A COMPARISON OF THE EFFECTS OF THE CONCORDANCE-BASED AND THE CONVENTIONAL TEACHING METHODS ON ENGINEERING STUDENTS' ENGLISH VOCABULARY LEARNING

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การเปรียบเทียบผลของวิธีสอนแบบคอนคอร์แดนซ์กับแบบประเพณีนิยมที่มีต่อการเรียนรู้คำศัพท์ภาษาอังกฤษของนักศึกษาสาขาวิชาวิศวกรรมศาสตร์

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งานวิจัยนี้มีจุดมุ่งหมายที่จะใช้วิธีสอนแบบคอนคอร์แดนซ์เพื่อแก้ปัญหาความรู้คำศัพท์ที่ไม่เพียงพอสำหรับการอ่านเชิงวิชาการ วัตถุประสงค์ในการวิจัยคือเพื่อศึกษาเปรียบเทียบผลการสอนแบบคอนคอร์แดนซ์กับแบบประเพณีนิยมที่มีต่อความรู้ความหมายศัพท์ ความรู้ศัพท์ที่สามารถปรับเปลี่ยนไปใช้ในรูปแบบอื่นได้ และอัตราการจำคำศัพท์ นอกจากนี้ งานวิจัยยังมีวัตถุประสงค์ที่จะสำรวจกระบวนการเรียนรู้และทัศนคติของผู้เรียนที่มีต่อการใช้วิธีการแบบคอนคอร์แดนซ์ การทดลองจัดทำกับนักศึกษาสาขาวิศวกรรมศาสตร์สองกลุ่มเป็นระยะเวลาหนึ่งภาคการศึกษา นักศึกษากลุ่มหนึ่งได้รับการสุ่มเลือกให้เป็นนักศึกษากลุ่มทดลองที่เรียนด้วยวิธีสอนแบบคอนคอร์แดนซ์ ส่วนอีกกลุ่มหนึ่งเป็นนักศึกษากลุ่มเปรียบเทียบเรียนด้วยวิธีสอนแบบประเพณีนิยม นักศึกษาแต่ละกลุ่มจะถูกจับคู่กันตามระดับความรู้คำศัพท์ที่ปรากฏในข้อสอบก่อนเรียน ในช่วงเตรียมการทดลอง ได้สร้างคลังข้อมูลภาษาขึ้นจากการรวบรวมข้อความภาษาอังกฤษจากบทความเชิงวิชาการที่เกี่ยวข้องกับสาขาวิศวกรรมศาสตร์ จากนั้น คำศัพท์สำหรับใช้เรียนในการทดลองได้คัดเลือกมาจากคำที่มีความถี่ในการใช้สูงมากในคลังข้อมูลทางภาษา คำศัพท์เหล่านี้ได้นำมาใช้เป็นเกณฑ์ในการออกแบบสร้างบทเรียน อุปกรณ์ประกอบการสอน กิจกรรมและเครื่องมือทดสอบ ในระหว่างการทดลอง นักศึกษากลุ่มทดลองฝึกกิจกรรมจากเอกสารประกอบการสอนและลงมือปฏิบัติเพื่อเรียนรู้จากข้อมูลคอนคอร์แดนซ์ที่ได้จากคลังข้อมูล ส่วนนักศึกษากลุ่มเปรียบเทียบได้รับการสอนโดยใช้แบบฝึกหัดจากการอ่านและการฝึกฝนด้านความรู้ศัพท์ เครื่องมือที่ใช้เก็บข้อมูลประกอบด้วย ข้อสอบก่อนเรียน ข้อสอบหลังเรียน ข้อสอบหลังจบการทดลองได้ระยะหนึ่ง ข้อสอบย่อย แบบจดบันทึกของครู แบบจดบันทึกของนักเรียน แบบสอบถาม และการสัมภาษณ์

ผลจากการทดลองสรุปเป็นสามประเด็นสำคัญคือผลสัมฤทธิ์จากการเรียน กระบวนการเรียนรู้ และทัศนคติของผู้เรียน ในด้านผลสัมฤทธิ์จากการเรียน ผลจากการเปรียบเทียบคะแนนเฉลี่ยของแต่ละกลุ่มโดยใช้วิธีการทางสถิติ MANOVA ที่ระดับค่านัยสำคัญที่ 0.05 พบว่า คะแนนเฉลี่ยของกลุ่มทดลองสูงกว่ากลุ่มเปรียบเทียบอย่างมีนัยสำคัญในทุกแบบทดสอบ ในด้านกระบวนการเรียนรู้พบว่าทักษะของนักศึกษาทั้งด้านคอนคอร์แดนซ์และทางภาษาพัฒนาขึ้นมากโดยเรียนรู้ทักษะการใช้โปรแกรมคอนคอร์แดนซ์ได้อย่างรวดเร็ว ส่วนทักษะในการวิเคราะห์และแปลความจากบทความพัฒนาขึ้นมาก แต่ยังจำเป็นต้องได้รับการฝึกฝนในระยะเวลาที่นานขึ้นก่อนที่นักศึกษาจะสามารถใช้วิธีการเหล่านี้ในการเรียนรู้ด้วยตนเอง นักศึกษามีทัศนคติที่ดีต่อวิธีการสอนแบบคอนคอร์แดนซ์

สาขาวิชา ภาษาอังกฤษเป็นภาษานานาชาติ (สหสาขาวิชา) ลายมือชื่อนิสิต...

ลายมือชื่ออาจารย์ที่ปรึกษา.......................................

ปีการศึกษา 2548 ลายมือชื่ออาจารย์ทีปรึกษาร่วม................................

4589668620 : MAJOR ENGLISH AS AN INTERNATIONAL LANGUAGE
KEY WORD: CONCORDANCE-BASED METHOD / CONVENTIONAL TEACHING METHOD / CORPUS / VOCABULARY LEARNING / ACADEMIC VOCABULARY / DEFINITIONAL KNOWLEDGE / TRANSFERABLE KNOWLEDGE / VOCABULARY RETENTION RATE
PISAMAI SUPATRANONT: A COMPARISON OF THE EFFECTS OF THE CONCORDANCE-BASED AND THE CONVENTIONAL TEACHING METHODS ON ENGINEERING STUDENTS' ENGLISH VOCABULARY LEARNING. THESIS ADVISOR: ASST. PROF. WIROTE AROONMANAKUN, PH.D., THESIS COADVISOR: ASSOC. PROF. SUPANEE CHINNAWONGS, PH.D., 303 pp. ISBN 974-17-6095-7.

