Effectiveness of Morphemic Analysis of Graeco-Latin Word Parts as a Vocabulary Learning Strategy among ESL Learners

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ABSTRACT

This study examined the effects of morphemic analysis of Graeco-Latin roots and affixes as a vocabulary learning strategy among Malaysian ESL learners. Three intact classes of undergraduates majoring in health sciences were assigned to three different treatments which are instructions focussing on Graeco-Latin morphemic analysis, general morphemic analysis and use of contextual clues as vocabulary learning strategies. Participants in all groups underwent the instructional intervention which was done biweekly over a five-week period. Each group was taught how to derive word meanings using these three different strategies. A pre-test and post-test comprising three vocabulary tests measuring students' morphemic analysis of general English words, morphemic analysis of Graeco-Latin word parts, and overall vocabulary size respectively, were administered. The scores were analysed using the paired sample T-test and one-way ANOVA to determine if there were improvements made in the three measures within each group, and subsequently whether the magnitude of improvement between the three groups were significant. The results indicated that (a) the group that were taught Graeco-Latin morphemic analysis scored the highest in all three vocabulary measures, (b) the group taught general morphemic analysis also improved in morphemic analysis of general English words but not Graeco-Latin words, and improved slightly in overall vocabulary size, but (c) the group that was taught to use contextual clues showed no improvement in all three vocabulary measures. The findings suggest that morphemic analysis, specifically analysis of Graeco-Latin word parts, may be a better vocabulary learning strategy particularly for the health sciences.

Keywords: morphemic analysis; vocabulary learning strategies; Graeco-Latin word parts; Health Sciences

INTRODUCTION

Learners who struggle with reading in a second or foreign language may actually have difficulty with the target language itself and not necessarily because of their problem in reading (Nambiar 2005). This premise is indeed true because it is nearly impossible for one who does not have a certain level of proficiency in the target language to understand any text written in that language. In fact, Nation (2001) argues that a knowledge of 8000 or 9000 words families is needed for L2 learners to understand written text, while Schmitt (2000) reports that as much as 10000 word families are needed for comprehension of academic texts.

Even though the learners' ability to read in their native language could be classified as 'advanced', that hardly reflects the same level of proficiency in a second or foreign if they do not possess the necessary vocabulary knowledge in the target language. In this regard, vocabulary knowledge may be taken as a strong predictor of learners' overall proficiency in the second language. Gill (2007) also points out that regardless of the foreign or second language involved, if the linguistic skills are flawed and below par, the processing and comprehension skills will be negatively affected in all respects.

Tertiary students read more academic materials covering many academic disciplines such as pharmacy, medicine, law, health sciences, and humanities and students are often required to not only read textbooks but also academic journals. In the process of accumulating discipline-specific knowledge, these students will inevitably need to comprehend and use new technical and scientific terminologies (Blachowicz & Fisher 2002). Since most academic books are written in English, not having sufficient vocabulary repertoire may impede learning as well as academic performance. Therefore, tertiary ESL learners have to make every effort to master scientific vocabulary while trying to comprehend the contents of their reading. Gill (2007) points out complex texts that are difficult to read will pose a problem for learners who have poor proficiency.

Many researchers in the past have underscored the importance of vocabulary in language learning particularly in academic reading. Vocabulary knowledge in English is deemed the strongest factor that could distinguish learners who could read and understand what they have read, from those who have difficulty reading even though they may have a colossal vocabulary stock in their native language (Blachowicz, Fisher, Ogle & Watts-Taffe 2006, Graves 2006).

In view of the importance of vocabulary to reading development, language teachers are constantly in search of helpful vocabulary strategies to facilitate active vocabulary learning among students within a linguistically-rich environment (e.g. Wong & Anie Attan 2014; Naginder Kaur 2013; Rasinski, Padak, Newton & Newton 2008; Graves 2006). There are many factors that need to be considered which make the learning environment conducive for second language vocabulary learning (Antonacci & O'Callaghan 2012). Previous studies have not singularly indicated any vocabulary learning strategy as the most helpful and successful in second language learning. However, some researchers have claimed that explicit instruction in Greek and Latin word parts could offer a promising strategy for vocabulary acquisition and literacy in the target language (Blachowicz & Fisher 2006). The Literacy and Numeracy Secretariat (2009) advocates that "when a word is essential for continued understanding of the text, and context clues do not help; the student's next recourse is word analysis" (p. 5). This is further supported by Holmes and Keffer (1995) who concluded that learning one Latin word part would suffice to help decode many English words. Since research on the efficacy of Greek and Latin word parts has not been carried out in the Malaysian context, this study explores the effectiveness of Graeco-Latin morphemic analysis as another approach for vocabulary learning particularly for ESL learners in the health sciences.

MORPHEMIC ANALYSIS AND VOCABULARY LEARNING

A plethora of research studies conducted in the area of second language learning have been reported to have focussed on the direct instruction of morphemic analysis in promoting vocabulary acquisition in second language learning (Graves 2000, 2006, Rasinski et al. 2008). These earlier studies show that morphological analysis can serve as a useful strategy to enhance ESL learners' vocabulary knowledge. This is because competence in a second

language is not only influenced by the number of words the learners have but also their ability to understand new words based on existing words in their vocabulary. Lowie (1998) mentions that morphological knowledge that learners possess can activate their word schema and morphological awareness which in turn help them dissect individual word parts to derive meaning of new words effortlessly.

