

以英語為國際語之學習者使用電腦輔助 語言教學系統學習學術英文字彙之成效： 以 MyET 及 WordMaster 為例

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摘 要

本研究旨在探討利用電腦輔助語言教學設備學習英文學術字彙對於英語為國際語之學習者之成效。本實驗參與者由 48 位大學部及研究所英文程度相似的學生組成，並採用兩種英文線上學習系統（MyET 及 Wordmaster）評估學習者學習英文學術相關字彙之成效。24 位受試者隨機分配為 MyET 組，另 24 位則為 Wordmaster 組。每位受試者在實驗開始前，須學習如何使用對應的線上學習系統，並於了解線上系統的操作後，立刻進行 50 個英文學術學術字彙的前測，之後於實驗開始後的第二個月進行後測，並填寫學習問卷。本實驗利用 t 檢定及共變數分析量化工具比較兩種不同電腦輔助語言教學系統，佐以學習問卷之分析，其研究結果顯示：Wordmaster 學習面機制優於 MyET，且 Wordmaster 提供延遲回饋的復習機制優於 MyET 的即時回饋機制，因此 Wordmaster 系統有較顯著的學習成效。此實驗證明 Wordmaster 系統較能幫助以英語為國際語之學習者學習英文學術字彙，並擴充其字彙量。

關鍵詞：英語為國際語、電腦輔助語言教學、學術字彙學習、單字記憶成效

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The Effect of Computer-assisted Vocabulary Learning Systems on EIL Learners on the Learning of Academic Vocabulary: A Comparison between MyET and WordMaster

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Abstract

To facilitate English vocabulary retention for learners in English as an International Language (EIL) context, different vocabulary learning systems have been adopted to maximize the learners' vocabulary bank. This study intends to examine two computer-assisted vocabulary learning systems (MyET and Wordmaster) and compare the learning results in an academic setting. A total of 48 EIL university students with similar language proficiency participated in the study. They were randomly assigned to either the MyET or Wordmaster group. Both groups were required to accomplish a 50-vocabulary-item test from the assigned learning systems. Pre- and 2-month-delayed tests were given to evaluate the efficacy of learners' vocabulary retention. A t-test and method of analysis of covariance (ANCOVA) were used to analyze the data and to answer research questions. A questionnaire intended to provide more credibility to the findings of this study was given to the participants at the end of the experiment to further confirm learners' preferences of using computer-assisted systems. Based on the findings derived from this study, the Wordmaster group yielded significantly better recall performance than the MyET group in the learning dimension. A significant finding was also demonstrated by the Wordmaster group that delayed feedback was more beneficial than that of instant feedback in the MyET group. The results obtained

from this study indicate that the application of Wordmaster enhances EIL learners' vocabulary retention and provides more vocabulary learning dimensions when academic related vocabulary were recalled.

Keywords: EIL, CALL, Academic Vocabulary Learning, Vocabulary Retention

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Introduction

The amount of non-native English speakers has dramatically increased. English as an International Language (EIL) has become a hot issue in the last two decades (Burns, 2005; Dong, 2012; Jenkins, 2000; Matsuda, 2003; Seidlhofer, 2001). Without doubt, EIL learners want to know English and to use English to reach a mutual understanding with the English-speaking world. English has become a tool for communication and sharing cultures. When anyone wishes to manipulate this tool, it is better to sharpen it with a whetstone, that is, the vocabulary.

Under the EIL context, vocabulary, the fundamental element of language learning, is recognized as the vehicle carrying communication elements. To master vocabulary is to understand the meaning, register, association, and its equivalence with the mother tongue (Bartley & Benítez-Castro, 2013; Nation, 1990). Learners should have sufficient vocabulary knowledge as to interpret and infer meaning from everyday communication, or to academic discourse. Without vocabulary, the true communication cannot be reached and extended. However, vocabulary acquisition is challenging for learners (Chang, 2013; Chen & Truscott, 2010; Graves, 2006), especially for learning difficult or rarely-used words.

A great deal of research assessing EIL learners' vocabulary sizes has been done for the past decades. These studies focus on applying different methods to increase learners' vocabulary banks. To find applicable vocabulary learning methods that accommodate EIL learners' aptitude is of great importance. Researchers have devoted to increase learners' vocabulary retention by using different vocabulary learning strategies: some prone to use rote learning to learn new words (Dhindsa, Kasim, & Anderson, 2010), while others might incorporate learning strategies such as concept maps (Hay, Kinchin, & Lygo-Baker, 2008) or mnemonics (Chen, 2013; Scruggs & Mastropieri, 1991) to monitor vocabulary

growth. Although vocabulary instruction has to include functional methodologies, it would need to go well beyond that for some of these strategies do not have drastic changes among EIL learners. One way in which vocabulary retention can be encouraged is through Computer Assisted Language Learning (CALL). Recently, with the advance of technology, more and more Information and Communications Technology researchers have expected that CALL could first alleviate the effects of traditional teaching methods, then bring a revolution for EIL vocabulary teaching and learning.

Previous studies have posted arguments on CALL, for example: (1) CALL is not applied in classroom setting, but for self-training; (2) CALL is usually compared with traditional learning methods and might not be as effective as traditional ones; (3) CALL does not evaluate sufficient vocabulary items; and (4) CALL is pricy under certain circumstances. On the contrary, this study hopes not to compare CALL with any traditional learning method, but aims to bridge the gap by presenting a well-designed framework of CALL system to examine EIL learners' vocabulary knowledge. The researcher wishes to shift the focus from English vocabulary for general purposes to academic oriented ones, and compare the effectiveness of two CALL vocabulary learning systems on the total amount of academic word learned for EIL university learners. At the end of the research, the researcher wishes to find a better or proper CALL system for EIL learners learning academic vocabulary from a range of instructional possibilities.