The study was aimed at solving the problem of engineering students' insufficient vocabulary size for academic reading with the application of the concordance-based method. The objectives of the study were to compare its learning effects with the conventional teaching method's effects on the measures of definitional knowledge, transferable knowledge and vocabulary retention rates, and to explore students' learning processes and attitudes in dealing with the concordance-based method. The study was conducted with two intact groups of engineering students in one academic semester. One group was randomly assigned to be the experimental group studying with the concordance-based method whereas the other represented the comparison group studying with the conventional teaching method. The students from both groups were matched in pairs according to their vocabulary proficiency on the pretest. In the preparatory stage, a purpose-built corpus was compiled from academic texts in engineering fields. Then, target words were selected from high frequency words in the corpus and used to design all lessons, materials, activities, tasks and tests. During the study, the experimental group was trained through paper-based and hands-on activities to deal with the concordance information in the corpus whereas the comparison group was taught vocabulary through reading contexts and vocabulary exercises. The instruments for collecting data included the pretest, posttest and delayed test, review tasks, teachers' field notes, students' logs, questionnaires and interviews.

The main findings from the study can be summarized in three areas: learning effects, learning processes and learners' attitudes. Regarding learning effects, the results from conducting MANOVA revealed that the students' average scores in the experimental group were significantly higher than those in the comparison group in all measures of definitional knowledge, transferable knowledge and retention rates with large effect sizes, especially in the measures of transferable knowledge. In terms of learning processes, findings revealed that students' concordancing and language skills improved significantly. They could acquire skills in operating the concordancer quickly whereas it took a longer time for them to master the skills in identifying various aspects of words, interpreting concordance texts and deducing word meaning from contexts. At the end of the study, these skills improved noticeably although the students could not fully master them. If the training could be extended, the students thought that they could utilize the concordance-based method for their self-study. Despite some difficulties, students expressed positive attitudes towards the method. They found the method challenging, interesting and useful for studying language.

Field of study English as an International Language Student's signature...

(Interdisciplinary International Program) Advisor's signature...

Academic year 2005 Co-advisor's signature...

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CHAPTER I
INTRODUCTION

1.1 Background of the Study

In the countries where English is used as a foreign language (EFL), reading academic texts in English is necessary for students especially those at university level. Due to high-technology transfer from the West, new knowledge is primarily learnt through a medium of English so reading academic texts in English becomes a central means to learn new information. In order to keep up with rapid advancements in technology, for example, engineering students are increasingly assigned to read English texts which are relevant to their specialized fields such as textbooks, manuals and journals. The students are expected to possess the ability to read and to extract information effectively from different types of academic texts. As a result, classes of English for Academic Purposes (EAP) become the main sources for preparing EFL students to cope with the demand of reading such texts.

Although reading academic texts in English is a necessary skill for university students, it is often found in many EAP instructions that students' reading proficiency cannot be properly developed because of their inadequate vocabulary size. This problem is reported in a number of studies including Cob and Horst (2001) and Nurweni and Read (1999), who reported the problems of Omani and Indonesian students respectively. Before entering the universities, students are assumed to possess adequate general English proficiency, but in fact, they do not. Many of them are much less proficient in English than what is expected for students at undergraduate level. Similarly, in many Thai universities such as Rajamangala University of Technology Lanna (RMUTL), Tak Campus, engineering students had limited lexical knowledge, which was the main source of problems in developing their academic reading proficiency. To investigate the problem, in January 2004 a sampling group of RMUTL engineering students was measured on their overall vocabulary size. Vocabulary tests at three levels were administered with 127 undergraduate students randomly selected as samples of a population of about 1,000. The measures were published in Nation (2001) i.e. Nation's (1990) 1000 Word Level Tests; and

Schmitt, Schmitt and Clapham's (2000) 2000 and Academic Word Level Tests, as illustrated in Appendix A.

These tests were well researched and often recommended in several published papers such as in Nation (2001), Coxhead and Nation (2001), Schmitt (2000) and Read (1997) for measuring students' partial knowledge of words in order to estimate their overall vocabulary size. According to these papers, the selected three levels are considered as representative of around 3,000 word families from the established Wordlists regarded as a lexical critical basis for academic reading. These words frequently occur in various academic text types in all disciplines. The test developers suggest that the desirable scores at each level should be above 80% in order to justify an individual student being adequately able to command that level. Only the sufficient control i.e. above 80% scores of all three levels will be interpreted as sufficient lexical knowledge for being a basis for academic reading. The results of the tests conducted with a sampling group of RMUTL undergraduate engineering students revealed that their mean scores were approximately 56%, 24% and 18% at 1000, 2000 and Academic Word Levels respectively. This means that their lexical knowledge is really insufficient in all three necessary levels since their mean scores were much below a desirable criterion of 80% at each level.

Lexical knowledge is an indispensable part of reading comprehension. Students' limitation of vocabulary size certainly inhibits their understanding of the reading texts. To adequately understand a piece of text, readers must be familiar with most of the words used in that text. Previous studies (Nation, 2001; Cobb and Horst, 2001; Coxhead and Nation, 2001; and Schmitt, 2000) suggest that students need to be familiar with 95% of the words occurring in that text. They also indicate that just over 90% of the running words in academic texts can be constituted from around 3,000 high frequency word families in two of the most cited wordlists i.e. West's (1953) *General Service List of English Words (GSL)*, and either Xue and Nation's (1984) *University Word List (UWL)* or Coxhead's (1998) *Academic Word List (AWL)*. In the case of RMUTL students, their lexical knowledge was found to be far below the lexical threshold for academic reading, so the chance for them to properly understand the texts was consequently very low. As a result, their reading proficiency could not be well developed without a more adequate vocabulary. Students' vocabulary size is insufficient to provide a critical basis for effective reading skills and strategies such as getting main ideas or guessing unknown words from context clues. To improve reading proficiency, students' lexical knowledge gap needs, first and foremost, to be bridged.