Knowledge of morphology will also help learners to improve their word learning strategies and enhance their vocabulary stock. This is because acquiring new words in the second language is not constrained to learning dictionary meaning by rote; the acquisition of word meaning actually goes beyond that. Booij (2005) further supports this view by claiming that "it takes a number of years to build up your mental lexicon, and during your whole life you will continue adding and losing words. It does not suffice just to memorise the simple words of your native language, and either decompose or construct complex words on the spot" (p. 235). The process of word learning takes a very long time to achieve a high level of mastery and learners cannot rely entirely on rote memorisation of dictionary meanings to be proficient users of the target language.

Rasinski, Padak, Newton and Newton (2011) assert that the most successful vocabulary instruction method is morphological analysis because of "the fact that a significant number of words, particularly academic words in English are derived from Latin and Greek" (p. 134). Given that a large proportion of words in the English language are borrowed from other foreign languages, Folse (2004) puts forth the notion that it is rather implausible for second language learners to learn many words in a short period of time. To make this task possible, explicit vocabulary instruction should be explored. In addition, Moore (2006) states that when English teachers provide students with direct vocabulary instruction, students are able to grasp scores of new concepts and terminologies as teachers could easily define and explain them in class. Students could also develop their learning strategies in tandem with explicit vocabulary instruction. Rasinski et al. (2011) further posit that "using Latin and Greek roots to teach multiple words is a more efficient approach than the traditional vocabulary instruction method of teaching words as single entities" (p. 133). Therefore, direct instruction of Graeco-Latin morphemic analysis could provide a linguistically-rich setting for learners to promote literacy success. Such instruction could also help to establish learners' morphological knowledge that could in turn facilitate future independent vocabulary learning. The following studies on the importance of morphemic analysis in vocabulary learning and reading ability provide strong evidence that instruction that emphasises morphological awareness generally, and the Graeco-Latin word part analysis specifically, serves to facilitate vocabulary learning.

Holmes and Keffer (1995) reported that learners who were taught Latin root words achieved high verbal scores in the Scholastic Aptitude Test (SAT). Using the Solomon four-group design and a computer program called Apple Hypercard System, the research was carried out over a 6-week period to expose 115 college-preparatory-level English students to the Graeco-Latin root elements for deriving word meaning of English vocabulary. The findings reveal that the students who were given direct instruction via the Apple Hypercard System scored 40 points higher than those who were not exposed to the computer program (Holmes & Keffer 1995).

Gilbert, Goodwin, Compton, and Kearns (2013) studied the effects of morphological analysis of multisyllabic words on reading comprehension among 169 fifth graders from 40 schools. The following five measures were used in their study: Academic Knowledge subtest of Woodcock-Johnson III, Morphological Awareness test, Multisyllabic Word Reading test, Reading Comprehension assessment, and The Peabody Picture Vocabulary test. The results indicated that the relationship between word reading and morphemic analysis was instrumental in yielding positive result in reading comprehension. A major difference was

noted on the effect of morphological awareness, where 39 percent of the participants encountered more problems reading morphologically-complex words compared to the rest of the subjects who were at a higher level of proficiency. This shows that the relationship between morphological analysis and reading comprehension was mediated by ability in reading multisyllabic words. Morphological awareness was found to have an important association with reading comprehension particularly for weaker readers.

Goodwin, Gilbert and Cho (2013) conducted a study on the effects of morphological awareness on word reading among adolescents, looking into learner characteristics and their word reading ability. The study was carried out on 221 young middle school students enrolled in two suburban middle schools in the United States. Three measures were used in this study: Reader-by-Word Measures, Derived-Word Reading Accuracy (DERIVED), and Root-Word Reading Accuracy (ROOT). The results showed that the participants' performance at reading a particular root word described their skill of associating words of the same root. For instance, the participants were able to associate the word 'predict' with 'prediction'. This points to the fact that knowledge of morphology promoted learners' vocabulary skill where they were able to relate and derive meanings of the words that have the same root. The researchers concluded that the learners' skills, morphemic awareness and knowledge of vocabulary, substantially promoted word reading ability and honed their morphological skills. It was highly important for learners to be equipped with word reading skills and morphological awareness as they encountered more academically specific vocabulary in school textbooks which were mostly morphologically-complex in nature.

Finally, Bellomo's (2005) study on the morphological instruction of Latinate word elements that was conducted with three different groups of learners also yielded interesting results. He used a quasi-experimental design where students in a college preparatory reading class in Central Florida were sampled for the research. The students were divided into three different groups: Native English Speakers Group (NES), Non Latin-based Group (NLB), and Latin-based Group (LB). The research was conducted to investigate the level of knowledge in Latinate roots and affixes among college students. It also aimed to observe whether or not students with Latin-based language origin had the upper hand over the non Latin-based language origins. The pre-test showed that the participants' knowledge of Latinate roots and affixes was very limited for the Native English Speakers Group (NES) and Non Latin-based Group (NLB) but not for the Latin-based Group (LB). However, the post-test results revealed that knowledge of Latinate roots and affixes and morphologically-complex vocabulary for all the three groups increased greatly after receiving direct instruction of Latinate roots and affixes as a word learning strategy despite the differences in their native languages.

