A Study of Vocabulary Learning Through Web-based Word Data Bank

透過線上英語字彙資料庫學習字彙之成效探究

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Abstract

This study aims to investigate the effect of online word data bank on EFL learners' vocabulary learning. To fulfill the purpose of this study, a web-based learning platform—a vocabulary database consisted of 3,000 words was constructed. The participants were 252 college freshmen at China University of Science and Technology. These students come from three different levels of English classes—beginning level, mediocre level, & advanced level. All participating students were expected to study the target words independently, and were required to take three vocabulary tests throughout the term. The research instruments used in this study include a pre-test, a post-test, and an evaluation questionnaire. Data collected from the pre-test and post-test was processed with pair-sample t-test. The factor analysis was applied to analyze the participants' responses to the questionnaire. The results of the study indicated that students at three different levels of proficiency had all shown significant progress on vocabulary learning after a four-month period of online self-study. The learners' improved mean scores in the post-test supported the claim that such a web-based vocabulary learning tool could aid EFL learners in achieving vocabulary gains. Similarly, feedback from the evaluation questionnaire also revealed students' overall positive perception of the online vocabulary learning program. Despite this, it should be noted that there are some limitations of this study which will be pointed out for future research. Pedagogical implications drawn from this study will be discussed as well.

Key words: online word data bank, vocabulary learning, pair-sample t-test, factor analysis.

摘　要

本研究目的旨在探討線上英語字彙資料庫對學生字彙學習的成效。為檢驗此成效，本研究建構一個涵蓋 3,000 英文單字的網路學習平台，邀請中華科技大學大一新生共計 252 位同學參與本研究。這些學生分別來自三種不同英文程度的班級—加強班、普通班及進階班。所有參與本研究的學生必須獨立學習字彙，並在為期一學期研究期間內接受 3 次字彙測驗。研究開始之前後，進行前測與後測測試，所得數據採用相依樣本 t 檢定來檢驗兩者之差異。此外，問卷由參與的學生於後測結束後填答，以應用因素分析來分析參與者對問卷的反應。最後研究結果顯示，學生使用線上英語字彙資料庫對其提升字彙學習有顯著成效。同樣，從評估問卷調中發現，整體而言參與者對此線上字彙學習課程持正面看法。本研究的局限及研究結果之教學意涵將予以討論並提出改進建議。

關鍵字: 英語字彙資料庫, 相依樣本 t 檢定, 因素分析

I. Introduction

In Taiwan, as in many other countries where English is a foreign language (EFL), English is a required subject for junior and senior high school students as well as university students. Students who receive tertiary education, in particular, are expected to be able to read English texts related to their discrete fields of study. In the second language (L2) reading process, several elements such as vocabulary size, learning skills, and contexts affect university students' reading comprehension. A number of studies on the impact of FFL readers' vocabulary knowledge on reading comprehension have confirmed the widespread belief that word knowledge, though not the only factor that influences reading comprehension, plays an essential role in EFL learners' reading performance. However, vocabulary learning is never an easy task. It is a complicated work which involves linguistic, psycholinguistic, and sociolinguistic aspects. Lexical competence requires training on various learning strategies and is far more than the ability to define a given number of words (Zimmerman, 1997).

In recent years, educators and instructors who teach at universities have discovered that in Taiwan, the capability of university students to understand English is so limited that many of them find it difficult to gain information from English textbooks in their areas of study. They usually ask their instructors to use textbooks printed in Chinese, or to translate the materials into Chinese. Instructors also find that many university

students claim that textbooks often contain many unknown or unfamiliar words and phrases that are merely beyond their comprehension. They cannot understand the meaning(s) of the texts they read. The sheer volume of English vocabulary often leads to frustration on the part of some EFL learners. Undoubtedly, insufficient vocabulary knowledge prevents L2 learners from effectively comprehending texts printed in English.

To promote students' English language proficiency, over one hundred universities islandwide have set up graduation threshold for English proficiency, a doorsill that requires students to meet the minimal level for this foreign language. Our school—China University of Science and Technology (CUST) is no exception in this case. It is mandatory for all CUST students to take the English proficiency test such as GEPT, CSEPT, or TOEIC in their first or second year of undergraduate studies. As proclaimed by Taiwan's Ministry of Education, technological university students must attain 225 points, at least, on the TOEIC test with 110 points on the listening comprehension component (= a total of 495 points) and 115 points on the reading comprehension component (= a total of 495 points), in order to be considered reaching the elementary level of GEPT. According to the score report obtained from the language learning center at CUST, it was found that the passing rates of the TOECI test were 34% and 58% respectively in 2009 and 2010. Yet, of the total students who took the TOEIC test, 35% of them (248 out of 702 students) did reach 225 points but were still considered "not passing" in 2009 while it was 32% (54 out of 171 students) in 2010. These students held one thing in common — they all performed exceedingly better on listening comprehension than they did on reading comprehension, but not vice versa. Their listening comprehension scores outran their reading comprehension scores. It was also a pity to find that quite a number of the students scored far below 100 points on the reading part. In fact, students constantly complained that there were too many questions (a total of 200 questions with 100 questions in each item) covered in one single test, and that the texts were lengthy, difficult, and contained many words that they were just unable to recognize. Some students reported that they were not used to long texts and they either lost patience or got tired from reading during the test. In sum, we attributed their inability to comprehend English passages to the deficiency of vocabulary knowledge and the lack of reading practice.