1.2 Rationale for the Concordance-based Method

Although it is obvious that students' inadequate vocabulary size is the main obstacle to their reading skill development, remedial work on bridging this gap is not easily conducted because of time limitation. In most engineering programs, only a few EAP courses are provided and no courses specifically focus on vocabulary learning. In the present study, the vocabulary component is integrated into an existing reading course because the approach of '*learning vocabulary through reading*' seems to be the best practice at present and previous studies demonstrated its success in vocabulary instruction (Schmitt, 2000; and Coady, 1997). With this approach, reading can enhance vocabulary learning in various contexts and make possible for some encounters of particular words. As a result, increasing vocabulary size has to be conducted simultaneously with developing reading proficiency in one academic semester. In order to expand students' vocabulary size for academic reading, a concordance-based method is proposed in the present study because of its potential in language learning (Cobb, 2001, 1999a and b, and 1997 a and b).

The concordance-based method is adapted from the method prominently used in language analysis in the fields of lexicography and linguistics (Kennedy, 1998). It involves corpus compilation from authentic texts and a concordancing program called a '*concordancer*'. In brief, a *corpus* is a collection of texts compiled for linguistic study whereas a *concordancer* is computer software which is used to access the information in the corpus and then display the output in a concordance format. Basically, most concordancers are used for counting the number of words in the corpus as well as the frequency of each word's occurrences. In addition, a concordancer can search particular words to be studied and then sort and display data in a way in which word behaviors in various contexts can be observed easily. The corpus outputs are typically displayed in concordance lines and this type of display is often called a KWIC (keywords-in-contexts) format. For example, the following illustration is the corpus output from searching the word '*current*' in eleven concordance lines. In a KWIC format, the keywords '*current'* are displayed in the center whereas the immediate contexts of each word are on both sides as illustrated in Figure 1.1.

Figure 1.1: Example of concordance output of '*current'* in a KWIC format

For electronics,	**current**	may also be measured in mA.
Every electric	**current**	produces a magnetic field.
The electron 'flow' is called an electric	**current**	the electrical force is called voltage.
The metal parts of the torch must conduct electric	**current**	if the torch is to function.
The electron drift in random directions until the	**current**	starts to flow.
Microsoft Word is the dominant word processor in	**current**	use.
For instance, many	**current**	machines use 64-bit buses.
Three	**current**	waveforms are produced.
The earth wire can carry enough	**current**	to blow a fuse.
When measuring high	**current**	value, refer to resistor self-heating.
The	**current**	version is AutoCAD 2005.

The concordance-based method was introduced to the area of language education a few decades ago (Steven, 1995; and Fox, 1998). At the beginning, however, it was applied exclusively among developers of curricula, syllabuses and materials (Fox, 1998; Willis, 1998; Carter, Hughes and McCarthy, 1998; Thurstan and Candlin, 1998; Flowerdew, 1993; Stevens, 1991a; and Tribble and Jones, 1990). Recently, this method has increasingly been applied directly to language classrooms since John (1991) introduced the new learning approach of '*data-driven*'. Its positive influences on language learning are often reported such as those published in Aston (2001), Wichmann, Filgelstone, McEnery, and Knowles (1997), and Johns and King (1991). However, the application of the concordance-based method in previous studies were mostly conducted as referential tools (Chan and Liou, 2005), parts of the courses (Sriphicharn, 2002; Todd, 2001) or tutorial programs (Cobb, 1999a and b; and 1997a and b). Therefore, empirical studies on using the method as the main method in the whole regular courses were very rare. In addition, concordance facilities in previous studies were web-based or specifically designed programs which might not be practical in most academic situations. Moreover, previous studies were mostly conducted with one group of students without a control group (Hadley, 2001 and

2002; and Todd, 2001). As a result, the comparisons between the outcomes of the concordance-based method and other teaching methods are still lacking.

To extend knowledge and insights derived from these previous works especially Cobb's studies (1999a and b; and 1997a and b), the present study attempts to fully integrate the hands-on concordance-based method with the whole course as the main method to increase students' vocabulary knowledge for academic reading. The concordance facilities used in the study are simple and can be in-house developed in order to make the implementation practical and compatible to most learning situations. Furthermore, conducting the concordance-based method in comparison with the conventional teaching method can provide empirical evidence in this area of research. Findings from the present study will expand insights derived from those in Cobb's studies (1999a and b; and 1997a and b) in the area of increasing two vocabulary types: definitional knowledge and transferable knowledge. The present study is different from his studies in many other aspects including the focuses and the implementation. Firstly, it focuses on vocabulary for academic reading in general whereas Cobb's studies focus on vocabulary for Cambridge Preliminary English Test (PET). Secondly, the concordance facilities are simple and in-house developed whereas Cobb's experimental concordancing programs – PET 2000 and PET 200 – are sophisticated. Finally, in the present study, the effects of the concordance-based method are studied in comparison with those of the conventional method of teaching vocabulary through reading. In contrast, those in Cobb's studies are compared with the methods of using another version of software (1999a) and using a wordlist with a dictionary (1999b). Therefore, classroom-based details of the present study bridge the gaps of research in comparing the effects of classroom concordancing with those of another teaching method with unique implementation.

To summarize, the concordance-based method is proposed in the present study since many previous studies suggest its potential in vocabulary learning. The effects of the hands-on concordance-based method are used as the main method in comparison with the conventional teaching method on vocabulary learning in the whole regular course. The application of a simple concordancer and a small in-house developed corpus can provide a practical framework for most EFL academic situation, especially with engineering students. The findings of the study originally provide details abut the effects of using the hands-on concordancing method in Thai classroom contexts. Accordingly, these findings of the study contribute to the area of teaching EAP in providing useful implications as well as empirical evidence in the areas where research is lacking.

1.3 Research Questions

The present study is aimed at investigating both quantitatively and qualitatively the comparative effects of the concordance-based method and the conventional teaching method. The focuses are on three main areas of vocabulary learning: learning effects, learning processes and learners' attitudes. Accordingly, five research questions are proposed. On the one hand, the first three questions are concerned with quantitative investigation in measuring learning effects on students' vocabulary size, ability to transfer lexical knowledge to new reading contexts, and retention of such knowledge. These learning effects of both methods are compared. On the other hand, the last two questions were more concerned with qualitative study in exploring students' learning processes and attitudes in dealing with the concordance-based method. Learning processes are examined in terms of students' performances in dealing with a computer concordancing program as well as concordance input whereas learners' attitudes are dealt with students' opinions on the usefulness of the concordance-based method, its level of difficulty and students' degree of preferences to the method. These questions are as follows.