Literature review

Vocabulary learning

Vocabulary knowledge serves as a precondition of language literacy. No learner can be left out of vocabulary instruction (Chiu, 2013). To master a word is to understand different dimensions of it, such as, the meaning, the written

form, the spoken form, the collocation, the syntactic usage, the register, the association, the frequency of the word, and its equivalence with the mother tongue (Bartley & Benitez-Castro, 2013; Nation, 1990). Rivers (1983) claimed that vocabulary learning should be started from “whole to part,” “agent or object to function,” and “superset to subset.” However, Lin (2010) reinforced that, “For most L2 learners, the vocabulary learning process is a painful experience with poor results (p. 201)” . Foreign language learners do not usually share the same experiences as native speakers so that they are facing learning difficulties (Griffiths & Keohane, 2000); therefore, EIL learners need sufficient vocabulary knowledge to reach fluency.

To achieve academic success, learners rely not only on individual ability, but appropriate learning strategies (Scruggs & Mastropieri, 1991). Different approaches, which include mnemonics (Chen, 2013), concept maps (Hay et al., 2008), or rote rehearsals (Dhindsa et al., 2010), have been practiced in classrooms in hope of expending learners' vocabulary size. Take rote rehearsal as an example, it is believed that learners rely heavily on constant drills in vocabulary memorization (Willingham & Price, 2009). Teachers spend most class time drilling words, and learners spend theirs listening (Dhindsa et al., 2010). This learning method is considered to be the only way to remember vocabulary (Boers, Eyckmans, & Stengers, 2007). Even if learners have passed critical examinations to get into universities under EFL settings, their learning habits on remembering vocabulary remain the same (Hay et al., 2008).

It is important to find an effective way to retain vocabulary (Liu, 2010; Sagarra & Alba, 2006; Taguchi, 2006) especially for EIL learners (Orawiatnakul, 2011; Smith, Li, Drobisz, Park, Kim, & Smith, 2013) under academic settings (Dalton & Grisham, 2011). However, academic words do not appear in course books until later stages and are widely viewed as particularly demanding for EIL learners. EIL learners become passive in vocabulary learning because they do not have sufficient awareness in expending their vocabulary banks (Liu,

2010). In a vocabulary learning survey, conducted by Liu (2010), the obstacles on learners' vocabulary learning behavior were investigated. 390 EIL students found it frustrating to remember vocabulary items. Among the sources of the difficulties are lack of transparency in word forms, technical terms, or polysemant. To improve learners' mastery of vocabulary, Liu (2010) suggested that (1) learning strategies should be taught, especially to low-achievers, and (2) bilingual dictionaries should be used. Apart from applying ready-made vocabulary learning strategies, implementing computer-assisted ones is another way to boost vocabulary retention.

CALL and Vocabulary learning

Computer technology enables learners to have easier access to novel materials (Dalton & Grisham, 2011; Davies, 2010). Computer interventions have positive effects on learners' vocabulary achievements (Huang, Huang, Huang, & Lin, 2011; Segers & Verhoeven, 2003). CALL has been intensified in recent decades that a number of studies have discussed how computer-assisted language learning is effective in vocabulary learning. Being literate in a digital environment involves various CALL systems so that vocabulary could be remembered and learned. For example, "Kurzweil 3000" is designed for learning disabled students to construct vocabulary knowledge on pronunciations, spellings, and matching spoken forms with their written counterparts (Cullen, Keesey, Alber-Morgan, & Wheaton, 2013); "VTS.S" is adjusted for teenagers to learn synonyms, antonyms, and definitions of various vocabulary items (Maftoon, Hamidi, & Sarem, 2012); "PLATO" is programed to self-evaluate word roots and derivatives (Scanlan, 1980); and "Ville" is created for L2 college students to enhance vocabulary memorization as well as pronunciations (Wik & Hjalmarsson, 2009). CALL devices allow each learner to be in control of his or her own learning pace; and it is believed that EIL learners, regardless of their proficiency level, are able to take full advantage of ubiquitous English

vocabulary learning systems in maximizing their vocabulary banks (Huang et al., 2011).

A number of attempts have been made to prove the efficacy of CALL. Hirschel and Fritz (2013) indicated the advantage of computer assisted language learning as: “CALL is increasing offering L2 students a range of opportunities for vocabulary practice and learning over and above pencil and paper activities (p. 640)” . One thing that is especially clear from research on CALL users is that those whose motivation is higher (Maftoon et al., 2012; Wik & Hjalmarsson, 2009) are also those with a more advanced vocabulary level (Lin, 2010; Smith et al., 2013). CALL is used to test L2 learners’ attention of glossed words, text comprehension, and vocabulary acquisition (Bowles, 2004), while it also provides translation practices on single vocabulary items and sentences (Scanlan, 1980). According to Grace (2000), after learning a dialogue with aids on narrations and L1 translations, CALL would be able to access and evaluate if learners know how to apply vocabulary knowledge in context (Grace, 2000). The application of CALL in boosting learners’ vocabulary retention is multidimensional, because computer technology delivers instant feedbacks (Kalbouss, 1973).