One implication from the above is that there is a pressing need for increasing

technological university students' vocabulary knowledge in order to enhance their reading performance on English proficiency tests. Nevertheless, vocabulary teaching has been underemphasized in English language teaching for decades. Vocabulary is usually taught indirectly as part of a wider area of language teaching. Not until recently has vocabulary acquisition gained more attention in second language teaching. Educators and teachers have come to understand the importance of vocabulary teaching and the role that the lexicon plays in language learning and communication. They realized that students must acquire a certain amount of vocabulary to understand what native speakers of English speak and write. More research studies have been undertaken on the process of vocabulary acquisition and how it relates to L2 learning.

In this study, an experimental web-based learning platform—a vocabulary data bank was constructed. A total of 3,000 theme-based words were developed and split into 4 categories: Daily Life English I (800 words), Daily Life English II (700 words), Workplace English I (800 words), and Workplace English II (700 words). To ensure secure learning, an online vocabulary learning syllabus was designed in a way that provides guidance to assist students in successful completion of the target words. Students were to take a pre-test and a post-test both prior to and near the end of each semester. They would also be quizzed periodically throughout the semester in order to determine whether they have gained new words through this online learning tool, which we assumed would be beneficial and would provide a general boost to their vocabulary growth. The research had two main goals: 1) to evaluate participants' vocabulary learning outcomes, and 2) to investigate participants' perceptions of the effectiveness of the online word bank. A set of research questions guides the current study.

1. Does the web-based word data bank lead to vocabulary gains on the target learners?

2. Is there a statistically significant difference in the pre-test and post-test scores among learners at different levels of proficiency?

3. What is the learners' feedback in response to the use of the online vocabulary learning program?

II. Literature Review

Definition of Vocabulary knowledge

Many L2 learners have a mistaken view about vocabulary learning. They think that to know a word is simply to know its forms and meanings. However, it has been acknowledged by a large number of lexical-minded researchers that knowing a word involves much more than just understanding its meaning (Aitchison, 1994; Laufer, 1997; McCarthy, 1990; Nation, 1990; Nation, 2001; Richards, 1976; Schmitt, 1998; Schmitt, 2000). There are several aspects of vocabulary knowledge that need to be mastered in order to "know" a word. Acquiring a word is not simply a process of connecting word form to word meaning, but a complex development involving the learning of grammatical functions such as parts of speech, sociolinguistic factors such as word connotation, and frequency intuitions such as collocations, all over the course of multiple encounters of target words in diverse contexts (Nation, 2001). As Read (2004) stated, comprehensive word knowledge involved not only the semantic features of a word, but also its orthographic, phonological, morphological, syntactic, collocational and pragmatic characteristics. The various types of word knowledge indicate that the nature of vocabulary acquisition is incremental, complex, and time-consuming and it is impossible to learn all of these types of vocabulary knowledge instantaneously (Schmitt, 2000). Vocabulary learning is not an all-or-nothing piece of learning, but rather a gradual process of one meeting with a word adding to or strengthening the small amount of knowledge gained from previous meetings (Nation, 2001). Receptive and productive types of knowledge of a word have commonly been used to describe the degree of learners' word knowledge (Nation, 2001; Read, 2000), and it is generally agreed that learners' vocabulary knowledge can be located on a receptive to productive continuum (Nation, 2001). Learners are likely to first recognize a word's form, pronunciation, and basic meanings; then with further experiences or practice, their word knowledge will move along the continuum and finally reach the point of being able to use these words freely in productive mode (Huang & Liou, 2007).

Vocabulary Size of L2 Learners

Although vocabulary knowledge is not the only factor that influences reading comprehension, it is universally accepted that L2 learners, before reaching a certain

vocabulary level, have to rely largely on their range of vocabulary to interpret reading passages and extract information from them. Unfortunately, some researchers found that EFL readers' vocabulary size was so limited that it could not help them comprehend reading texts. Barnard (1961) and Quinn (1968), for example, found that Indian and Indonesian students who learned English as a foreign language (EFL) acquired only 1,000 to 2,000 words after five years of 4 to 5 English classes a week. Nurweni and Read (1999) administered a study on Indonesian university students to determine whether their vocabulary size had progressed over the course of 30 years. The results revealed that their subjects had a vocabulary size of 1,226 frequent words and 240 general academic words. Barrow, Nakanishi and Ishino (1999) measured vocabulary knowledge of Japanese college freshmen and discovered that, on average, their subjects could recall 2,304 basic words. In Taiwan, Huang (2001) found that Taiwanese technological university students who majored in applied science and technology could identify only 1,690 frequent word families and about 140 general academic words. Ou (1997) analyzed the TOEFL scores of 514 seniors selected at two comprehensive universities and two technological universities in Taiwan. The results showed that the technological university seniors' vocabulary scores (M=13.68) and reading comprehension scores (M=11.35) were much lower than those (M=17.72; M=15.63) of comprehensive university seniors, and the difference was statistically significant. These findings indicate that apparently, university/college EFL students' vocabulary size is much smaller than 3,000 words. The lack of lexical knowledge often leads EFL learners to experience difficulties in effectively comprehending academic textbooks and/or materials printed in English as well as in acquiring knowledge in their subject matters.