1. Is there a significant difference between the effects of the concordance-based method and the conventional teaching method on students' average scores on the measure of their vocabulary size?
2. Is there a significant difference between the effects of the concordance-based method and the conventional teaching method on students' average scores on the measure of their ability to transfer vocabulary knowledge to new contexts?
3. Is there a significant difference between the effects of the concordance-based method and the conventional teaching method on students' retention rates of vocabulary knowledge?

4. What are the processes used by the students while dealing with the concordance input?

5. What are students' attitudes towards the application of the concordance-based method?

1.4 Objectives of the Study

The objectives of the study are summarized as follows.

1. To compare the effects of the concordance-based method and the conventional teaching method on vocabulary learning in the following areas.

1.1. Students' vocabulary size.

1.2. Students' ability to transfer vocabulary knowledge to new contexts.

1.3. Students' retention of vocabulary knowledge

2. To explore students' learning processes in dealing with the concordance input.

3. To explore students' attitudes towards the application of the concordance-based method.

1.5 Statements of Hypotheses

In most previous studies, the positive influences of the concordance-based method are usually found. However, a problem of its difficulty level of the concordance texts was also reported (Hadley, 2001 and 2002) and significance differences between the method and other teaching methods were not always found (Chan and Liou, 2005; and Sriphicharn, 2002) although students' positive attitudes towards the concordancing method were still maintained. Accordingly, the effectiveness of classroom concordancing over other methods is still uncertain. It is still questionable whether the concordance-based method can increase higher learning effects than the others. Therefore, in the present study, three non-directional hypotheses are formulated in conforming to the first three research questions concerning only quantitative study of learning effects.

Hypothesis 1: Students' scores on the measure of vocabulary size in the experimental group are significantly different from those in the comparison group.

Hypothesis 2: Students' scores on the measure of students' ability to transfer lexical knowledge to new contexts are significantly different from those in the comparison group.

Hypothesis 3: Students' retention rates in the experimental group are significantly different from those in the comparison group.

1.6 Scope of the Study

The present study is in the area of teaching English for Academic Purposes (EAP) focusing on vocabulary for academic reading at an undergraduate level. The study is confined to the following areas.

1. The focus vocabulary includes academic words necessary for a critical basis for academic reading in the field of Engineering. Academic vocabulary, in this case, includes word families from the two established wordlists of West's (1953) *General Service List of English Words (GSL)* and Coxhead's (1998) *Academic Word List (AWL)*. The combination of both lists is regarded as the lexical knowledge base for reading in any academic domain.

2. The present study is aimed at tracking two levels of vocabulary knowledge i.e. definitional and transferable knowledge. '*Definitional knowledge*' refers to students' knowledge of word meaning or their ability to connect a word form to its meaning. On the other hand, '*transferable knowledge*' refers to students' knowledge at a deeper level sufficient for effective interpretation of general academic texts i.e. students' ability to recognize and retrieve new learned words for interpreting unseen texts. Apart from gaining such knowledge, its retention rate is also explored.

3. Linguistic items and examples in concordance-based lessons are confined to the compiled corpus of around 500,000 running words. In addition, language analyses in students' practice are kept only at the basic levels of analyzing word parts, grammatical functions and collocations.

4. The population of the study consists of around 1,000 undergraduate engineering students at RMUTL, Tak Campus. As a result, the findings emerging

from the present study are generalizable to the population although they may be relevant to other similar settings.

1.7 Assumptions of the Study

The study is based on the following assumptions.

1. The students in the study are familiar with the use of computers as they are engineering students.

2. They accurately recall the mental processes used during the application of the concordance-based method and reflect their opinions and feelings in students' logs, questionnaires, and interviews.

3. They fully attempt to do all the tests and tasks.

1.8 Definitions of Terms

The key terms used in this study are defined as follows.

Lexical thresholds to academic reading

Minimum requirements of lexical knowledge as a critical basis for reading academic texts in English. These thresholds include around 3,000 word families from the lists of the GSL (West, 1953) and the AWL (Coxhead, 1998).

Academic vocabulary

Vocabulary frequently found in different written academic text types such as textbooks, handouts, manuals, articles and research abstracts. It includes 480 target words in the study. These target words refer to high frequency words in the Engineering Corpus, which are also high frequency words in general English texts (the GSL) and in academic texts of all disciplines (the AWL).

Vocabulary / lexical knowledge

Receptive knowledge of vocabulary used for interpreting the academic texts. Two levels of vocabulary knowledge are studied: definitional knowledge and transferable knowledge.

Definitional knowledge of vocabulary / vocabulary size

Knowledge of at least one meaning of each word. Such knowledge is regarded as the breadth of knowledge i.e. vocabulary size or the number of known words. Definitional knowledge, which is the minimum knowledge of a word, is used as a measure for quantitative gain of vocabulary size. In the present study, the definitional knowledge is measured by students' ability to connect a particular word form to its meaning. In other words, it is represented by students' average scores on the Definition Part of the test.

Transferable knowledge of vocabulary

Knowing a particular word so well that such knowledge can be transferred to other contexts. Transferable knowledge relates to the depth of knowledge. This knowledge involves perceiving the form of a word while reading, and retrieving its meaning for interpreting the reading text. In this study, transferable knowledge is assessed by students' ability to transfer vocabulary knowledge to new contexts i.e. the ability to recognize and retrieve words to reconstruct or replace them properly in different contexts. This knowledge is represented by students' average scores on the Cloze Part in the test.

Retention rate of vocabulary knowledge

Vocabulary knowledge which is retained about a month after the study. The retention rate in this study refers to the difference between the average scores on both the Definition Part and the Cloze Part in the immediate posttest and those in the delayed posttest within the same group represented by percentage and the differences between the average scores on both parts in the delayed posttest of both groups.