These studies have shown an important link between morphological knowledge of words and effective vocabulary learning. Hence, instruction that focuses on enhancing ESL learners' ability to conduct morphemic analysis of Graeco-Latin words, which occur abundantly in most science academic texts, has the potential to greatly benefit these learners. However, what is not clear from past studies is the extent to which the better vocabulary learning can be attributed to general morphological analytical skills or specific morphemic analysis of particular types of words, such as the ability to analyse Graeco-Latin word parts. Further, it is also not known how such instruction emphasising morphemic analysis measures against other types of instruction, particularly those that focus on using contextual clues.

RESEARCH QUESTIONS

The current study set out to seek answers pertaining to the effectiveness of instruction aimed at building morphemic awareness in improving vocabulary acquisition among ESL tertiary

students enrolled in a health sciences programme. More specifically, morphemic awareness attended to in the instructional intervention targets two levels – general morphemic awareness and morphemic awareness specific to Graeco-Latin word parts. The following questions are addressed in the study:

1. To what extent does general morphemic awareness play a part in vocabulary acquisition among health sciences students?
2. To what extent does morphemic awareness of Graeco-Latin word parts promote vocabulary acquisition among health sciences students?
3. Is instruction based on morphemic analysis more effective for vocabulary acquisition among health sciences students than one that is not based on morphemic analysis?
4. Which specific type of morphemic analysis instruction is more effective for vocabulary acquisition among health sciences students?

METHODOLOGY

This study uses a quasi-experimental research design that adopts a pre-test-post-test control group design. Three groups of ESL tertiary students in the health sciences programme underwent instructional intervention for vocabulary learning. Three types of treatments were rendered: instruction on vocabulary focussing on general morphological analysis of English words, instruction focussing on morphemic analysis of Graeco-Latin word parts, and instruction using contextual clues for vocabulary learning. Quantitative data were gathered from three structured vocabulary measures. The participants were evaluated prior to and after the experimental intervention was administered.

INSTRUMENTS: VOCABULARY MEASURES

This study uses three vocabulary measures which were carried out both during the pre-test and the post-test. The same set of questions was used for the pre-test and post-test but the order of the questions were rearranged in the post-test such that the sequence of the questions differed from that in the pre-test. The tests are the Graeco-Latin Word Part & Vocabulary Test (GLWPVT) which was adapted from Bellomo (2005), the General Word Part Levels Test (GWPLT) adapted from Sasao (2013), and the Vocabulary Size Test 1400 (VST 1-14K) which was designed by Nation and Beglar (2007). Some minor modifications were made to adapt the tests, and face validity was established by having the test items checked through by two of the authors. The tests were then piloted on several students to get their feedback and to ensure there were no ambiguities with the instructions and items. To determine the reliability of the tests, Guttman's split-half coefficient was computed twice; once with the pre-test scores of the study participants comprising 60 students, and again with the post-test scores of the same participants. The pre-test reliability was high for the Vocabulary Size Test 1400, and just at the acceptable level for both the General Word Part Levels Test and the Graeco-Latin Word Part & Vocabulary Test, as shown in Table 1.

TABLE 1. Guttman's Split-Half Reliability Coefficient for the Three Vocabulary Tests

Test	No. of Test Items	Pre-Test (N=60)	Post-Test (N=60)
General Word Part Levels Test	40	.591	.829
Graeco-Latin Word Part & Vocabulary Test	40	.665	.837
Vocabulary Size Test 1400	140	.723	.828

However, when the reliability measure was repeated in the post-test, all the three tests proved to be reliable at coefficient values of above .80. It is not clear why the reliability of the tests at the pre-testing stage was lower, but it is likely that examinee-specific factors could have played a role in influencing the results negatively, for instance, the state of the mind (concentration, motivation, boredom) of students (Wells & Wollack, 2003). As test reliability is dependent on test participants answering the questions sincerely to reflect their ability, random or absent-minded answers would result in measurement error, affecting the reliability index for the test.

GRAECO-LATIN WORD PART & VOCABULARY TEST (GLWPVT)

The Graeco-Latin Word Parts & Vocabulary Test was adapted from Bellomo (2005) where some of the words tested were replaced in order to suit the needs of the research. The vocabulary test was intended to measure the learners' existing morphological knowledge of Greek and Latin word elements. It is important to emphasise that the Graeco-Latin Word Parts & Vocabulary Test only tests learners' implicit knowledge of Greek and Latin word elements and vocabulary that have Greek and Latin origins. Below are examples of items from the Graeco-Latin Word Parts & Vocabulary Test.