Vocabulary Knowledge and Reading Comprehension

There is ample research evidence to show that there is a strong relationship between vocabulary and reading comprehension. A text is not only a pile of words, but also meaningful information related to the interaction of lexical knowledge and other factors such as experience and imagination (Huang, 2004). Vocabulary knowledge is strongly related to reading comprehension, because knowledge of a word involves at least meaning, phonological and grammatical/morphological awareness (Schmitt, 2000). In their study, Coady et al. (1993) found that vocabulary not only had a positive effect on reading comprehension, but also led to reading proficiency.

Since vocabulary is the one crucial factor that determines L2 learners' reading comprehension, several researchers, educators, and teachers are eager to know the extent to which reading comprehension depends on vocabulary knowledge. Some researchers (Brisbois 1995; Hulstijn & Bossers 1992) claimed that about 28%-58% of L2 reading comprehension depended upon the range of vocabulary knowledge. Laufer (1992) conducted a study to examine the relationship between the amount of receptive words and reading comprehension. The results showed that subjects who understood 3,000 word families had a predicted 56% reading comprehension score, that increased by 7% for every further 1,000 word families. Huang (1999) found that in Taiwan, students' reading comprehension scores were 69% explained by their vocabulary knowledge score. Evidently, L2 reading comprehension relies greatly on vocabulary knowledge.

In terms of what coverage rate is needed in order to read pleasurably, a study by Liu & Nation (1985) supported the necessity of learners having 95% coverage of a text. They claimed that unless there was at least 95% or higher coverage rate (the percentage of the vocabulary that is known by the reader) of the running words in a text, the probability of successful guessing of unknown words would be severely reduced. Likewise, Laufer (1989, 1992) found that when EFL learners' vocabulary exceeded 95% coverage of the words in a reading passage, they could successfully guess the unknown words and effectively achieve adequate level of comprehension. Hu & Nation (2000), however, suggested that it should be at least 98%. In their study, it was found that no subject reported adequate comprehension of text with only 80% coverage rate, but at 90% and 95% coverage a few did, and only at the 98% level did most subjects gain adequate comprehension. Moreover, the 'guessing from context' research suggested that unless the reading was done at a high level of coverage, little learning would take place (Waring & Nation, 2004). Clearly, coverage rate and vocabulary size are closely related in the second language reading process.

Vocabulary Threshold

In order to be successful in academic studies, it is necessary for EFL learners to be familiar not only with the high frequency words of English, but also with the general academic vocabulary that is common to many academic disciplines (Nation, 1993). According to Nation (1990), vocabulary can be generally divided into 4 categories—

high frequency (or general service) vocabulary, academic vocabulary, technical vocabulary, and low frequency vocabulary.

General service vocabulary consists of words that are of high frequency in most uses of the language. General service words occur frequently across a wide range of texts. The most well-known general service vocabulary is Michael West's (1953) *A General Service List of English Words*, which contains around 2,000 word families. This list has been the basis of many series of graded readers. For learners who intend to go on academic study, it is imperative that they expand their vocabulary other than general service words. Xue and Nation (1984) later composed a university word list (UWL) which consisted of about 800 word families that occurred frequently in academic texts used at university level. Hwang (1989) found that Xue and Nation's UWL offered 8.5% coverage of academic texts. Nation and Hwang (1995) claimed that 2,000 word families of general service vocabulary plus the 800 of the UWL might cover about 95% running words in general academic texts. It was obvious that Nation and Hwang suggested that the minimum vocabulary for L2 university students' reading comprehension was 2,000 high-frequency words and the UWL.

Laufer (1992) conducted a study on university freshmen to determine the minimum vocabulary needed for reading comprehension. She found that about 3,000 word families or 5,000 lexical items represented a "turning point" in vocabulary threshold. Huang (1999) also found that the 3,000-word level was a good water-shed for this vocabulary threshold. Before EFL readers pass the vocabulary threshold, they often have to guess the meaning of each word and/or each sentence, rather than the meaning of the text as a whole. However, once a reader's vocabulary knowledge passes this threshold, he/she is free from the loading of vocabulary and other factors including background knowledge and reading strategies may play a more important role in the reading process.

III. Methodology

Research Design

To fulfill the purpose of this study, a web-based learning platform—a vocabulary database was constructed. The vocabulary database consisted of a total of 3,000 words and was developed into two major themes: 1) Daily Life English I & II, and 2)

Workplace English I & II. Most of these words were selected from the current English textbooks used by teachers of English at CUST—Outlook I, English for Work, and English for Life & Work II, and were also arranged according to their level of difficulty. To simply put it, words which were compiled in Daily Life English I & Workplace English I were considered relatively easier than those collected in Daily Life English II & Workplace English II. Daily Life English I & II were designed basically for low-proficiency EFL learners, while Daily Life English II & Workplace English I were aimed for learners whose English proficiency was considered mediocre. For advanced learners, Workplace English I & II would just suit their need. Three sets of pre-test and post-test were specifically designed for learners of different ability levels—beginning level, intermediate level, & advanced level. Students were to take a pre-test and post-test according to their respective level of proficiency. The research instruments used in this study include a pre-test, a post-test, and an evaluation questionnaire. Data collected from the pre-test and post-test was processed with pair-sample t-test. In addition, a questionnaire with 15 items was distributed to the participants. The factor analysis was applied to analyze the participants' responses to the questionnaire. The results of the survey are discussed in the later section.