Learning processes

Students' performances in dealing with the concordance input to acquire concordancing skills and vocabulary knowledge. Learning processes are examined in terms of students' performances in dealing with a computer concordancer and those in dealing with concordance information. Dealing with a computer concordancer refers to students' abilities to operate a concordancer to find corpus information, display and manipulate concordance output for facilitating the observation of word behaviours in various concordance contexts. On the other hand, dealing with concordance information is concerned with students' abilities to utilize the concordance facilities for enhancing their vocabulary learning by identifying various aspects of words to interpret texts and deduce word meaning. Learning processes are assessed by relevant data from teacher's field notes, students' logs, questionnaire and interview.

Learning development

A trend of learning gains at different stages from the beginning through the end of the study. It is assessed by average total scores on all measures of vocabulary knowledge i.e. the pretest, four reviewed tasks, the immediate posttest and the delayed posttest.

Learners' attitudes

Students' opinions towards the application of the concordance-based method in terms of its usefulness, level of difficulty and students' degree of preferences to the method. Such attitudes are assessed with the data from students' logs, questionnaire and interview.

Concordance-based method

A teaching/learning method concerned with concordances in the forms of both paper-based and hands-on activities for students to learn vocabulary by doing language analysis on word parts, grammatical functions and collocations through the contexts in concordances. Then, students are trained in utilizing such lexical knowledge for interpreting texts and/or deducing word meaning. The term a '*concordance-based method*' is used interchangeably with a '*corpus-based method*' or a '*classroom concordancing*' in this study.

Conventional teaching method

A traditional teaching/learning method for students to learn vocabulary through reading. With this method, various aspects of words i.e. word parts, functions and collocations are taught through the contexts of normal paper-based reading in short passages in order to enable students to utilize such lexical knowledge in dealing with unknown words in new reading contexts.

1.9 Significance of the Study

The present study is significant in providing a practical framework for teaching EAP as well as extending insights in the areas of vocabulary research on integrating the hands-on concordancing with the whole course to increase students' vocabulary knowledge for academic reading. It is distinctive from other related studies in terms of its implementation design. The concordance facilities are simple and a specialized corpus can be in-house developed to be fully used in word selection as well as designs of concordance-based materials and activities. These practices are integrated with the benefits from other familiar teaching techniques to explicitly teach vocabulary through reading either in concordances in the experimental group or in short reading passages in the comparison group, and engineering contexts familiar to the students are also used to enhance vocabulary learning. This design of concordance lessons is rarely found in previous studies and can make the method more practical in normal classrooms.

In addition, the present study is significant in expanding insights and evidence in using classroom concordancing in Thai contexts. So far, only two classroom-based studies of Sriphicharn (2002) and Todd (2001) have been conducted in Thai educational settings and their applications were used as supplementary of the courses in the forms of paper-based concordances or hand-concordancing respectively. Unlikely, the present study applies hands-on concordancing as the main method to solve a problem of Thai low-proficiency students' limitation of vocabulary size. If the results turn positive, it will indicate the contribution of the concordance-based teaching method to the teaching English for Academic Purposes in general and vocabulary instruction in particular.

1.10 Outline of the Dissertation

This chapter describes the background of the study concerning the importance of academic reading in EFL countries and students' reading problems due to their limited vocabulary size. Therefore, the concordance-based method is proposed in the study with the aim to compare its learning effects on vocabulary learning with the conventional teaching method; as well as exploring students' learning processes and attitudes in dealing with the concordance-based method.

Chapter II reviews the underlying principles that lend support to the application of the concordance-based method to vocabulary learning. The chapter starts with the classification of vocabulary followed by the description of lexical thresholds for academic reading and vocabulary assessments. Then, two focused lexical knowledge types are described and the incremental nature of vocabulary acquisition and retention is discussed in order to identify learning principles that promote vocabulary acquisition. Next, the background of vocabulary instruction in ESL/EFL contexts is presented to highlight the role of vocabulary in language acquisition and various approaches to vocabulary instruction are reviewed. Finally, the concordance-based method is discussed, including its inherent learning approach as well as its application. Chapter 3 deals with the research methodology of the study which includes the research design, all research materials and instruments as well as the methods of data collection. The pilot study is also presented together with proposed changes for the main study. In Chapter 4, data analyses and findings are presented, focusing on three main areas of the study i.e. learning effects, learning processes and learners' attitudes in dealing with the concordance-based method. In Chapter 5, a summary of the present study is provided prior to the discussions on the findings of the study, its implications for vocabulary instructions and learning, suggestions on the application of the concordance-based method, and the recommendations for further research study.

CHAPTER II
LITERATURE REVIEW

2.1 Introduction

In this chapter, the literature related to the study is reviewed in order to obtain a theoretical framework for implementing the concordance-based method in comparison with the conventional teaching method on vocabulary learning. The review is divided into four main areas: academic vocabulary, the nature of vocabulary acquisition, vocabulary instruction and the concordance-based method. Firstly, the academic vocabulary is identified in terms of vocabulary types, lexical thresholds for academic reading, and assessment of students' vocabulary size. Principles derived from reviewing these matters are used in the present study as criteria for selecting target words systematically as well as designing the tests for assessing the vocabulary in focus. Secondly, two types of knowledge being focused in the study i.e. definitional knowledge and transferable knowledge are described and the nature of vocabulary acquisition and retention is examined in order to derive insights how to enhance students' vocabulary acquisition and retention. .

Thirdly, the background of vocabulary instruction is presented to highlight the importance of vocabulary instruction at present. After that, the main current approaches to vocabulary instruction are reviewed in order to indicate the strengths of each method and their compatibility to the design of the concordance-based lessons. Fourthly, the concordance-based method is introduced in terms of its background, description and learning approach of DDL before its roles in ELT are discussed in terms of its compatibility to various approaches to vocabulary instructions and previous applications. Finally, the status of the present study in this area of research is established.

2.2 Academic Vocabulary

In general, lexical knowledge is accepted as a necessary factor for successful reading comprehension. The more the readers know about words in a particular passage, the better they can comprehend that passage. To increase students' lexical knowledge for academic reading as in the present study, however, the exact words must be identified in order to ensure that they are worth being studied. Accordingly, considerations must be taken towards vocabulary types and lexical thresholds for academic reading in order to obtain the principles for selecting words most suitable for the students' needs. Apart from word selection, the measure of such word knowledge is also important for accurate assessment. As a result, word selection and instrument design for assessing vocabulary size in the study are based on previous works in the following areas: types of vocabulary, lexical thresholds for academic reading, and assessment of vocabulary size.