1.	*tele:*	a) live	b) far	c) picture	d) between
2.	*ject:*	a) throw	b) lift	c) choose	d) arrange
3.	*astro:*	a) broadcasting	b) media	c) air	d) star

GENERAL WORD PART LEVELS TEST (GWPLT)

The General Word Part Levels Test (GWPLT) is an adapted version of the Word Part Levels Test (WPLT) designed by Sasao (2013). It is used to measure learners' morphological knowledge of English word parts. Sasao (2013) divided the WPLT into three different aspects of testing (word part forms, word part meanings, and word part grammatical functions). It is important to note that the GWPLT only tests the knowledge of general word parts and does not test knowledge of Greek or Latin word parts.

The general word parts used in this GWPLT mostly originated from Old French, Modern French, Old English, and Middle English (Minkova & Stockwell 2009). It also only tests the breadth of word parts and does not measure the learners' depth of word part knowledge although there were many word parts with multiple meanings. The example below is a sample item from the General Word Part Levels Test.

1. under- (<u>under</u>achieve; <u>under</u>pass)
(A) around; near; all sides
(B) against; opposite; unalike
(C) beyond; above; top
(D) below; lower; lesser

VOCABULARY SIZE TEST 1400 (VST 1-14K)

The Vocabulary Size Test 1400 (VST 1-14K) was designed by Nation and Beglar (2007). There are 14 levels in the test: the First 1000 is the lowest and the Fourteenth 1000 the highest level. Each level consists of 10 questions, adding up to 140 multiple-choice questions in total. Nation and Beglar (2007) elucidate that "the Vocabulary Size Test was developed to provide a reliable, accurate, and comprehensive measure of a learner's vocabulary size from the 1st 1000 to the 14th 1000 word families of English" (p. 9). The Vocabulary Size Test was designed to measure learners' knowledge of words, and not to

assess the proficiency in the first or second language. The following example is a sample item from the Vocabulary Size Test 1400:

1. DEMOGRAPHY: This book is about demography.
   a. the study of patterns of land use
   b. the study of the use of pictures to show facts about numbers
   c. the study of the movement of water
   d. the study of population

MATERIALS USED FOR THE TREATMENTS: READING TEXTS AND VOCABULARY PRACTICES

Explicit instruction of the vocabulary learning strategies was provided throughout five weeks with ten sets of reading articles taken from a number of university health science textbooks. The selection of texts is based on science-related topics in which the use of word parts is ubiquitous. Since the existence of word parts is widespread in science-based texts, a wide variety of science topics that suit the needs of the research was available. A different reading article was used in every session of instruction which was done biweekly for a period of five-weeks. All the three groups used the same reading articles but they were introduced to different approaches of vocabulary learning strategies. The duration of five-weeks was used as it was felt that because the intervention comprises only the teaching of a narrowly specific skill, that is a vocabulary learning strategy that is aimed at understanding meanings of words, instruction over ten lessons was deemed sufficient.

There were two experimental groups and one control group involved in this study. Experimental Group 1 was taught Morphemic Analysis of words with Greek and Latin origins. The selection of words depended on the existence of different types of word parts and the length of the text. The number of word parts taught ranged from 40 to 60 parts, of which many appeared more than twice in the text. Other than teaching the students the word parts, making the students aware of the existence of Greek-Latin and Old English word parts was of paramount importance in the instruction. For example, the word *neurosis* has two parts: 'neuro' and 'osis'. Students were taught that the word 'neuro' carries the meaning of 'nerves or the nervous system' and the word 'osis' means 'a pathological state'. Thus, the word *neurosis* means 'a psychiatric disorder'. Greek and Latin word parts are prevalent in medical and scientific fields.

The students in the second experimental group (Group 2) were given input on General Morphemic Analysis. The general word parts used in this research were mostly taken from Old French, Modern French, Old English, Middle English, and Modern English. To illustrate, the word *unworldly* has three parts: 'un', 'world' and 'ly'. The word 'world' is the root and it means 'all of the people and societies on the earth'. While, the prefix 'un' originated from Old English which denotes reversal or cancellation of an action or state; in this case, it means 'not'. The suffix 'ly' also stems from Old English and carries the meaning of 'having the qualities of'. The text below is an extract from one of the articles used in the research that was adapted from Phillips, Murray, and Kirk (2011).

> In **bipolar disorder**, the **transition** from depress*ion* to **mania** and vice versa can occur in **regular cycles** lasting from less than 1 day in some patients to months or years in others. However, **bipolar disorder** is relatively rare, affecting **approximately** 1 to 1000 of the **population** in Western societies. **Unipolar** depression is much more common, with up to 5% off the **population** experiencing **depression** at some time in their lives. Family, **twin** and adoption studies have supported the influence of **genetic** factors in affect*ive* **disorders**. Research has indicated at least two **subgroups** of **bipolar** affective disorder, one X-linked and another **transmitted** on **chromosome** 11, though these studies are not conclus*ive* and **genes** on other **chromo*some*** may be involved.

Word parts such as 'bi', 'trans', 'uni', 'chromo', 'sub', populat', 'gene', and 'dis' are examples of Graeco-Latin roots and word parts. Word parts such as 'ive' as in 'conclusive' and 'affective' and 'ion' as in 'depression' and 'population' are examples of word parts from Old French.