Participants

The participants were 252 college freshmen at China University of Science and Technology. These students were from 6 freshman English classes, with 2 classes for each level of proficiency—beginning level, mediocre level, & advanced level. All participating students were expected to study the target words independently, and were required to take three vocabulary tests throughout the term. Moreover, to assess the participants' entry vocabulary level, a pre-test was carried out at the start of the term, whereas a post-test was administered close to the end of the term in order to determine whether or not the learners had achieved vocabulary gains over a period of 4 months.

Questionnaire

A questionnaire was designed to examine the participants' attitudes toward the web-based vocabulary data bank. The questionnaire was written in Chinese so as to reduce any possibility of misunderstanding, owning to their limited English ability. The evaluation questionnaire had 15 items addressing five aspects of the web-based vocabulary learning program: contents, test design, mode of delivery, effectiveness of learning, and overall experience. The 15-item questionnaire was concerned with the

participants' perceptions of the use of the online vocabulary learning program, from which we retrieved information on learners' computer use, web access at home, and their perspectives on vocabulary learning as well as their overall experience with the online word bank.

IV. Results

Proposed Strategy

In this study, SPSS 13.0 was employed to analyze the data. The proposed strategy was adopted to achieve the objective of this research work. Primary data reduction technique—Factor Analysis was applied as well. Factor analysis is a multivariate statistical technique in which the whole set of interdependent relationship is examined. The main purpose of this technique is to condense the information contained in a number of original variables into a smaller set of new composite dimensions with a minimum loss of information. In particular, Exploratory Factor Analysis was applied in this work. A set of 15 statements were measured on a five point Likert scale (where 5 is strongly agree and 1 strongly disagree) regarding the opinions of respondents (derived through a survey) who had used the online vocabulary learning tool as a supplementary material. Each statement with its code, average score, and standard deviation was given in **Table 1**.

Table 1. Descriptive Statistics of Statements

Code	Statement	Mean	S.D.
Q_1	I think that words selected from the「vocabulary data bank」are very practical.	3.67	0.72
Q_2	I think that the provision of vocabulary sentence examples helps me better remember the target words.	3.55	0.78
Q_3	I think that the 「vocabulary data bank」 theme-based categorization helps me learn words of the same kind in a more systematic way.	3.65	0.75
Q_4	I think that the test questions in the「vocabulary data bank」are generally fair.	3.37	0.73
Q_5	I think that the periodic testing of「vocabulary data bank」can lead me to study the target words.	3.44	0.88
Q_6	I think that the periodic testing of「vocabulary data bank」	3.47	0.82

	makes learning more effective.		
Q_7	I think that the online learning of「vocabulary data bank」is convenient.	3.45	1.00
Q_8	I think that the「vocabulary data bank」interface is easy to use.	3.39	0.87
Q_9	I think that the downloading of「vocabulary data bank」is smooth.	3.49	0.92
Q_{10}	I think that the「vocabulary data bank」helps build up my vocabulary.	3.74	0.76
Q_{11}	I think that the「vocabulary data bank」helps improve my English reading ability.	3.59	0.77
Q_{12}	I think that the「vocabulary data bank」helps me better prepared for English proficiency tests.	3.54	0.73
Q_{13}	Overall, I think that the「vocabulary data bank」will enhance my English competence.	3.66	0.76
Q_{14}	Overall, I consider myself devoted to the learning of「vocabulary data bank」.	3.15	0.80
Q_{15}	Overall, I am very satisfied with my learning performance of「vocabulary data bank」.	3.16	0.83

Basically, three conditions must be satisfied before we perform factor analysis in this study. These three conditions are explained and discussed below.

According to Gorsuch (1983), to carry out factor analysis, a minimum sample size of at least four or five times of the variables should be taken into consideration. In the present study, a total number of 252 questionnaires were equally distributed. The returned questionnaires were initially scrutinized on the basis of usability and reliability. Finally, 238 responses were found to be complete and usable against 15 variables. Thus, the present study met the sample size requirement for the application of Factor Analysis.

The reliability of scale can be tested by a widely used method—Cronbach's Alpha. It is the average of all possible split-half coefficients resulting from different ways of splitting the scale items. It is measured as below.

Table2. Reliability Statistics

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
0.931	0.934	15

After ensuring the reliability of scale, it is obligatory to check the adequacy of

collected data for the application of Factor Analysis.

To check the adequacy of the data for Factor Analysis, various techniques are recommended. Kaiser-Meyer-Oklin (KMO) Measure of Sampling Adequacy: It is an index used to examine the appropriateness of factor analysis. High values (between 0.5 and 1.0) indicate adequacy of data for the use of Factor Analysis (Leech, Barrett & Morgan, 2005). Here, the computed value of KMO statistic is 0.913 as indicated in **Table 3**. Bartlett's Test of Sphericity: This test, as shown in **Table 3**, finds the overall significance of correlation matrix, which indicates that the factor model is appropriate.