2.2.1 Types of vocabulary

It is quite obvious that different sets of vocabulary are needed for different types of language use. In reading, for example, some vocabulary is found more frequently in textbooks than in newspapers or advertisements whereas some is used more often in engineering textbooks than in business or medical ones. In teaching academic reading, it is, therefore, advantageous to pay attention to words frequently occurring in students' academic texts and closely relevant to their needs. The lessons will be more meaningful if the vocabulary that students are likely to encounter in their future study and career is taught. Several studies have investigated the vocabulary needed for academic reading. One such attempt has been conducted in the form of a frequency-based method. In these studies (Nation, 2001), words found in a very wide range of text types were counted according to the frequency of their occurrences and then identified and classified for pedagogical use. Based on these studies, vocabulary is divided into four main types i.e. high frequency words, academic words, technical words and low frequency words (Nation, 2001; Coxhead and Nation, 2001; Dudley-Evans and St. John, 1998; and Nation and Waring, 1997).

2.2.1.1 High frequency words

A group of high frequency words is regarded as an essential basis for all language use. This group consists of around 2,000 word families, which covers a very large proportion of the running words in spoken and written texts and occurs in all kinds of language use. Some examples of high frequency words are '*answer, work, high, idea, left, metal, often, page, mile, strong, usually*' etc. All function words such as prepositions, conjunctions and auxiliary verbs are also included in this group. Many lists of the most frequently occurring words in English are established for convenient use in pedagogy, but the most commonly cited list is the classic collection of Michael West (1953), *The General Service List of English Words (GSL)*. Nation and Waring (1997, p.15) mention, "Although the GSL is in need of replacement because of its age, errors it contains, and its written focus, it is still the best available list, given a range of information it contains about the relative frequency of the meanings of the words." Several studies indicate that the GSL can provide coverage of around 80% of the running words in most academic texts (Coxhead and Nation, 2001; Cobb and Horst 2001; and Nation and Waring, 1997). This means that when readers have control of the 2,000 words of general usefulness in English, they should be able to understand 80% of texts i.e. two words unknown per printed line or one unknown word in every five words.

2.2.1.2 Academic words

Academic vocabulary is a group of words occurring frequently over a wide range of academic texts across disciplines i.e. not restricted in any specific domains. Generally, these words are not so common in non-academic texts, and they are not technical terms in any particular domain either. Instead, such words are usually found over a range of academic texts or formal papers such as secondary-school and university textbooks, specialized journals, reports, manuals, or newspapers etc. Academic vocabulary is sometimes referred to as '*semi-technical vocabulary, sub-technical vocabulary, or specialized non-technical lexis*', (Coxhead and Nation, 2001). Some examples of academic vocabulary are '*assume, cite, capable, approach, aspect, crucial, element, feature, integrate, justify, manipulate, vision, publish, accurate*' etc. Two outstanding lists of academic vocabulary are *The University Word List (UWL)* (Xue and Nation, 1984; and Nation, 1990), and *The Academic Word List (AWL)* (Coxhead, 1998).

The UWL is a compilation of four separate studies, according to Coxhead and Nation (2001) and Nation and Waring (1997). The UWL consists of around 800 word families, not included in the first 2,000 words of the GSL. It is found from an analysis of text corpora in a variety of disciplines that the GSL together with the UWL reliably account for 90% of tokens. In other words, the inclusion of the UWL knowledge to the GSL knowledge can increase 10% of the text coverage i.e. from 80% to 90%. More recently, the AWL has been similarly developed to see which words in the list are truly academic words and which are general service words, not in West's GSL. Coxhead and Nation (2001, p.254) mention that the list of 570 AWL words provides slightly better coverage of academic texts than the UWL even though it contains fewer words. As a result, knowing the GSL together with the UWL or the AWL will also give close to 90% coverage of the running words in most academic texts.

2.2.1.3 Technical words

Technical words are very closely related to the topic and subject area of the texts. They are reasonably common in one topic area but not so common in the others. For example, the words '*phoneme, morpheme, lemma, hapax legomena*' are restricted in Applied Linguistics whereas the words '*anode, impedance, dielectric, galvanometer*' are exclusively used in Electronics. Therefore, these types of words differ from one subject area to another. In some cases, the same words are used in various fields, but with different meanings. For instance, the words '*operation*' in the Medical field, '*mouse*' in Computer Science, '*strength*' in Physics, and '*overhead*' in Business mean something different from those in general or in other fields. Similarly, the words '*range* and *frequency*' in Linguistics have a completely different meaning from those in Electronics. However, technical words in any particular subject are probably about 1,000 words or less as it can be noticed from the number of headwords in any specialized dictionary. These words typically cover about 5% of the running words in a text, according to Coxhead and Nation (2001). With the text coverage of 5%, knowledge of technical words can enhance that of high frequency and academic words to get closer to the 95% threshold of text coverage.

2.2.1.4 Low frequency words

This group consists of words typically occurring in a very narrow range and low frequency. So far, this group is the biggest since they are all words which are not included in the above three groups. These words, for example, include proper nouns, words which almost belong in the high-frequency list, words rarely found in language use, words found only once or twice in one text and seldom appearing in other texts, etc. The study of Carroll, Davies and Richman (1971, cited in Coxhead and Nation, 2001) found that 40.4% of 5,000,000 running words in a corpus were 86,741 different word types occurring only once or twice.

This classification of words is certainly useful for pedagogical practice because it provides a clear goal for teaching vocabulary. It suggests the type as well as the number of words that need to be learned so as to be able to cope effectively with specific goals in language use. It is quite obvious that the most frequently occurring words should be primarily dealt with. From these four types of vocabulary, it has been agreed that at least the GSL 2,000 high frequency word families must be learned by foreign language learners in order for them to have an essential basis for all language use (Cobb and Horst, 2001; Coxhead and Nation, 2001; and Nation and Waring, 1997). For academic study, however, these 2,000 words are still insufficient to empower readers. If English is to be used for academic study, general academic vocabulary i.e. the UWL or the AWL of about 500-800 word families must be added to the knowledge of general vocabulary. After gaining control of the GSL 2,000 high frequency words, then learners are suggested to focus on general academic vocabulary. Cobb and Horst (2001, p.319) point out that the two groups of high frequency words and academic words "constitute a general English for Academic Purposes (EAP) vocabulary syllabus that takes a learner to the outer edge of reading in a specific domain". In addition, Coxhead and Nation (2001, p.260) confirm that knowing these two groups of words "will give close to 90% coverage of the running words in most academic texts. When this is supplemented by proper nouns and technical vocabulary, learners will approach the critical 95% coverage threshold needed for reading". Therefore, it is often suggested that the GSL together with either the UWL or the AWL is the minimum lexical knowledge base for reading in any academic domain. In other words, it has been estimated that 'a lexical threshold' to reading comprehension of academic texts should be around 3,000 word families including about 2,000 high frequency words in the GSL and 500-800 academic words in the AWL or the UWL.