Group 3, which is the Control Group, were taught how to use contextual clues to guess the meaning of unknown words. Students were taught how to derive meanings by analysing the context in which the word was used. They were taught how to identify neighbouring phrases or words that were actually a clue to the meaning of a particular vocabulary item.

PARTICIPANTS

The students participating in the study were selected from the Faculty of Health Sciences at a public university. There were nine classes available for that particular cohort, but only three classes were chosen to be involved in this research. A total of sixty students participated in the study. Each class comprised 20 students with an English proficiency score of Band 3 on the Malaysian University English Test (MUET), indicating a level of proficiency described as "modest users" of English. Students from the Faculty of Health Sciences were selected for the study as a large part of the vocabulary in health sciences texts originates from the ancient Greek and Latin languages. The students were all freshmen who had minimal knowledge of Greek and Latin word origins. This was evident from the pre-test scores of the Graeco-Latin Word Part & Vocabulary Test where all the students in the three groups obtained relatively average scores.

Approval from the Research Ethics Committee of the university was obtained prior to the commencement of the research. Participation was voluntary, and students who participated in the study gave their informed consent. The students were assured that their identities would be kept confidential and that their scores from the tests would be used solely for research purposes and would not affect the scores of the course enrolled. They were also assured that they would not be disadvantaged in any way regardless of their performance.

RESULTS

PRE- AND POST-TEST SCORES

The pre- and post-test scores for the three vocabulary measures of the three groups are shown in Tables 2, 3, and 4. For the General Word Part Levels Test, the two experimental groups unlike the control group appear to have improvements in their scores after the treatment period. For the Graeco-Latin Word Part & Vocabulary Test, only the Graeco-Latin group (experimental group 1) appear to have gained in morphemic analysis specific to Graeco-Latin word parts. Finally, in the Vocabulary Size Test, only the experimental groups recorded improvements.

TABLE 2. Pre- and Post-Test Scores for the General Word Part Levels Test

Groups	N	Pre-Test Mean	Std. Deviation	Post-Test Mean	Std. Deviation
Exp. Group 1	20	27.25	3.932	32.90	2.404
Exp. Group 2	20	27.75	2.693	32.80	3.054
Control Group	20	29.05	2.502	26.50	5.492

[Note: Exp. Group 1 = Graeco-Latin Morphemic Analysis group; Exp. Group 2 = General Morphemic Awareness group; Control Group = Contextual Clues group]

TABLE 3. Pre- and Post-Test Scores for the Graeco-Latin Word Part & Vocabulary Test

Groups	N	Pre-Test Mean	Std. Deviation	Post-Test Mean	Std. Deviation
Exp. Group 1	20	21.70	3.840	32.65	1.843
Exp. Group 2	20	23.45	3.873	22.00	4.371
Control Group	20	19.25	3.864	18.45	4.673

TABLE 4. Pre- and Post-Test Scores for the Vocabulary Size Test 1400

Groups	N	Pre-Test Mean	Std. Deviation	Post-Test Mean	Std. Deviation
Exp. Group 1	20	81.85	8.113	99.95	17.966
Exp. Group 2	20	86.70	11.022	90.00	10.244
Control Group	20	80.05	8.562	81.55	10.738

WITHIN-GROUP GAINS IN VOCABULARY ACQUISITION

To determine whether the gains made by the three groups after the treatments are significant, a paired sample t-test was conducted for all the groups on the three vocabulary tests.

EXPERIMENTAL GROUP 1 (GREEK LATIN GROUP)

Table 5 presents the descriptive and t-statistics obtained for the first group that were taught morphemic analysis of words with Greek and Latin roots. It was found that there was a significant gain in the mean scores for General Word Part Levels Test in the pre-test (M = 27.25, SD = 3.931) and post-test scores [M = 32.90, SD = 2.404; t (19) = -7.519, p = .000]. The same was found with the analysis of mean scores in the Graeco-Latin Word Part & Vocabulary Test as shown in Table 6 [pre-test: M = 21.70, SD = 3.840; post-test: M = 32.65; SD = 1.843; t (19) = -16.326, p = .000]. Similarly, Table 7 shows that the difference in mean scores of Vocabulary Size Test 1400 for the pre-test and post-test is also statistically significant [pre-test: M = 81.85; SD = 8.113, post-test: M = 99.95; SD = 17.966; t (19) = -4.969, p = .000].