Vocabulary learners, however, are constantly overwhelmed with the learning burden (Smith et al., 2013; Zolfagharkhani & Moghadam, 2011). To release the burden, Smith et al.’s (2013) proved that inference-based computer games are more beneficial than rote rehearsal in vocabulary learning for EIL Chinese college students. Hirschel and Fritz (2013) have also demonstrated how CALL pays off in vocabulary learning among Japanese EIL students’ learning of new vocabulary items. They examined students’ long-term retention on 36 vocabulary items among 140 college students. The CALL treatment group used a specially-adapted vocabulary recycling program (Praxised.com) to remember the assigned vocabulary. The system includes different types of vocabulary learning tasks, such as translation, partial cloze, and appropriate response. On the other hand, the vocabulary notebook group was told to take notes during the learning

process. Vocabulary information written down in the notebook includes translations, definitions, example sentences, and collocations of the assigned words. Furthermore, a no-instruction group was treated as the control group. No significant gains were observed for short-term intervention from all groups; however, the CALL group improved their test score by 5 % at the end of the treatment. Hirschel and Fritz therefore concluded that there is a need for CALL approaches to heighten the learnability and memorability of vocabulary items.

Purposes of this study

The findings derived from the aforementioned literature provide valuable references for teacher educators and researchers. However, it should be noticed that, among relevant studies, empirical studies focusing on the impact of English vocabulary learning systems, especially in the English as an International Language context, are still rare. In practice, how have CALL in the past dealt with academic word learning? The question of which particular CALL system is appropriate is one which has been left unanswered. Therefore, this study aims to examine two computer-assisted vocabulary learning systems (MyET and Wordmaster) used by EIL university students for the learning of academic-specific vocabulary. The reasons why MyET and Wordmaster are chosen for this study have two folds: (1) MyET is accounted as one of the biggest online learning systems in Taiwan providing language learning opportunities among university-level learners. This system works with publishers and universities to cater learning needs for language learners. It is possible to input vocabulary practices to satisfy different learning objectives. (2) Wordmaster is designed by engineers of a university in Taiwan. This system does not work with publishers to assess vocabulary learning from commercial EFL textbooks. It is created to facilitate vocabulary-building for currently-enrolled students at the university.

Instructors may assign to-be-learned vocabulary to the system with a view to accommodate various learning needs. The researcher intended to compare the learning results of these two systems in learning academic vocabulary, and to understand the impact of CALL in assisting vocabulary memorization.

Research questions

As has been shown, the trend over the decades has been for boosting learner's vocabulary bank. The aim of the study is to consider three research questions relating to the incorporation of CALL. The research questions are proposed as follows:

1. Which CALL vocabulary learning system enhances EIL learners' vocabulary retention?
2. Which CALL vocabulary learning system provides more vocabulary learning dimensions?
3. Which CALL vocabulary learning system is more beneficial for EIL learners in terms of learning mechanism, practice mechanism, and feedback mechanism?

Methodology

Participants

To examine the learning performance of the proposed English vocabulary learning systems, a total of 48 undergraduate and graduate students, ranging from 21 to 27 years old, took part in the experiment. The participants were taking EIL academic courses in a national university in southern Taiwan. All participants involved were native speakers of Mandarin. They have taken TOEIC

test before the experiment and were of equal Common European Framework of Reference proficiency on B1/B2 levels. They attended a four-skill-combined course for two hours per week for one semester. The participants were randomly assigned to either MyET group or Wordmaster group. They would be learning vocabulary from Academic Word List (Coxhead, 2000) from different computer-assisted systems (MyET or Wordmaster). None had had any previous experiences of using CALL in language learning, especially in learning vocabulary.

Application of MyET

My English Tutor (MyET) is a computer-assisted learning system and can be installed for free. This system serves as a virtual tutor in promoting learners' speaking fluency and proficiency. It focuses on a learning interval from 5 to 15 words each time. Vocabulary would be learned through repetition, vocabulary in context, saying aloud, and instant feedback on pronunciation performance practices. MyET has a unique and award-winning technology named "Automatic Speech Analysis System (ASAS?)". When learners are having speaking practices, their sound will be recorded and analyzed by the ASAS?. The analysis of the sounds would target different facets of learners' speech forms, such as pronunciation, pitch, timing and stress. After having a speaking practice, learners get an overall score and instant feedback on mispronounced words or comments on "how to improve your speech". This study adopted the vocabulary practice section in the ASAS? (as shown in fig 1. on the interface of MyET vocabulary practice). Vocabulary tested in the ASAS? is adapted from Academic Word List (Coxhead, 2000).



Fig. 1
The interface of MyET vocabulary practice

Application of Wordmaster

Wordmaster is a web-based vocabulary-building system. This learning system is developed by Center for Language Studies at National Chung Cheng University (as shown in Fig. 2 on the interface of Wordmaster). Wordmaster emphasizes on remembering the pronunciations, spellings, definitions, and meanings of target words in the learning process. For each of the learning session, 50 words would be provided. Vocabulary practices in Wordmaster include “listen and spell the word”, “listen and choose the word”, “listen and choose the definition of the word”, “read a definition and choose the word”, and “choose vocabulary in context” (as shown in Fig. 3). Learners are required to either type-in the spelling of vocabulary or choose the correct answer after hearing the sound of vocabulary within a time frame. All the practice sections can be mixed and matched, according to learners’ need. Scores will be shown and a complete list of misspelled or mischosen words will be provided immediately after the practice is finished. Learners will also know the total time consumed in completing the practice.