Table 3. KMO and Bartlett's Test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		0.913
Bartlett's Test of Sphericity	Approx. Chi-Square	2478.255
	df	105
	Sig.	0.000

Based on *Kaiser's Criterion*, as many factors should be extracted as variables with eigenvalues greater than or equal to one (Kaiser, 1960).We orthogonally rotated the principal factors using Varimax Rotation. This method minimizes the number of variables that have high loading on a factor, and thereby enhancing the interpretability of factors. The Varimax Rotated Factor Loading Matrix has been presented in **Table 4**. Perusal of **Table 4** revealed that the percentage of variance explained by the factors 1 to 3 is 52.625, 9.723 and 7.553 respectively. The percentage of total variance is used as an index to determine how well a particular factor solution accounts for what all the variables together represent. It shows that 69.901 percent of total variance is explained by the information contained in the factor matrix.

Table 4. Varimax Rotated Factor Loading Matrix

Code	Factor		
	1	2	3
Q_6	0.784	0.045	0.333
Q_3	0.780	0.105	0.179
Q_{11}	0.771	0.362	0.149
Q_{10}	0.757	0.403	0.149
Q_2	0.749	0.212	0.026
Q_1	0.743	0.172	0.189
Q_5	0.736	0.107	0.339

Q_{12}	0.718	0.352	0.133
Q_{13}	0.708	0.347	0.246
Q_4	0.590	0.144	0.442
Q_8	0.176	0.871	0.163
Q_7	0.226	0.773	0.211
Q_9	0.228	0.733	0.115
Q_{15}	0.186	0.231	0.878
Q_{14}	0.317	0.216	0.829
Eigenvalues	7.894	1.458	1.133
% of variance explained	52.625%	9.723%	7.553%

Extraction Method: Principal Component Analysis.
Rotation Method: Varimax with Kaiser Normalization.

Thus, a model with these 3 factors can be considered adequate to represent the whole data and be categorized as 「Contents of Vocabulary Data Bank」, 「Delivery Mode of Vocabulary Data Bank」, and 「Students' Self-awareness」.

1. Factor 1:「Contents of Vocabulary Data Bank」

   Perusal of **Table 4** reveals that it is the most significant factor with 52.625 percent of total variance. A total number of ten variables have been loaded on this factor. Variables Q6, Q3, Q11, Q10, Q2, Q1, Q5, Q12, Q13, and Q4 have been positively loaded on this factor. This factor showed that the respondents in this study held a generally positive view on the learning of vocabulary data bank.

2. Factor 2:「Delivery Mode of Vocabulary Data Bank」

   Compared to factor 1, there is a drastic drop in this factor. The percentage of variance explained by factor 2 is 9.723. Three variables Q8, Q7, and Q9 have been loaded on this factor. This factor revealed that the participants in this study did not seem to favor the online mode of delivery.

3. Factor 3: 「Students' Self-awareness」

   This factor indicates that students have the ability to examine their learning

performance. As shown in **Table 4**, factor 3 receives the lowest average score with only 7.553 percent of total variance. Two variables Q15 and Q14 have been loaded on this factor. This explained that most of the participants in this study did not think they had worked as hard as they knew they should have, despite the fact that they valued positively the contents and the use of vocabulary data bank as a supplement to the curriculum.

Comparison of the Pretest & Posttest Scores

A total number of 252 freshmen at China University of Science and Technology participated in this study. The participants were from three different levels of English classes, with 2 classes for each level of proficiency—beginning level, mediocre level, & advanced level. Three sets of pre-test and post-test were specifically designed for learners at various levels. All participating students were required to take a pre-test and post-test according to their respective level of proficiency. In order to address the first two research questions, data collected from the pre-test and post-test were analyzed.

The mean scores of the pre-test and post-test from the three groups of the participants are indicated in **Fig. 1**. Students from these three different levels of classes performed far better in the post-test than they did in the pre-test. As shown in **Fig. 1**, the pre-test mean scores of each group are 28.95 for the low level, 43.48 for the mediocre level, and 33.13 for the advanced level, whereas the post-test mean scores are 78.72 for the low level, 75.51 for the mediocre level, and 73.01 for the advanced level. Students have made significant progress in the post-test regardless of their ability levels. The result shown in **Fig. 1** also indicates that the mean scores of the post-test are much higher than those of the pre-test.

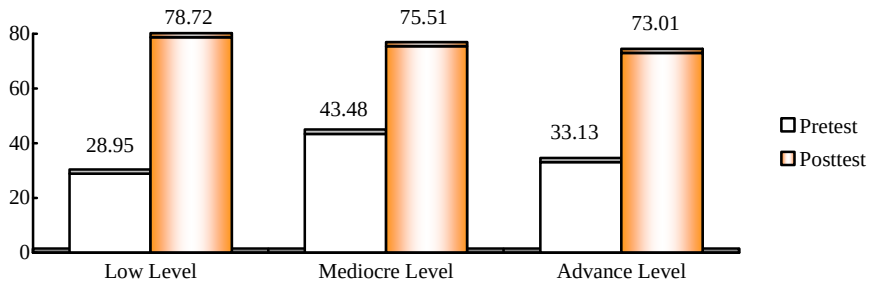

Fig. 1. Bar Graph of Mean Scores of Pretest & Posttest

Table 5. Paired-Sample *t*-Test

Class	Mean	S.D.	*t*-value	df	Sig
Low Level Posttest-Pretest	49.767	29.822	15.476	85	0.000*
Mediocre Level Posttest-Pretest	32.029	26.434	10.065	68	0.000*
Advanced Level Posttest-Pretest	39.880	25.722	14.119	82	0.000*

