can use them as cues for new words learning. Some learners may not be aware that certain words are cognates (for example, Chinese 'nai xi': milkshake). In such cases, if English teachers can elaborate that they are borrowed from English, students can have a better and deeper understanding of the cognates, and the learning outcome will be better. On the other hand, it is worth noting that although there is phonetic similarity in cognates, the pronunciation is slightly different between English words and its Chinese equivalents. Hence, teachers need to highlight the difference and

help students pronounce correctly for better speaking in English. Cognates enjoy a big advantage and due to the large number of them, both students and teachers should take advantage of them to increase learners' vocabulary size.

Further, polysemy was positively correlated with vocabulary acquisition, which implied that words with more meanings tended to be easier to learn. This finding was consistent with the result of Reynolds et al. [12] and Verspoor and Lowie [44]. In the study of Verspoor and Lowie [44], Dutch learners of English were provided with a core sense (or meaning), and results showed that in this learning environment, learners performed better on guessing and long-term retention of polysemous words. This study implied that for polysemous words learning, the context of reading materials was important. Provided with cues, learners had the ability to guess the definition of polysemous words. Another study conducted by Reynolds et al. [12] also supported that polysemous words were easy to learn. It is possible that because polysemous words contain multiple but related meanings, the exposure frequency in different contexts may be higher, leading to the better learning outcomes. Particularly, the various definitions of polysemous words are related, so in a given reading context, learners have the ability to infer the meaning of polysemous words. This result implies that in the vocabulary teaching practice, teachers should provide students with abundant reading materials, and EFL learners also should try to read more [60]. With much language input, the polysemous words can be exposed in different contexts with different but related meanings, so that EFL learners can have a better leaning of polysemous words. Similarly, frequency was found to be positively correlated with vocabulary acquisition, indicating that high frequency words tend to be easier to acquire and retain. This finding was consistent with many previous studies [11,12]. It is well known that increasing the exposure of new words will help learners to acquire vocabulary [61,62]. Besides asking students to read as much as possible, it is recommended that English teachers should provide supplementary reading materials in addition to the textbooks to target for a higher vocabulary frequency [63]. Further, listening vocabulary can be an innovative form to increase exposure when students already have too much "reading" [64].

In contrast, for lexicalization, non-lexicalized words were found to pose great difficulty for vocabulary leaning. This result was consistent with Heidari-Shahreza and Tavakoli [17], Paribakht [41] and Chen and Truscott [18]. All of these studies support the idea that NL words were more difficult to acquire. For NL words learning, learners not only need to learn a new label, but also need to build a new concept [65]. Nagy, Anderson [66] found that concept difficulty significantly affected incidental vocabulary learning. Chen and Truscott [18] also proposed that learners should map a new label to a new concept in the learning of NL words. Since NL words do not have fixed expressions and require a sentence or a phrase to explain their meanings, which means that there are not fixed psychological units in EFL learners' mental lexicon, therefore EFL learners need more cognitive resources to understand the vocabulary knowledge. Although the number of NL words are limited between Chinese and English and therefore lexicalization contributes little in the model in this study, it still requires attention. Regarding NL words, teachers first should develop the awareness of lexicalization, realizing that there are some words that do not have fixed equivalent expression. For these words, teachers should elaborate the definition of NL words or even compare the definition of NL words with its translations. In addition, teachers should focus on helping students build a new concept and a new label for NL words, which will facilitate the acquisition of NL words. There are other types of NL words which are not included in this study, such as "drive-through" and "walk -in". These words are high frequency words since they are often used in daily life; however, they are still not easy to understand for EFL learners. Special attention should be also paid to these NL words in the vocabulary teaching practice. It is worth noting that language changes over time. Specifically, one word that was once a NL word may become a lexicalized word after some time. For example, there was not a fixed equivalent Chinese word for "portfolio". However, using portfolios as learning assessment has gradually evolving in China, which has resulted in a fixed translation (dang an dai) to

represent it. In other words, "portfolio" has become a lexicalized word. This phenomenon implies that NL words are difficult to acquire and thus require a fixed expression (a word, namely lexicalization) to represent the definition.