Fig. 2
The interface of Wordmaster

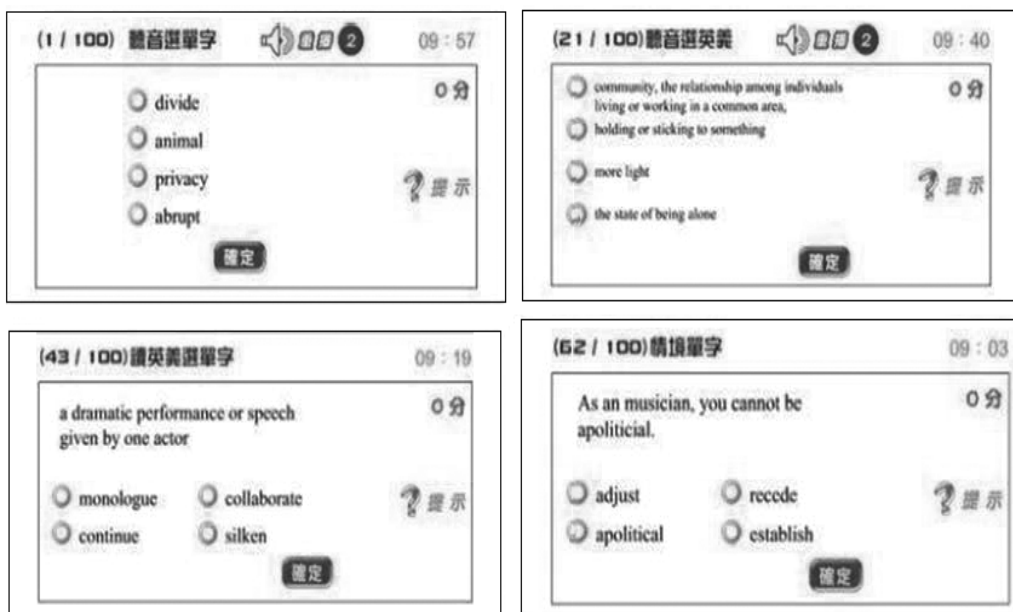


Fig. 3
Vocabulary practice in Wordmaster

Vocabulary tested in Wordmaster is also adapted from the Academic Word List (Coxhead, 2000).

Comparison of MyET and Wordmaster

A comparison of the two learning systems is shown in Table 1. Both learning systems adopted the Academic Word List as a mean to evaluate vocabulary knowledge. The reason why Academic Word List is used is because it includes the most frequently-used words for non-native English speakers who wish to succeed in academic settings (Coxhead, 2000). However, these two systems do vary from the learning dimensions to system dimensions. For the learning dimensions, MyET concentrates on students' learning words through the sound and meaning practices; while Wordmaster puts its focal point on learning words through typing, instead of from the sound and meaning of words. Even though both systems occupy a section on explaining the meaning of words, MyET centers the meaning of words by feeding the learners with vocabulary-in-context clues, as Wordmaster directs the meaning of words separately, on definition and vocabulary-in-context clues. The range of possible scores on both systems is between 0 to 100 points.

These two systems also draw different attention on the system dimensions, which focus on learning, feedback, and practice mechanisms. For the learning mechanism, MyET provides vocabulary exercises from 5 to 15 words each time. Learners have to practice listening first and speaking at the end. Each exercise has a set sequence. On the other hand, learners practice 50 words from multiple choice questions in Wordmaster. In the first section, learners listen to the pronunciations of 15 words, then choose matching definitions. In the second section, learners choose correct definitions of 15 target words. In the third section, learners listen to the pronunciations of 20 words, then type the spelling of the words. As for the feedback mechanism, MyET provides instant feedback that learners would be able to know the test results immediately; therefore,

mistakes could be corrected when each word is practiced and learned. On the contrary, Wordmaster offers delayed feedback in which commonly-made mistakes on spelling and definition are shown at the end of the practice. With regard to the practice mechanism, the ultimate learning outcome of MyET aims at speaking output, while Wordmaster stresses on spelling output.

Table 1
Comparison of MyET & Wordmaster

		MyET	Wordmaster
	Vocabulary Bank	Academic Word List	Academic Word List
Learning dimension	Form	N/A	Yes(typing)
	Sound	Yes	Yes
	Meaning	Yes (vocabulary in context)	Yes (definition, vocabulary in context)
	Grading	100 points	100 points
System dimension	Learning Mechanism	• 5–15 words in each practice • Listening then speaking	• 50 words from multiple choices • Listen–definition: 15 items Definition: 15 items Listen–spelling: 20 items
	Feedback Mechanism	Instant feedback	Delayed feedback
	Practice Mechanism	Speaking output	Spelling output

Materials and apparatus

Participants of this study were provided with computer access in the self-access learning classroom in which MyET and Wordmaster were installed. They were also allowed to have access to the two systems outside of school, as long as they have internet connection. In order to examine the efficacy of academic

vocabulary learning, Academic Word List (Coxhead, 2000) was adopted in both learning systems. The list contains 570 word families in which each family was selected according to principles and priorities of the academic setting.

Participants were measured on the improvement of their vocabulary retention ability in the pre- and two month delayed post-tests. To make sure the reliability and validity of the tests, both pre- and post-tests were implemented with consistency of test forms and raters to make sure that less variables occur during the experiment. Both tests in this study applied an online grading system to assure test fairness. There were 50 items in each of the test. Each test consisted of two sections. In the first section, 25 sounds were required to be recognized. Participants listened to the pronunciations of the target words then selected one correct answer out of four options. In the second section, 25 definitions had to be identified. Participants first read a definition of the target word, then chose a word that best describes the definition. All the test items need to be completed within ten minutes. After the test is finished, the online grading systems would calculate the scores immediately.

The “Vocabulary learning system questionnaire” was implemented at the end of the experiment, with a view to lend more credibility to the findings of this study. The purpose of the survey was to further confirm learners’ preferences on using computer-assisted vocabulary learning systems. A 14-item questionnaire (see Appendix 1) with five-point Likert-scale was given to all the participants. The arrangement of the items from the questionnaire was planned to answer the research questions of this study (see Table 1 for reference). The design of item 1 to 7 from the questionnaire was prepared to answer research question two. From the collected answers of the survey, it will reveal on which CALL vocabulary learning system provides more learning dimensions for participants’ understanding of the written form, spoken form, and word meaning of the target words. Item 8 to 14 from the questionnaire were designed to answer research question three. The analysis of the answers will focus on which vocabulary learning system is more beneficial on learning, feedback and practice mechanisms from the system

dimension. By validating the questionnaire, the findings of the survey will show learners' satisfactory levels on learning vocabulary from the two learning systems.