*p< 0.05

We find it obligatory to explain that the questions in the pre-test and post-test are varied from level to level. For advanced level students, vocabulary learning is geared primarily toward work-related words, which are considered to be of a much higher difficulty level. Consequently, the pre-test and post-test scores in the advanced level are comparatively lower than those of its counterparts. All three groups of students have demonstrated noticeable improvement with the average scores of 49.7 for the low level, 32.0 for the mediocre level, and 39.8 for the advanced level (**Table 5**). Paired-Sample t-Test was further employed to compare the pre-test and post-test scores among these three groups of students. As revealed in **Table 5**, there was a significant difference in the pre-test and post-test scores among learners of different ability levels. This finding concludes that the online vocabulary data bank does lead to vocabulary gains on the target learners since the participants in this study have shown marked progress of vocabulary learning in their post-test.

Results of the Evaluation Questionnaire

The Evaluation Questionnaire includes a total of 15 items addressing five aspects of the web-based vocabulary learning program: contents, test design, mode of delivery, effectiveness of learning, and overall experience. In order to address the third research question, responses to the questionnaire were analyzed.

As one can see in **Table 1**, it was the contents of the vocabulary data bank that was rated most highly among the learners, with an overall mean score of 3.6. The selection of words, the provision of vocabulary sentence examples, and the theme-based categorization had proven beneficial for most EFL learners. As for learners' responses regarding the effectiveness of learning, learners also rated positively with an average score of 3.6. The result indicated that the majority of the EFL learners viewed the online

vocabulary learning program as a useful tool, which would enable them to build their vocabulary, enhance their reading comprehension ability, and prepare them to take English proficiency tests.

For questions relating to the test design and mode of delivery, the results we came up with were pretty much the same. Both were rated with an overall mean score of 3.4. One interesting finding was that for questions concerning the online mode of delivery (Q7, Q8, & Q9), the standard deviations revealed by **Table 1** were slightly higher with 1.0, 0.87, and 0.92 respectively. The result showed that while some learners were in favor of the online mode of delivery, some were not. In fact, a number of students reported that they had difficulty downloading the materials, and that the process of downloading was time-consuming. If learners have a very slow internet connection, it can be a real painstaking experience. Several learners claimed that they did not have access to computers; thus, they usually had to go to the trouble of asking around for help. There were learners who commented that they would rather study the materials in print than studying online because they were not used to learning vocabulary online.

Of the total 15 items, questions regarding learners' self-evaluation of learning performance were rated the lowest, with an overall mean score of 3.1. Many learners confessed to the fact that they did not put in as much time and effort as they should have studying vocabulary, even though they understood the importance of vocabulary learning and the effect that it had on reading comprehension as well as on English proficiency tests. In general, the results of the survey showed that learners were satisfied with the use of online vocabulary learning program.

V. Discussion

In this section, the discussion of findings focuses on answering the research questions. There are some limitations that need to be acknowledged and addressed regarding the present study. The results of this study may provide some pedagogical implications for language teaching and learning as well.

The outcomes in **Fig. 1** and **Table 5** answer Research Questions 1 & 2. The results in **Table 1** answer Research Question 3.

1. Does the web-based word data bank lead to vocabulary gains on the target learners?

2. Is there a statistically significant difference in the pre-test and post-test scores among learners at different levels of proficiency?

3. What is the learners' feedback in response to the use of the online vocabulary learning program?

The pretest-posttest comparison discussed above indicated that learners at three different proficiency levels had all shown significant progress on vocabulary learning after a four-month period of online self-study. The learners' improved mean scores in the post-test supported the claim that such a web-based vocabulary learning tool could aid EFL learners in achieving vocabulary gains. Similarly, feedback from the evaluation questionnaire also revealed learners' overall positive perception of the online vocabulary learning program. In spite of this, the present study has a number of limitations which we will now go on to point out.

First, we have used only one type of test—the standard multiple-choice test to collect data. Testees may have easily chosen their answers by guessing. That is to say, a test taker could have no idea about the target words, but ends up guessing the answers correctly. As Waring & Takaki (2003) indicated in their study, the type of test used in collecting data could generally affect the results that one would obtain. Their research results showed clearly that the sight recognition test produced the higher scores, the multiple-choice test the next highest, and then the translation test the lowest on the immediate posttest. The translation test whereby the target word was required to be translated into the L1 was considered the most demanding because it required unassisted recall of a word meaning. They stated that each test revealed another facet of information about the kinds of learning that would take place. Hence, in future work of this kind it will be important to collect data from more than one type of test. The use of several tests is necessary to gain a more accurate and balanced picture of learning.

Second, though most of the participants in this study have achieved a substantial vocabulary growth over a period of time, it is still difficult to ascertain whether there have in fact been significant gains in other aspects of vocabulary knowledge other than meaning. In order to have a full command of a word, a learner will need to acquire additional knowledge of a word. This 'deeper' knowledge includes its inflections and derivations, the shades of meanings of the word, its collocations, and the knowledge of

its restrictions of use, whether it is formal or informal, its frequency of use, whether it is more common in speech or written text, and so on (Waring & Nation, 2004). In the present study, the multiple-choice test we have used can assess only the first level of word knowledge—form-meaning relationship. While this is certainly of value, it understates the importance of other types of word knowledge and possibly overrates the importance of the form-meaning relationship type of word learning. It is clear that vocabulary measures able to address the above limitations still needs further research.