On the other hand, knowledge of technical words largely depends on existing or specialized knowledge whereas low frequency words are in a large number of different word types, but with rare occurrences in a piece of text. Technical vocabulary is sometimes not considered to be the English teacher's job to teach (Coxhead and Nation, 2001), since it seems to be less of a problem to the learners and it can be naturally acquired from their specialized courses. Regarding low frequency words, although this type of vocabulary is in a large group, most of them occur only once or twice in a piece of text. Despite a low coverage of text i.e. 5%, they are too large in number to all be learnt in academic courses. Therefore, it is not practical to spend most of the course time learning words which are occasionally found in the target texts. To prepare students to deal with these two types of words, the students should be taught reading strategies such as guessing word meanings from context clues, analyzing word parts, or using word cards and dictionaries (Nation, 2001; and Coxhead and Nation, 2001). In specialized texts, for example, when technical terms are introduced, they are normally defined and exemplified. Therefore, it is a good idea to teach the students to cope with texts by using the context clues of definitions and examples.

Regarding the present study, it is obvious that the first two word types i.e. high frequency and academic words are very suitable for the students because they are necessary for academic reading. As a result, one criteria of word selection in the study are based on the established wordlists of high frequency words (the GSL) and academic words (the AWL). These wordlists are used as '*reference lists*' for selecting words from the corpus.

2.2.2 Lexical thresholds for academic reading

Pedagogically, a lexical threshold for academic reading is the estimate of the minimal lexical knowledge used as a critical basis for academic reading. It is a useful criterion in setting teaching goals, diagnosing students' weaknesses, and designing syllabuses or lessons. Lexical thresholds are described in the areas of reading comprehension and vocabulary size in order to identify which words can be used as critical basis for academic reading in the present study.

2.2.2.1 Lexical threshold for reading comprehension

In previous studies of reading comprehension, one important area to investigate is the relationship between vocabulary coverage and reading comprehension. The main interest is to define the minimal language lexical knowledge to be transferred to reading comprehension. Accordingly, the percentage of known and unknown words was calculated in order to determine the coverage of texts sufficient for comprehending that text. Very interesting findings were revealed by Laufer's studies (cited in Nation, 2001; and Cobb and Horst, 2001) conducted in 1989 and 1992. It was found from her studies that vocabulary coverage correlated consistently with reading comprehension. Students with scores of 95% and above on the vocabulary measure were significantly more successful on the reading measure than those scoring below 95%. Therefore, Laufer determined such percent coverage as minimally acceptable comprehension. In determining vocabulary size for providing 95% coverage of academic texts, her studies consistently showed that the 3,000 word family level was a minimum for reading unsimplified texts. Similarly, another study of Hirsh and Nation (1992, cited in Cobb and Horst, 2001) also agrees that unsimplified texts could be comprehended when 95% of tokens are known i.e. approximately one unknown word per two printed lines.

Consequently, in current literature, 95% coverage of words known in the text is considered the minimum requirement for reading comprehension. Schmitt (2000, p.152) comments, "A figure of 95% known words crops up in the literature frequently, and at the moment this seems to be a reasonable estimate". Similarly, Nation (2001, p.146) points out, "The safest measure to use in defining the threshold is the coverage (word token) measure which Laufer (1992) found to be around 95%". This means that, in order to adequately understand a piece of text, students need to be familiar with at least 95% of the words occurring in that text. If their lexical knowledge is below this threshold, their ability to comprehend the reading text will unlikely be adequate.

2.2.2.2 Lexical threshold for vocabulary size

As previously mentioned, the 95% coverage of known words is the minimum requirement for reading comprehension. Some studies have attempted to identify which words and how many words can provide the critical 95% coverage. Laufer (1997) mentions that the minimal comprehension of Israeli university students highly correlated with knowledge of the 3,000 most frequent words of English. The learners below the 3,000-words level did poorly on the reading test regardless of how high their academic ability was. Therefore, Laufer (1997, p.23) concludes, “The turning point of vocabulary size for reading comprehension is about 3,000 word families”, and the level of 3,000 word families is regarded as a minimum for the reading comprehension of unsimplified texts.

Regarding the classification of word types mentioned earlier, many specialists such as Nation (2001), Cobb and Horst (2001), Coxhead and Nation (2001), and Nation and Waring (1997) indicate that just over 90% of the running words in academic texts can be accounted for by two established words lists i.e. the GSL with either the UWL or the AWL. Adding the GSL to either the UWL or the AWL constitutes a set of about 3,000 academic words shared in all disciplines, and this set also provides about 90% text coverage which is close to the estimated threshold of 95%. As a result, knowledge of the GSL together with either the UWL or the AWL is seen as the lexical knowledge base for reading in any academic domain. Learning these 3,000 word families should be a high priority before students can start to learn at a more advanced level.

The literature on vocabulary types and lexical thresholds for academic reading are consistent in revealing that the two types of high frequency and academic words included in the GSL and the AWL are necessary for being a critical basis for academic reading. In the present study, therefore, it is more appropriate to select words based on these wordlists since the target words are likely to be used frequently by the students in their real academic reading.