Procedure

In the beginning of the study, the participants were informed that they are taking part in a language learning experiment and the results of their tests would have no negative influence on their midterm or final exams during the semester. Participants were randomly assigned to either MyET or Wordmaster group in the experiment. Each group received a 20-minute training session on its assigned CALL learning system. A pre-test of 50 vocabulary items on AWL was implemented immediately after the training session. After the pre-test, participants were encouraged to use the assigned system either at school or at home in the following two months. They were required to use the system at least once in a week, and they had to practice for at least half an hour each time. Both systems have implemented monitoring devices as to supervise the learning progress of the participants on their log-in time, the points gained from the practice, and the total time spent in the practice. A recorded learning portfolios of all the participants would be provided from the systems for the researcher. The post-test was implemented after the two-month learning phase. A follow-up questionnaire was given to all the students. The researchers intended to get a closer look at learners' satisfactory levels on learning vocabulary from different CALL learning system via the test scores of the pre- and post-tests, as well as the analysis of the questionnaires.

Results and Discussions

In consistency with previous research questions, the efficacy of CALL is calculated from the t-test and the results are given in the following tables. An

examination of test scores from the pre- and post-tests for each group is shown from Table 2 to 6 of which attempts to answer research question one on the effectiveness of two CALL vocabulary learning systems. The participants were divided as Group A (MyET) and Group B (Wordmaster) in Table 2 for a comparison of test scores.

Table 2
Comparison of groups

	Pre-test	Post-test
Group A (MyET)	PreTestA	PostTestA
Group B (Wordmaster)	PreTestB	PostTestB

Table 3 represents the statistics of the paired t-test on the improvement in test scores. It investigates whether Group A (MyEt) or Group B (Wordmaster) exert positive effects on learning. The mean of the difference from Wordmaster group outnumber in pre- and post-tests than that of MyET (Wordmaster=7.917, MyET= 3.417). The p-value for both groups (0.003 and 0.028) indicates that there is statistically significant improvement in English capability for both CALL methods.

Table 3
Paired t-test on the improvement in test scores of individual CALL

		Paired Differences					<i>t</i>	<i>df</i>	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
					Lower	Upper			
Group A	PostTestA – PreTestA	3.417	7.113	1.452	.413	6.420	2.353	23	.028
Group B	PostTestB – PreTestB	7.917	11.474	2.342	3.072	12.762	3.380	23	.003

Table 4 shows the results of the t-test comparing the mean of improvement observed in test scores for Group A and B. It intends to find whether there is a better progress of scores for Wordmaster over MyET. The preliminary F-test concluded that there is no statistically significant difference in the variances; therefore, the following t-test was conducted on the assumption of equal variances. The results indicate that there is an obvious difference (PostTestA- PostTestB $t = -2.261$ $p < 0.05$) that Wordmaster yields recall performance significantly better than MyET.

Table 4
Comparing improvement in test scores using t-test

	Levene's Test for Equality of Variances		t-test for Equality of Mean		
	F	Sig.	t	Sig. (2-tailed)	Mean Difference
Equal variances assumed	3.812	0.057	-2.261	0.029	-6.167

One might assume that a higher pre-test score might lead to higher or lower post-test scores and therefore obfuscate the resulted improvement in learning. For example, the benefit of using CALL might be less obvious when the given subject students had already possessed a good English proficiency. To further clarify the issue, the method of analysis of covariance (ANCOVA) is employed, hoping the effect of pre-test scores can be eliminated in order to show the effect of improvement attributed by different CALL treatments.

Table 5 shows a comparison of testing for homogeneity of regression slopes. There is no significant difference in the slope of the regression line between MyET and Wordmaster group (Pre-Test: Post-Test Difference $Pr = 0.1069 < 0.05$). Hence, there is homogeneity of regression slopes within the two groups, and the use of ANCOVA is valid.

Table 5
Testing for homogeneity of regression slopes

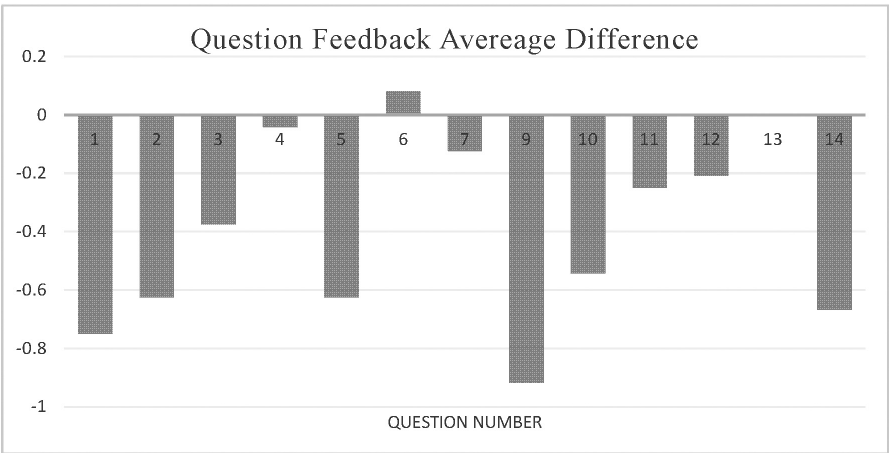
	df	Sum Sq	Mean Sq	F-value	Pr(>F)
Pre-Test	1	560	560.5	6.371	0.0153
Post-Test Difference	1	321	321.1	3.65	0.0626
Pre-Test: Post-Test Difference	1	238	238.3	2.709	0.1069
Residuals	44	3871	88		

Table 6 represents the results of ANCOVA analysis. The findings show that Wordmaster is almost statistically significant than MyET (CALL treatment $Pr.=0.06725 > 0.05$). Even if the effect of the subjects' pre-test English proficiency is taken into consideration, Wordmaster is still better than that of MyET. As a result, from above-mentioned data and to answer research question one, it can be concluded that Wordmaster enhances EIL learners' vocabulary retention.