Lastly, as far as the retention of the target words is concerned, it requires further investigation. Despite the fact that the subjects in this study have, for the most part, made distinct progress in their post-test, it is hard to determine how well the target words are retained over time. Our study lasted only over the course of one semester. A less capable learner or learner who answers the questions by guessing may have well forgotten the words by the time he/she finishes the test. In this case, this type of vocabulary testing does not necessarily lead to word retention. Moreover, some of the words would have been concrete and thus easier to learn, whereas others are more abstract and probably harder to learn. For instance, words related to work environment are usually considered more difficult than those used in daily life English, and therefore may need longer time to be learned. It is also found in numerous studies that learners need frequent and repetitive exposure to target words for the development of word knowledge. While some researchers claimed that 6 to 10 encounters was an adequate number, others suggested that this figure be raised to as high as 20 meetings or more. In addition, Zahar, Cobb & Spada (2001) found that weaker learners needed more encounters to learn a new word than more proficient learners. The above data can provide us with insights into how fragile the vocabulary learning is.

From a pedagogical perspective, the findings of this study may offer some implications for language teaching and learning. To begin with, one must realize that vocabulary learning is incremental in nature. It is considered as a cumulative process where learners build up knowledge of a word through repeated encounters over a reasonable period of time. Some of the words would need to be looked up only once, while others require multiple exposure and multiple dictionary consultations in order to be learned and remembered. Some sets of words, however, would just not be remembered (Grabe & Stoller, 1997:115). Though there are diverse ways to build one's English vocabulary, many researchers suggest that reading is the best way to learn

vocabulary. Stephen Krashen, who is one of the most famous proponents of the need for reading claims that reading is a very effective way of building up a lot of one's language competence. He goes further to suggest that no other methods are more effective than simply reading. Hulstijn's study (1988), on other hand, concludes that reading should be supplemented by other activities. More researchers suggest that intentional learning rather than incidental learning should supplement the reading as it is a more effective way of learning vocabulary. Since word knowledge involves a wide range of skills, there is no doubt that no single approach can address all of these skills. It is proposed that a well-balanced language program should make good use of various types of learning. As Waring & Nation (2004) suggest, some combination of direct intentional study accompanied by adequate reading at the right level and in the right amounts would benefit learners the most.

VI. Conclusion

The study demonstrated that using web-based word data bank as a supplemental material was a good way for building learners' vocabulary. A total of 3,000 theme-based words were selected from the current English textbook glossaries. Each of these words was provided with a sentence example along with its Chinese translation as well as parts of speech. To ensure successful learning, learners were to take a multiple choice test at regular intervals throughout the term. Pedagogically, word gains occurred, to some extent, and learners' attitudes toward the online vocabulary learning program were generally positive. Nevertheless, the measure used for assessing the effect of vocabulary acquisition was not without limitation. Vocabulary gains were found in our study, but they might be superficial and unstable because we did not have the slightest idea how well these words were retained over time. The multiple-choice test did not explore other aspects of lexical knowledge. Much of the word knowledge that learners acquired in this study was in the realm of form and meaning. We hope that a multi-test format will be adopted in future research in order to provide a richer picture of the types of word knowledge that learners can obtain. One implication drawn from the current study is that learners must be exposed to target words as frequently as possible in order for them to be stored in long-term memory. It is suggested that the online word lists can be used as both in-class direct and explicit instruction for reinforcement purposes. For less proficient learners, we should schedule practice sessions in a way that provides

guidance for vocabulary learning. More importantly, learners must develop the habit of reading as a source of entertainment, information, and self-improvement. Frequent reading nurtures skills for learning and using the language. Learners should be encouraged to read English materials, on a regular basis, to foster the desire to read voluntarily. The importance of vocabulary knowledge is such that further studies should be undertaken and multiple experiments be conducted in order to determine which method of lexical instruction can most effectively increase EFL learners' vocabulary knowledge.

References

Aitchison, J. (1994). *Words in the mind: An introduction to the mental lexicon*. Oxford, UK: Blackwell.

Anuthama, B. (2010). Strategies for vocabulary teaching. *Journal of NELTA, 15*(1-2), 10-15.

Barnard, H. (1961). *Teachers' book for advanced English vocabulary*. Rowley, MA: Newbury House.

Barrow, J., Nakanishi, Y., & Ishino, H. (1999). Assessing Japanese college students' vocabulary knowledge with a self-checking familiarity survey. *System, 27*, 223-247.

Brisbois, J. E. (1995). Connections between first- and second-language reading. *Journal of Reading Behavior, 27*(4), 565-584.

Coady et al. (1993). High frequency vocabulary and reading proficiency in ESL readers. In T. Huckin, M. Haynes, & J. Coady (Eds.), *Second language reading & vocabulary learning* (pp. 217-218). Norwood, NJ: Ablex.

Coady, J. (1997). *L2 vocabulary acquisition: A synthesis of the research*. Cambridge, UK: Cambridge University Press.