Word length in letter showed significant negative correlation with vocabulary learning. This finding was consistent with Willis and Ohashi [11], Milton and Daller [58], Milton [67] and Reynolds et al. [12]. The difference between the current study and previous one was that they used different methods to measure word length. Specifically, the current study used word length in letter whereas the previous study adopted word length in phoneme, both showing a significant effect on vocabulary acquisition. As is shown in the correlation table, the three dimensions of word length had high correlations. More letters always mean more phonemes. It is well known that longer words are hard to learn, but in the teaching practice, we cannot change the number of letters of a word. In this case, the repetition-based method can be implemented in vocabulary teaching. With enough times of repetition, the learning will be better [60].

Last, in this study, neither word family nor part of speech showed significant correlation with acquisition and retention. No significant effect was found on the variable of word family, and this was consistent with the study of Reynolds et al. [12], implying that the number of word family members did not affect the learning difficulty. As aforementioned, emerging studies questioned EFL learners' ability of associating head word with its family members [19,50], and even for advanced learners or even native speakers, they still lack the ability [19]. With the development of morphological awareness, it is assumed that learners are able to associate family members under the same head word [68]. However, for EFL learners, without enough input, the development of morphological awareness of a foreign language is difficult to take place. It is not easy to infer the meaning of other family members even if learners have acquired the head word or its family members. This result was inconsistent with Webb and Macalister [69], in which the authors proposed that learners can infer the meaning of its family members. One possible reason for this inconsistency may be that in the previous study, the authors used simple and small number of items. For such tested items, it is easy for participants to infer the meaning. However, in the current study, there are a large number of test items, and it covers all levels of frequency, so it is not easy to infer the meaning from its family members. In addition, part of speech did not show significant correlation with vocabulary acquisition. This result was inconsistent with the findings from Reynolds et al. [12], in which nouns were easier to acquire than verbs and adjectives. One possible explanation for this result is that the participants of this study were non-English majors, while the participants in Reynolds et al. [12]'s study were Taiwanese English majors. In China, the academic requirement of non-English majors is different from English majors, and their learning motivation is not as strong as English majors. Moreover, their English proficiency is not as good as English majors. In other words, non-English majors may not read as much as possible. Without enough language input, the effect of part of speech may not take place. Just as the pedagogical approach of the four strands proposed by Nation [60], which proposed that meaning focused input, meaning-focused output, language-focused learning and fluency development are the four strands of language teaching and should be assigned roughly equal amount of time, implying that there should be a lot of language input and output for language learning. Language-focused learning makes up one fourth of the time, which is crucial for language learning, because language-focused learning is efficient and effective. In other words, both extensive reading and explicit grammar instruction are indispensable for vocabulary teaching.

In general, to promote the sustainable development of vocabulary acquisition, there are many approaches, one of which is to take advantage of technology. Vocabulary learning is often boring [7]. However, with the help of technology which provides interesting learning resources, the learning can be fun and enjoyable [70]. In addition, vocabulary teaching should also consider individual differences. For example, Yeldham [71] found that learners with higher vocabulary knowledge saw a much greater improvement in their

self-efficacy compared to their counterparts with lower vocabulary knowledge. What's more, motivation plays an important part in language learning. As indicated by Namazi-andost et al. [72] the involvement load had a significant effect on incidental vocabulary acquisition in reading tasks. Hence, for vocabulary teaching, teachers, instructors, and trainers should focus on students' participation in the learning activity, and design learning activities which are attractive to promote involvement, so as to enhance students' motivation and learning achievement.

6.2. Answer to Research Question 3

Based on the sequential regression modeling, we found that the three main contributors to the model were cognateness, polysemy, and frequency. Cognateness was the greatest contributor to the model. This result was consistent with the finding from Willis and Ohashi [11], which showed that cognateness was the greatest contributor to their model of Japanese EFL learners' English vocabulary acquisition. The second contributor to the model was polysemy, and the third contributor to the model was frequency.