Table 6
ANCOVA analysis result

	Sum Sq	df	F value	Pr(>F)
Pre-Test Score	518.6	1	5.6797	0.02144
CALL Method	321.1	1	3.5168	0.06725
Residuals	4109	45		

To answer research questions two and three, the analysis of "Vocabulary learning system questionnaire" needs to be discussed. The results of the survey for question 1 through 14 from both groups are summarized in Graph 1 in order to create a general concept of the questionnaire. The value reveals the difference between the mean value of the responses for MyET and Wordmaster. Over all, the responses are more favorable toward Wordmaster than MyET, especially in question 1, 2, 5, 9 10 and 14, where Wordmaster make most part of the improvement over MyET during the learning phase.



Graph 1
Difference in feedback mean (MyET – Wordmaster)

To have a closer look at the overall responses, attention can be directed to Table 7. This table further summarizes statistically significant responses from the questionnaire. Questions 1, 2, 5, 9, 10 and 14 suggest that Wordmaster be a more beneficial learning system than MyET. Questions 1, 2, 5 refer to its effectiveness on learning dimensions, while questions 9, 10, 14 refer to its learning mechanism, practice mechanism, and feedback mechanism respectively from the system dimension.

Table 7
Summarization of the questionnaire response

Question Number	1	2	3	4	5	6	7	8	9	10	11	12	14
	Learning dimensions							Learning mechanism		Practice mechanism			Feedback mechanism
Difference in response mean (MyET–Wordmaster)	-0.75	-0.625	-0.375	-0.042	-0.625	0.083	-0.125	0.042	-0.917	-0.542	-0.25	-0.208	-0.667
p-value (2-tail)	0.011	0.026	0.207	0.882	0.038	0.757	0.496	0.877	0.001	0.038	0.298	0.431	0.007
Statically Significance	YES	YES	-	-	YES	-	-	-	YES	YES	-	-	YES

In the following sections, a detailed analysis of the questionnaire will be provided. Research question two will be answered from Table 8 to 14, and research question three from Table 15 to 20.

Table 8 to 14 intends to answer research question two on which CALL vocabulary learning system provides more learning dimensions for participants' understanding of the written form, spoken form, and word meaning of the target words. First, Table 8 and 9 present the statistic results of questions 1 and 2 from the questionnaire. This table wishes to discover a better written form practice in the learning dimension. According to the t-test, it indicates that Wordmaster learning system shows up a better form practice of the vocabulary than MyET from the findings of question 1 ($t=-2.695$ $p<0.05$) and question 2 ($t=-2.304$ $p<0.05$).

Table 8

Question 1

Question 1: 我覺得用英文單字寫下來,我會比較容易學會					
	Levene's Test for Equality of Variances		t-test for Equality of Mean		
	F	Sig.	t	Sig. (2-tailed)	Mean Difference
Equal variances assumed	1.069	0.307	-2.659	0.011	-.750

Table 9

Question 2

Question 2: 我覺得配合圖片記憶單字,我會比較容易學會					
	Levene's Test for Equality of Variances		t-test for Equality of Mean		
	F	Sig.	t	Sig. (2-tailed)	Mean Difference
Equal variances assumed	2.217	0.143	-2.304	0.026	-0.625

Next, Table 10 and 11 discuss the learning dimension in the learning of pronunciations for the target words from questionnaires questions 3 and 4. There were no significant differences between Wordmaster and MyET groups (Question 3 $t=-1.281$ & Question 4 $t=-0.149$).

Table 10
Question 3

Question 3: 我覺得大聲把單字唸出來,我會比較容易記得					
	Levene's Test for Equality of Variances		t-test for Equality of Mean		
	F	Sig.	t	Sig. (2-tailed)	Mean Difference
Equal variances assumed	0.006	0.940	-1.281	0.207	-0.375

Table 11
Question 4

Question 4: 我覺得反覆把單字聲音念出來,我會比較容易記得					
	Levene's Test for Equality of Variances		t-test for Equality of Mean		
	F	Sig.	t	Sig. (2-tailed)	Mean Difference
Equal variances assumed	0.452	0.505	-0.149	0.882	-0.042

Table 12, 13 and 14 display the learning dimension in learning the meaning of vocabulary in both groups. A significance is found in question 5 ($t=-2.135$ $p<0.05$) for Wordmaster group, while no significance is found in question 6 ($t=0.3111$) and 7 ($t=-0.687$). Wordmaster appears to be able to achieve better results than MyET in the learning dimension of written form and referencing the meaning of vocabulary. However, there is no apparent advantage in learning via the spoken form. To answer research question two, a conclusion can be drawn that Wordmaster provides more vocabulary learning dimensions on spoken form and word meaning than MyET.