TABLE 5. Paired Sample T-Test of General Word Part Levels Test for the Graeco-Latin Group (Group 1)

Test	N	Mean	Std. Deviation	df	t	Sig.
Pre-test	20	27.25	3.931	19	-7.519	.000
Post-test	20	32.90	2.404			

TABLE 6. Paired Sample T-Test of Graeco-Latin Word Part & Vocabulary Test for the Graeco-Latin Group (Group 1)

Test	N	Mean	Std. Deviation	df	t	Sig.
Pre-test	20	21.70	3.840	19	-16.326	.000
Post-test	20	32.65	1.843			

TABLE 7. Paired Sample T-Test of Vocabulary Size Test 1400 for the Graeco-Latin Group (Group 1)

Test	N	Mean	Std. Deviation	Df	t	Sig.
Pre-test	20	81.85	8.113	19	-4.969	.000
Post-test	20	99.95	17.966			

Taken together, the results suggest that the treatment given to Experimental Group 1 (Graeco-Latin Group) was effective in enhancing the students' scores in all three measures of vocabulary knowledge and size. This is evidenced by the substantial increase in the mean scores in the three different vocabulary measures. This increase of scores shows that the students have improved considerably after receiving only five weeks of intervention on Greek

and Latin morphemic analysis. An interesting observation from the results is that while the students were taught morphemic analysis which focussed only on Graeco-Latin words, their knowledge in general morphemic analysis of English words have also improved in tandem.

EXPERIMENTAL GROUP 2 (GENERAL MORPHEMIC ANALYSIS GROUP)

Table 8 presents the descriptive and t-statistics obtained for the second group that were taught general morphemic analysis. It was discovered that there was a significant difference in mean scores in the General Word Part Levels Test in the pre-test (M = 27.75, SD = 2.693) and post-test scores [M = 32.80, SD = 3.054; t(19) = -10.809, p = .000]. However, there was no significant gain in the mean scores in the Graeco-Latin Word Part & Vocabulary Test as shown in Table 9 [pre-test (M = 23.45, SD = 3.873) and post-test: M = 22.009; SD = 4.371; t (19) = -1.291, p = .212]. With the Vocabulary Size Test 1400, a significant difference was found in the mean scores as depicted in Table 10 [pre-test (M = 86.70; SD = 11.022) and post-test: M = 90.00; SD = 10.244; t (19) = -4.502, p = .000].

TABLE 8. Paired Sample t-Test of General Word Part Levels Test for the General Morphemic Analysis Group (Group 2)

Test	N	Mean	Std. Deviation	df	t	Sig.
Pre-test	20	27.75	2.693	19	-10.809	.000
Post-test	20	32.80	3.054			

TABLE 9. Paired Sample t-Test of Graeco-Latin Word Part & Vocabulary Test for the General Morphemic Analysis Group (Group 2)

Test	N	Mean	Std. Deviation	df	t	Sig.
Pre-test	20	23.45	3.873	19	-1.291	.212
Post-test	20	22.00	4.371			

TABLE 10. Paired Sample t-Test of Vocabulary Size Test 1400 for the General Morphemic Analysis Group (Group 2)

Test	N	Mean	Std. Deviation	df	t	Sig.
Pre-test	20	86.70	11.022	19	-4.502	.000
Post-test	20	90.00	10.244			

Thus, it can be deduced from the findings that the Experimental Group 2 (General Morphemic Analysis Group) who were not taught Graeco-Latin morphemic analysis as a word-learning strategy improved in morphemic awareness and gained in overall vocabulary learning, although they did not improve in their knowledge of Graeco-Latin word analysis. This finding is important in advancing our understanding of the teaching of morphemic analysis as a vocabulary acquisition strategy. Whereas the group that was taught morphemic analysis specific to Graeco-Latin word parts gained significantly in their knowledge of both Graeco-Latin word analysis as well as general morphemic analysis of English words, the group that were taught general morphemic analysis of English words did not seem to be able to transfer that knowledge towards its use on words with Graeco-Latin roots.

CONTROL GROUP (CONTEXTUAL CLUES GROUP)

Table 11 presents the descriptive and t-statistics obtained for the third group that were taught contextual clues as a vocabulary learning strategy. It was found that there was no significant difference in the mean scores for General Word Part Levels Test in the pre-test (M = 29.05, SD = 2.502) and post-test scores [M = 26.50, SD = 5.492; t (19) = 1.814]. The same was found with the analysis of mean scores in the Graeco-Latin Word Part & Vocabulary Test, as

shown in Table 12 [pre-test: *M* = 19.25, *SD* = 3.864); post-test: *M* = 18.45; *SD* = 4.673; t (19) = .920, p = .369 < .05]. Likewise, as indicated in Table 13, the difference in mean scores of the Vocabulary Size Test 1400 for the pre-test and post-test is also not statistically significant [pre-test: *M* = 80.05; SD = 8.562), post-test: M = 81.55; *SD* = 10.738; t (19) = -.625, p = .539].