According to the current model, cognateness, polysemy, and frequency were the three main contributors to the model, implying that high frequency polysemous cognates are easier to be acquired and retained by Chinese non-English majors. This result is partly different from previous studies [11,12]. In the model of Reynolds et al. [12], frequency and polysemy were the most significant contributors to English vocabulary acquisition. The possible reason for this inconsistency may be that this study investigated main word features comprehensively, whereas the other two previous studies excluded some main word features. Another reason may be that the participants in this study were from a different population, that is, the academic background and education experience may be different in different regions [73].

This study was guided by the theoretical model created by Reynolds et al. [12], however, the model was slightly modified based on the results in the present study. In other words, the current modified model is more appropriate to depict Chinese non-English majors' vocabulary acquisition.

7. Conclusions

To better understand the sustainable development of English vocabulary acquisition, that is, to explore the word features that affect the sustainable development of English vocabulary acquisition, this study made a unique contribution to this research topic by modifying the measurement tool to assess vocabulary size to be more closely aligned with authentic language use. Specifically, it simultaneously investigated seven important variables within the same model to determine the relative importance of each word feature. Among these seven variables, this was the first study that examined cognateness and lexicalization in the context of Chinese EFL learners. Previous studies have proposed that cognateness facilitated L2 vocabulary learning and NL words posed a great difficulty for vocabulary learning in the context of other languages [11,25]. However, empirical research in the context of Chinese EFL learners is rare. This study filled this gap and enriched the literature in this line of research. The results supported that knowledge of cognates, polysemous words, and high frequency words were associated with greater vocabulary acquisition. In contrast, longer words and NL words were hard to learn.

8. Limitations and Future Directions

This study bears some limitations. First, the participants of this study comprised non-English majors, and thus, the results may not be generalized to English majors. People with different academic interests may have different English proficiency (vocabulary size) and different English learning motivation, along with different English attitudes [73]. English majors and English minors are distinct in many aspects. In general, English majors have better language proficiency, larger vocabulary size and higher learning motivation.

Given these differences, the results of the current study were inconsistent in some aspects of the previous studies; moreover, the results cannot be generalized for learners from other academic backgrounds. Second, the participants in the current study were from a less developed region in mainland China, thus the result may be generalized to other regions, such as the developed region of Eastern China, or the Chinese EFL learners in Taiwan, Hong Kong and Macao. Hence, studies conducted among English majors or students in other regions of China (for example, the developed Eastern China) are expected in the future. Third, the respondents in the present study had a medium vocabulary size in general. Specifically, participants' average vocabulary size reported in this study was 6391, which belongs to a medium level according to Nation and Beglar [23], so future research can conduct replication studies among Chinese EFL learners with a different language proficiency level (for example, advanced; English majors, or graduate students) by explicitly measuring their general L2 proficiency. Fourth, although the VST is a common tool used in research, there are other methods of assessing vocabulary acquisition [74,75]. For example, future studies may examine the learning performance by the task of learning words, and measure learning depth of vocabulary knowledge, such as knowledge about grammatical characteristics and contextual constraints, and knowledge about use, word association, word parts, and collocations [76]. A good vocabulary size does not guarantee good vocabulary knowledge. Hence, future research on the test of the depth knowledge of vocabulary is expected. Fifth, since the VST is designed to test learners' receptive vocabulary knowledge, future studies focusing on learners' vocabulary productive knowledge may have different findings. Last but not least, vocabulary acquisition may vary depending on disciplines. For example, word acquisition difficulty among students studying biology may be affected by different variables from those revealed in this study. The current study provides a foundation to examine word features that affect vocabulary acquisition for non-English majors in general and more future research is encouraged to examine whether these features differ across specific academic disciplines.

Appendix A. Sample of VST Items

In the original measure, the four choices or options are in Chinese. We translated it into English for readers' convenience. Same for Appendix B.

see: They saw it.

A. cut   B. wait

C. notice   D. begin

Appendix B. Sample of Added Items

hamburger: He is going to buy a hamburger.

A. food with two pieces of bread and meat   B. trash can

C. rice cooker   D. charger

loll: Don't loll there next time

A. walking around without purpose

B. vomiting without control

C. eating quickly

D. walking lazily

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