Table 12
Question 5

Question 5: 我覺得用字典查出單字定義,我會比較容易理解					
	Levene's Test for Equality of Variances		t-test for Equality of Mean		
	F	Sig.	t	Sig. (2-tailed)	Mean Difference
Equal variances assumed	0.592	0.446	-2.135	0.038	-0.625

Table 13
Question 6

Question 6: 我覺得用字典查出單字的中文,我會比較容易理解					
	Levene's Test for Equality of Variances		t-test for Equality of Mean		
	F	Sig.	t	Sig. (2-tailed)	Mean Difference
Equal variances assumed	0.448	0.506	0.311	0.757	0.083

Table 14
Question 7

Question 7: 我覺得從文章的前後文來學習單字,我會比較容易理解					
	Levene's Test for Equality of Variances		t-test for Equality of Mean		
	F	Sig.	t	Sig. (2-tailed)	Mean Difference
Equal variances assumed	1.508	0.226	-0.684	0.496	-0.125

To answer research question three on finding a more beneficial CALL system on learning, practice, and feedback mechanisms among EIL learners, attention should be drawn from Table 15 to 20 in which explain the findings of the questionnaires. Table 15 and 16 reflect the results of questionnaire questions 8 and 9 on the learning mechanism from both groups. No significance was

found in question 8 ($t=0.156$) on the applications of CALL in vocabulary learning; however, it is proved that Wordmaster system is beneficial for providing a set learning schedule ($t=-3.381$ $p<0.05$) for EIL learners.

Table 15
Question 8

Question 8: 我覺得用電腦學習系統來學習單字比較容易記得					
	Levene's Test for Equality of Variances		t-test for Equality of Mean		
	F	Sig.	t	Sig. (2-tailed)	Mean Difference
Equal variances assumed	1.059	0.309	0.156	0.877	0.042

Table 16
Question 9

Question 9: 我覺得按照系統的規劃，每次固定學習5-15個單字有助於我的學習 (MyET) 我覺得一開始拿到單字清單，有助於我的學習 (Wordmaster)					
	Levene's Test for Equality of Variances		t-test for Equality of Mean		
	F	Sig.	t	Sig. (2-tailed)	Mean Difference
Equal variances assumed	1.171	0.285	-3.381	0.001	-0.917

In the aspect of practice mechanism, Table 17, 18 and 19 summarize the findings from questionnaire questions 10 to 13. The statistics shows that Wordmaster provides better vocabulary practice on listening to the pronunciations of target words than MyET ($t=-2.137$ $p<0.05$) in question 10; however, no difference was found in question 11 ($t=-1.052$) and question 12 ($t=-0.794$) on learning target words via translations and context in CALL systems.

Table 17

Question 10

Question 10: 我覺得系統提供多次的單字及相關句子覆誦練習有助於我的學習 (MyET) 我覺得系統提供單字發音讓我選擇單字解釋有助於我的學習 (Wordmaster)					
	Levene's Test for Equality of Variances		t-test for Equality of Mean		
	F	Sig.	t	Sig. (2-tailed)	Mean Difference
Equal variances assumed	0.161	0.690	-2.137	0.038	-0.542

Table 18

Question 11

Question 10: 我覺得系統提供多次的單字及相關句子覆誦練習有助於我的學習 (MyET) 我覺得系統提供單字發音讓我選擇單字解釋有助於我的學習 (Wordmaster)					
	Levene's Test for Equality of Variances		t-test for Equality of Mean		
	F	Sig.	t	Sig. (2-tailed)	Mean Difference
Equal variances assumed	2.026	0.161	-1.052	0.298	-0.250

Table 19

Question 12

Question 12: 我覺得用說的來記憶單字有助於我的學習及記憶 (MyET) 我覺得聽單字發音用鍵盤拼出單字有助於我記憶單字 (Wordmaster)					
	Levene's Test for Equality of Variances		t-test for Equality of Mean		
	F	Sig.	t	Sig. (2-tailed)	Mean Difference
Equal variances assumed	0.203	0.654	-0.794	0.431	-0.208

It is observed from Table 20 that Wordmaster offers more efficient feedback mechanism ($t = -2.832$ $p < 0.05$) than MyET group for its delayed feedback. According to the results from Table 15 to 20, they indicate that Wordmaster is a more beneficial CALL device for EIL learners. Whether on the learning, practicing, or feedback mechanism, Wordmaster has demonstrated a better result over MyET, thus research question three is answered.

Table 20
Question 13

Question 14: 我覺得系統提供反覆練習直到達到標準有助於我的學習 (MyET) 我覺得完成一回合後，自行參考常犯錯誤單字清單有助於我的學習 (Wordmaster)					
	Levene's Test for Equality of Variances		t-test for Equality of Mean		
	F	Sig.	t	Sig. (2-tailed)	Mean Difference
Equal variances assumed	3.569	0.065	-2.832	0.007	-0.667

Conclusion and call for future research

Based on the findings derived from this study, Wordmaster group significantly outperformed MyET group. Participants in Wordmaster group demonstrated a better vocabulary retention on target-word pronunciations and meanings on the learning dimension. A noteworthy finding is also shown in Wordmaster group that delayed feedback is more beneficial than that of instant feedback in MyET group. This system provides more vocabulary learning dimensions when academic related vocabulary were remembered and yields better learning results for vocabulary retention among EIL university learners. Therefore, the results obtained from this study indicates that the application of Wordmaster elevates EIL

learners' vocabulary memorization.

It is proved that Wordmaster enhances EIL learners' vocabulary retention; therefore, the findings of this study could provide various implications to educational system designers and researchers that small investment of teaching time could yield a relatively high pay-off in terms of the application of Wordmaster. For educational system designers, a well-designed framework of a vocabulary learning system should include all learning dimensions of vocabulary, practice mechanisms, and delayed feedback as to facilitate vocabulary retention for EIL learners. A system designed by the aforementioned principles may most benefit EIL learners in learning academic vocabulary. The findings of this study is to give an authentic and practical way of profiling the vocabulary knowledge of the participants with a view to provide a basis for planning learning programs or teaching aids either for individual learners or for a language class as a whole. Although the results of this experiment point to the superiority of Wordmaster, this does not necessarily mean that the results will be replicated in other pedagogical contexts.