TABLE 11. Paired Sample t-Test of General Word Part Levels Test for the Contextual Clues Group

Test	N	Mean	Std. Deviation	df	t	Sig.
Pre-test	20	29.05	2.502	19	1.814	.086
Post-test	20	26.50	5.492			

TABLE 12. Paired Sample t-Test of Graeco-Latin Word Part & Vocabulary Test for the Contextual Clues Group

Test	N	Mean	Std. Deviation	df	t	Sig.
Pre-test	20	19.25	3.864	19	.920	.369
Post-test	20	18.45	4.673			

TABLE 13. Paired Sample t-Test of Vocabulary Size Test 1400 for the Contextual Clues Group

Test	N	Mean	Std. Deviation	df	t	Sig.
Pre-test	20	80.05	8.562	19	-.625	.539
Post-test	20	81.55	10.738			

Simply put, the results indicate that the instruction of contextual clues as an intervention given to the Control Group (Contextual Clues Group) was not effective in enhancing the students' test scores in all three measures of vocabulary knowledge and size. The poor performance of the control groups could be attributed to the nature of testing of vocabulary itself. Since the three vocabulary measures are in a multiple-choice format, there is no impartial measure of effectiveness of learning vocabulary using contextual clues. Had the test included a test which required use of contextual knowledge, as in the form of a reading comprehension assessment where the word items must be part of a reading text which required the use of contextual clues, the results could have been different. However, this form of assessment would deviate from the objective of the study which only focussed on the learners' vocabulary acquisition, and not reading comprehension. Nevertheless, this is a possible direction for future studies on vocabulary learning strategies.

The finding that the control group showed no significant gains in general morphemic analysis ability, specific morphemic analysis ability of Graeco-Latin words parts, nor vocabulary size compared to the two experimental groups, is evidence that morphemic analysis as a vocabulary learning strategy has to be deliberately taught, and not left to incidental learning, if students are to derive benefit from it.

ACROSS-GROUP COMPARISON OF GAINS IN VOCABULARY ACQUISITION

Further to the paired sample t-test conducted that showed whether the performance within each group did or did not improve, a one-way ANOVA followed by the Tukey post-hoc analysis was conducted to determine whether the gains obtained by each group were significantly different from each other. The score representing the 'gain' was computed as the mean difference between the pre- and post test scores (the magnitude of the gain) for each student, and the means of the group gains were compared in the ANOVA tests.

The results of the one-way ANOVA show there is a significant difference between the groups in the gains made in the General Word Part Levels Test [F(2,57) = 22.7, p =0.00], Graeco-Latin Word Part & Vocabulary Test [F(2,57) = 74.7, p = 0.00], and the Vocabulary

Size Test 1400 [F(2,57) = 12.72, p = 0.00]. Table 14 shows the results of the Tukey post-hoc analysis.

TABLE 14. Post-Hoc Analysis of gains made by the three groups in the three vocabulary tests

Dependent Variable (Difference in pre- and post-test scores)	(I) Group	(J) Group	Mean Difference (I-J)	Std Error	Sig.
General Word Part Levels Test	Graeco-Latin	General	.60000	1.35624	.898
		Contextual	8.20000*	1.35624	.000
	General	Graeco-Latin	-.60000	1.35624	.898
		Contextual	7.60000*	1.35624	.000
	Contextual	Graeco-Latin	-8.20000*	1.35624	.000
		General	-7.60000*	1.35624	.000
Graeco-Latin Word Part & Vocabulary Test	Graeco-Latin	General	12.40000*	1.14179	.000
		Contextual	11.75000*	1.14179	.000
	General	Graeco-Latin	-12.40000*	1.14179	.000
		Contextual	-.65000	1.14179	.837
	Contextual	Graeco-Latin	-11.75000*	1.14179	.000
		General	.65000	1.14179	.837
Vocabulary Size Test 1400	Graeco-Latin	General	14.80000*	3.61163	.000
		Contextual	16.60000*	3.61163	.000
	General	Graeco-Latin	-14.80000*	3.61163	.000
		Contextual	1.80000	3.61163	.872
	Contextual	Graeco-Latin	-16.60000*	3.61163	.000
		General	-1.80000	3.61163	.872

**The mean difference is significant at the 0.05 level*

From the post-hoc analysis, it is concluded that the group given instruction in Graeco-Latin morphemic analysis (Group 1) made the most improvements in terms of morphemic analysis of Graeco-Latin word parts and vocabulary size. These improvements are statistically significant compared to the improvements made by the other two groups. However, there is no difference in the magnitude of attainment between the Graeco-Latin group with the General Morphemic Analysis group. However, it is pointed out that from the paired sample t-test conducted earlier, both these experimental groups registered significant improvements in the General Word Part Levels Test. This means that both the Graeco-Latin and General Morphemic Analysis groups gained significantly in their knowledge in general morphemic analysis, and the gains are comparable between the two groups (no difference in magnitude of gain between the groups).

The General Morphemic Analysis group had significant improvements over the control group that was given instruction on using the contextual clues strategy, with regard to general morphemic awareness as well as vocabulary size. However, both these groups were no different in terms of improvement in Graeco-Latin morphemic analysis, of which neither of them recorded any improvement.

An important conclusion that can be made from these results is that instruction in Graeco-Latin morphemic analysis improved students' ability to acquire not only words with Graeco-Latin word parts, but this awareness of morphemic analysis spilled over to general English words as well. On the other hand, instruction in morphemic analysis of general English words did not provide any advantage to students in dealing with vocabulary with Graeco-Latin word parts. This accounts for the biggest gain in vocabulary size by the Graeco-Latin group followed by the General Morphemic Analysis group. Furthermore, when comparing instruction in morphemic analysis versus use of contextual clues as a vocabulary learning strategy, instruction building on morphemic analytical skills far outweighs the other in effectiveness in promoting vocabulary acquisition.