Gorsuch, R.L. (1983). *Factor Analysis*. Hillsdale, NJ: Lawrence Erlbaum.

Grabe, W. & Stoller, F. (1997). Reading and vocabulary development in a second language: a case study. In Coady and Huckin (Eds.), *Second language vocabulary acquisition* (pp. 98-122). Cambridge, UK: Cambridge University Press.

Hu, H. C., & Nation, P. (2000). Unknown word density and reading comprehension. *Reading in Foreign Language, 13*(1), 403-430.

Huang, C. C. (1999). *The effects of vocabulary knowledge and prior knowledge on*

reading comprehension of EFL students in Taiwan (Unpublished doctoral dissertation). University of Ohio, Athens, OH.

Huang, C. C. (2001). *An investigation of ESP students' vocabulary knowledge and reading comprehension*. Selected Papers from the Tenth International Symposium on English Teaching, pp. 435-445. Taipei, Taiwan: Crane.

Huang C. C. (2004). University Students' Vocabulary Knowledge, Content Knowledge and Reading Comprehension。**國立台南師範學院［南師學報］**，38，125~153。

Huang, H. T., & Liou, H. C. (2007). Vocabulary learning in an automated graded reading program. *Language Learning & Technology, 11*(3), 64-82.

Hulstijn, J. H., & Bossers, B. (1992). Individual differences in L2 proficiency as function of L1 proficiency. *European Journal of Cognitive Psychology, 4*(4), 341-353.

Hwang, K. (1989). *Reading newspapers for the improvement of vocabulary and reading skills* (Unpublished doctoral dissertation). Victoria University of Wellington, Wellington, New Zealand.

Kaiser, H. F. (1960). The application of electronic computer to factor analysis. *Educational Psychology Measurement, 20*, 141-151.

Laufer, B. (1989). What percentage of text-lexis is essential for comprehension? In C. Lauren & M. Nordman (Eds.), *Special language: From human thinking to thinking machines* (pp. 316-323). Clevedon, UK: Multilingual Matters.

Laufer, B. (1992). How much lexis is necessary for reading comprehension? In J. L. Arnaud & H. Bejoint (Eds.), *Vocabulary and applied linguistics* (pp. 126-132). London, UK: MacMillan.

Laufer, 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 : A rationale for pedagogy* (pp. 20-34). New York, NY: Cambridge University Press.

Leech, N., Barrett, K. C., & Morgan, G. A. (2005). *SPSS for intermediate statistics: Use and interpretation* (2nd ed.). Mahwah, NJ: Lawrence Erlbaum Association.

Liu, N., & Nation, I. S. P. (1985). Factors affecting guessing vocabulary in context. *RELC Journal, 16*, 33-42.

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

Nation, I. S. P. (1990). *Teaching & learning vocabulary*. New York, NY: Newbury

House.

Nation, I. S. P. (1993). Vocabulary size, growth, and use. In R. Schreuder & B. Weltens (Eds.), *The bilingual lexicon* (pp. 115-134). Philadelphia, PA: John Benjamins.

Nation, I.S.P. (1993b). Vocabulary size, growth and use. In R. Schreuder & B. Weltens (Eds.), *The bilingual lexicon* (pp. 115-134). Amsterdam/Philadelphia: John Benjamins.

Nation, I. S. P., & Hwang, K. (1995). Where would general service vocabulary stop and special purposes vocabulary begin? *System, 23*(1), 35-41.

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

Nattinger, J. & DeCarrico, J. (1992). *Lexical phrases and language teaching*. Oxford, UK: Oxford University Press.

Nurweni, A., & Read, J. (1999). The English vocabulary knowledge of Indonesian university students. *English for Specific Purposes, 18*(2), 161-175.

Ou, H. C. (1997). A comparative study of English reading proficiency between comprehensive university and technological institute seniors. *Studies in English Language and Literature, 2*, 1-12.

Quinn, G. (1968). *The English Vocabulary of Some Indonesian University Entrants*. [English Department Monograph]. IKIP Kristen Satya Watjana: Salatiga.

Read, J. (2000). *Assessing Vocabulary Knowledge and Use* (1st ed.,). Cambridge, UK: Cambridge University Press.

Read, J. (2004). Plumbing the depths: How should the construct of vocabulary knowledge be defined? In P. Bogaards & B. Laufer (Eds.), *Vocabulary in a Second Language*. Amsterdam, Netherlands: John Benjamins.

Richards, J. (1976). The role of vocabulary teaching. *TESOL Quarterly, 10*(1), 77-90.

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

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

Waring, R., & Nation, P. (2004). *Second language reading and incidental vocabulary learning* (Vol. 4, pp. 96-110). The University of Copenhagen, Denmark: Museum Tusculanum Press.

West, M. (1953). *A general service list of English words*. London, UK: Longman,

Green & Co.

Xue, G. & Nation, I. S. P. (1984). A university word list. *Language Learning and Communication*, *3*, 215-229.

Zimmerman, C. B. (1997). Do reading and interactive vocabulary instruction make a difference? An empirical study. *TESOL Quarterly, 31*, 121-140.

Zahar, R., Cobb, T. and Spada, N. (2001). Acquiring vocabulary through reading: effects of frequency and contextual richness. *Canadian Modern Language Review*, *57*(3), 541-572.