This study had several limitations which may lead to future investigations because the reported results may not generalize to other kinds of learning systems among EIL learners. To begin with, this study involved a relatively small sample size. The size of the data may limit the applicability of the methodology used in the study. It would have been better to conduct a further research with a larger sample size. Second, this study only adopted vocabulary from Academic Word List to examine whether academic-related vocabulary could be remembered among EIL university learners or not. Vocabulary could not have been limited to academic fields, so that the effectiveness of other learning systems could be further justified. It would have been interesting to explore possibilities and effects of other vocabulary frequency lists on general English, survival English, or business English courses. It remains to be seen how the applications may be put into

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Appendix 1

Vocabulary learning system questionnaire (MyET)

Background check	我這學期每周至少使用系統 (MyET) 學習單字 <input type="checkbox"/> 1次 <input type="checkbox"/> 2次 <input type="checkbox"/> 3次 <input type="checkbox"/> 4次 <input type="checkbox"/> 5次 (含以上) I practiced learning vocabulary by using MyET once/twice/three times/four times/five times (above) a week.
Background check	每次練習時間約為 <input type="checkbox"/> 10 分鐘 <input type="checkbox"/> 20 分鐘 <input type="checkbox"/> 30 分鐘 (含以上) I practiced 10minutes/ 20minutes/ 30minutes each time with the vocabulary learning system.
1	我覺得用英文單字寫下來，我會比較容易學會。 Writing down English vocabularies helps me master them.
2	我覺得配合圖片記憶單字，我會比較容易學會。 Learning vocabulary by using visual aids (pictures) helps me master them.
3	我覺得大聲把單字唸出來，我會比較容易記得。 Reading aloud vocabulary helps me memorize them.
4	我覺得反覆把單字聲音念出來，我會比較容易記得。 Saying the words repeatedly helps me memorize them.
5	我覺得用字典查出單字定義，我會比較容易理解。 Looking up the definitions of vocabularies helps me comprehend them.
6	我覺得用字典查出單字的中文，我會比較容易理解。 Looking up the Chinese translation of vocabularies helps me comprehend them.
7	我覺得從文章的前後文來學習單字，我會比較容易理解。 Learning vocabularies with context helps me comprehend them.
8	我覺得用電腦學習系統來學習單字比較容易記得。 Learning vocabulary with computer learning system helps me master vocabularies.
9	我覺得按照系統的規劃，每次固定學習 5-15 個單字有助於我的學習。 According to the system schedule, learning 5-15 words each time helps my vocabulary learning.
10	我覺得系統提供多次的單字及相關句子覆誦練習有助於我的學習。 Repetition of words and sentences provided by the system helps my vocabulary learning.
11	我覺得配合例句來練習單字的發音及意義有助於我的理解。 Leaning vocabulary pronunciation and definitions with sentences helps my comprehension.
12	我覺得用說的來記憶單字有助於我的學習及記憶。 Saying vocabulary aloud helps my learning and mastering of vocabulary.
13	我覺得發音的即時回饋有助於我的學習。 Instant feedback of my pronunciation helps my vocabulary learning.
14	我覺得系統提供反覆練習直到達到標準有助於我的學習。 Repetition mastering practices provided by system helps my vocabulary learning.

Appendix 2

Vocabulary learning system questionnaire (Wordmaster)

Background check	我這學期每周至少使用系統 (MyET) 學習單字 <input type="checkbox"/> 1次 <input type="checkbox"/> 2次 <input type="checkbox"/> 3次 <input type="checkbox"/> 4次 <input type="checkbox"/> 5次 (含以上) I practiced learning vocabulary by using MyET once/twice/three times/four times/five times (above) a week.
Background check	每次練習時間約為 <input type="checkbox"/> 10 分鐘 <input type="checkbox"/> 20 分鐘 <input type="checkbox"/> 30 分鐘 (含以上) I practiced 10minutes/ 20minutes/ 30minutes each time with the vocabulary learning system.
1	我覺得用英文單字寫下來，我會比較容易學會。 Writing down English vocabularies helps me master them.
2	我覺得配合圖片記憶單字，我會比較容易學會。 Learning vocabulary by using visual aids (pictures) helps me master them.
3	我覺得大聲把單字唸出來，我會比較容易記得。 Reading aloud vocabulary helps me memorize them.
4	我覺得反覆把單字聲音念出來，我會比較容易記得。 Saying the words repeatedly helps me memorize them.
5	我覺得用字典查出單字定義，我會比較容易理解。 Looking up the definitions of vocabularies helps me comprehend them.
6	我覺得用字典查出單字的中文，我會比較容易理解。 Looking up the Chinese translation of vocabularies helps me comprehend them.
7	我覺得從文章的前後文來學習單字，我會比較容易理解。 Learning vocabularies with context helps me comprehend them.
8	我覺得用電腦學習系統來學習單字比較容易記得。 Learning vocabulary with computer learning system helps me master vocabularies.
9	我覺得一開始拿到單字清單，有助於我的學習。 The vocabulary list provided by the system helps my vocabulary learning.
10	我覺得系統提供多次的單字及相關句子覆誦練習有助於我的學習。 Repetition of words and sentences provided by the system helps my vocabulary learning.
11	我覺得配合例句來練習單字的發音及意義有助於我的理解。 Leaning vocabulary pronunciation and definitions with sentences helps my comprehension.
12	我覺得用說的來記憶單字有助於我的學習及記憶。 Saying vocabulary aloud helps my learning and mastering of vocabulary.
13	我覺得發音的即時回饋有助於我的學習。 Instant feedback of my pronunciation helps my vocabulary learning.
14	我覺得系統提供反覆練習直到達到標準有助於我的學習。 Repetition mastering practices provided by system helps my vocabulary learning.