DISCUSSION

The findings from this study indicate that morphological analysis does indeed help second language learners improve their English vocabulary knowledge. As suggested by the good performance shown in the Vocabulary Size Test 1400 (VST 1-14K) for both the Graeco-Latin group and General Morphemic Analysis group, morphemic analysis, particularly the type focussing on Graeco-Latin word parts, is found to be an effective strategy for vocabulary learning in the fields of science and technology. In this regard, teaching morphemic analysis to science-stream majors could be a helpful support for them to enrich their vocabulary knowledge and size as it prepares them to be word-conscious and independent word learners. This is in line with the premise posed by Rasinski et al. (2008) who claim that exposing students to Greek and Latinate word elements could be an effective vocabulary learning strategy. It could also help learners rehash their word schema by making connections of words they have just discovered with words they know. Ramirez, Chen, Geva, and Kiefer (2010) reported the same finding when they examined the effects of morphological awareness on reading among Spanish-speaking English language learners. Their results showed that Spanish morphological analysis contributed to the acquisition of Spanish vocabulary. In addition to that, it was revealed that English morphological analysis contributed greatly to improvement in English word reading.

The findings from this study also showed that the explicit teaching of Graeco-Latin morphemic analysis resulted in better gain compared to other vocabulary instruction methods. General morphemic instruction resulted in only slight improvements in the vocabulary measures. Although the general morphemic analysis presented a noticeable increase in the Vocabulary Size Test 1400, the instruction focussing on Graeco-Latin morphemic analysis seems to be the most effective as the students who received this instruction scored significantly higher than the group that received instruction in general morphemic analysis in the Vocabulary Size Test 1400. Thus, Graeco-Latin morphemic analysis as a vocabulary learning strategy can be claimed to be a more successful strategy than the other two strategies. The study's finding is comparable with Bellomo's (2005) finding from his research where direct instruction of Latinate word parts facilitated development of vocabulary knowledge regardless of their native language. Also, similar to Holmes and Keffer (1995), a short intervention period was sufficient for significant gains in vocabulary development as shown in the three vocabulary measures. The results of the study also provide further support for direct teaching of vocabulary for intentional learning over incidental learning as reported in other studies (e.g. Hulstijn & Laufer 2001, Wong & Anie Attan, 2014, Sonbul & Schmitt 2010).

The results also suggest that compared to instruction that does not utilise morphemic analysis, both morphemic analysis-based instructions are more effective for vocabulary learning as evidenced by the considerable increase of test scores in the Vocabulary Size Test 1400 for both the experimental groups that received morphological analysis instruction in the 10 treatment sessions. The study showed that the use of contextual clues resulted in no improvements in vocabulary scores among the learners. Çetinavcı **(**2014) showed that guessing from context works better when the unknown word is embedded in rich context; while Kaivanpanah & Alavi (2008) showed that guessing from context is not a very reliable strategy as their study showed that the performance of EFL learners in their study was not consistent. Furthermore, since scientific texts are often concise and may not provide sufficient contexts for guessing from the context, teaching contextual clues to derive word meanings found in scientific texts may not be a feasible method. This position is also supported by Mokhtar and Rawian (2012) who argues that in order for ESL learners to be able to successfully derive the meanings of unknown words, readers have to examine the

adjacent sentences or paragraphs in the entire text. Although the findings from previous studies (e.g. Reardon 2011, Karbalaei, Amoli, & Tavakoli 2012) show that the use of contextual clues helps in promoting learners' reading comprehension skills for young as well as adult learners, the effectiveness of this strategy on vocabulary learning could not be directly asserted as there were no direct or independent measures of vocabulary gains in these studies.

CONCLUSION

The current study has shown that explicit vocabulary instruction did assist ESL learners to enhance their vocabulary acquisition. However, not all three vocabulary learning strategies are effective in enhancing their gain in vocabulary. Morphemic analysis has been shown to be effective in promoting vocabulary acquisition but the use of contextual clues seems to be quite limited in its application for learners in acquiring English vocabulary especially in dealing with scientific and technological reading texts.

The findings of this research have significant pedagogical implications in the area of second language learning particularly vocabulary development among ESL learners. Although there are a number of vocabulary learning strategies used to enhance learners' vocabulary repertoire, Greek-Latin morphemic analysis seems to have a more promising effect in facilitating comprehension of technical and scientific texts. Contextual clues may seem effective for reading literary texts or general reading texts such as newspapers or story books, but when dealing with scientific texts, the use of contextual clues alone may not be of much help.

For future studies seeking to investigate further the effects of Greek-Latin morphemic analysis and vocabulary acquisition, the following recommendations are offered. First, a study using subjects from different disciplines of study from both the arts and the sciences, such as political science, medicine, engineering, history, psychology, and even law, would be able to shed more light on whether the effects of morphemic analysis of Greek-Latin words are discipline specific. Secondly, since the current study only engaged the students for a 5-week period, future research could examine the effect of different treatment lengths on the development of vocabulary among ESL learners. A delayed post-test could be added to the design to examine the retention rate of the acquired vocabulary.

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