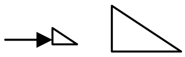
2.2.3. Assessment of students’ vocabulary size

Apart from identifying and teaching the target words, the measure of students’ knowledge of these words is also important. After study, students’ vocabulary size should be measured to determine how many of the target words have been learnt. In the present study, the measure of students’ vocabulary size or definitional knowledge is designed based on the established vocabulary level tests. Some tests have been developed specifically for assessing students’ vocabulary size from the GSL and the UWL/AWL since these two wordlists are regarded as a prerequisite for coping with academic texts. These tests are used to measure two types of knowledge: one is for assessing receptive knowledge and the other is for assessing productive knowledge. The present study is only concerned with the receptive version of these tests. Widely used tests of receptive knowledge are Nation's (1990), Beglar and Hunt's (1999), and Schmitt, Schmitt and Clapham's (2000) Vocabulary Level Tests whereas those of productive knowledge are Laufer and Nation's (1995) and Laufer and Nation's (1999) Vocabulary Level Tests.

These Vocabulary Level Tests are often recommended (Nation, 2001; Coxhead and Nation, 2001; Beglar, 2000; and Read, 1997) for assessing students' overall vocabulary size because they are well researched and reliable. The Vocabulary Level Tests at 2000 word level from the GSL and Academic Word Level from the UWL/AWL are typically employed to measure the breadth of the learners' vocabulary size as well as to specify what levels of basic lexical knowledge the learners have. These two levels are claimed to represent around 3,000 word families regarded as a lexical critical basis for academic reading since these words frequently occur in various academic text types in all disciplines. According to Nation (2001, p.21), the Vocabulary Level Test "gives credit for partial knowledge of words. Its main purpose is to let teachers quickly find out whether learners need to be working on high-frequency or low-frequency words, and roughly how much work needs to be done on these words". In addition, Beglar (2000, p.2) confirms that the test is classified as a sensitive vocabulary test, which means that the format is sensitive to partial word knowledge. According to him, "This test is designed to estimate examinees' basic knowledge of common word meanings, and specifically, the extent to which they know the common meanings of words at the 2000, 3000, 5000, 10000 and University Word Levels". The Vocabulary Level Tests have been used extensively as diagnostic and placement tests such as at Sultan Qaboos University in Oman (Cobb, 1977) and at Temple University Japan's Corporate Education Program (Beglar, 2000).

One of the well-known Receptive Versions of Vocabulary Level Tests was developed by Paul Nation. This version consists of four equivalent forms of six Word Levels i.e. 1000, 2000, 3000, 5000, 10000 and University Word Levels. The first 1000 Word Level Test consists of 39 questions, each of which has three options for test takers to decide whether a particular question is true, not true, or not understood as in the following examples.

Instructions: Write T if a sentence is true. Write N if it is not true. Write X if you do not understand the sentence. The first one has been answered for you.

1. We cut time into minutes, hours and days. __T__.
2. This one is little.  ______
3. Some children call their mother Mama. ______
4. *Show me the way to do it* means 'show me how to do it'. ______

(Extracted from Nation's (1993) 1000 Word Level Test A published in Nation, 2001, p.412)

The other Levels are in the same format: i.e. 30 items including 10 sets of 3 definitions and 6 words at each level. Recently, Beglar and Hunt (1999) have revised and validated the four forms of the 2000 and University Levels by means of Rasch Item Analyses. Subsequently, they proposed two revised forms, concluding that their content validity is greater than that of the original ones, and both forms are adequately equivalent. Each revised form consists of 27 items making up 9 sets of 3 definitions and 6 words. More recently, another version of Vocabulary Level Tests has been developed by Norbert Schmitt, Diane Schmitt, and C. Clapham (published in Nation, 2001 and Schmitt, 2000). According to Nation (2001), this version includes a pair of equivalent forms and is a major improvement on Nation's original Test, which it replaces. Each form consists of 5 Levels i.e. 2000, 3000, 5000, Academic and 10000 Word Levels. Each Level includes 30 items making up 10 sets of 3 definitions and 6 words. The test-taker's task is to match the words with their definitions, as in the following examples.

Instructions: Choose the right word to go with each meaning. Write the number of that word next to its meaning. Here is an example.

1. business	
2. clock	___6___ part of a house
3. horse	___3___ animal with four legs
4. pencil	___4___ something used for writing
5. shoe	
6. wall	

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1. copy	
2. event	_______ end or highest point
3. motor	_______ this moves a car
4. pity	_______ thing made to be like another
5. profit	
6. tip	

(Extracted from Norbert Schmitt, Diane Schmitt and C. Clapham's 2000 Word Level Test B published in Nation, 2001, p.416)

The way to interpret the result is in percentage. Beglar (2000, p.2) exemplifies, "If learner A scores 9 out of 12 (75%) on the 2000 word level, s/he probably knows approximately 75% (1,500) of the first 2000 words of English. And this logic can be applied to the results of the rest of the tests". Nation (2001) suggests that a score of at least 25 out of 30 (or over 80%) is desirable for each level.

In the present study, the design format of these vocabulary level tests is adapted to develop the measures of students' vocabulary size or definitional knowledge. These measures are the Definitional Part in four review tasks as well as in the pretest, the immediate posttest and the delayed posttest.

2.3. Vocabulary Acquisition and Retention

In dealing with vocabulary learning, the present study focuses attention on the measurement of two levels of vocabulary knowledge: definitional knowledge and transferable knowledge. Accordingly, both knowledge types are described before the nature of vocabulary acquisition and retention is reviewed in order to find the best ways which may help learners to learn, retain and retrieve these knowledge types.

2.3.1. Definitional knowledge and transferable knowledge

The accumulation of vocabulary acquisition is concerned with the breadth and depth of knowledge. According to Qian (1999, p.282), "*breadth of vocabulary knowledge* is defined as vocabulary size or the number of words for which a learner has at least some minimum knowledge of meaning. On the other hand, *depth of vocabulary knowledge* is defined as a learner's level of knowledge of various aspects of a given word, or how well the learner knows this word". As mentioned earlier, definitional knowledge of a word is regarded as a shallow level of understanding and likely to occur at early encounters of that word. Nagy (1997, p. 73) mentions, "Definition-based learning typically involves memorizing (or attempting to memorize) brief definitions representing only a single meaning of the word to be learned, and hence lead to only a shallow level of word knowledge". According to him, definitional knowledge usually occurs at an initial stage to learn new words. However, simply memorizing word definitions cannot guarantee lexical transfer to other contexts because this type of knowledge is superficial and is unlikely to increase comprehension of texts. It is often found that students know definitions, yet apparently are unable to comprehend textual information.

To increase comprehension of a text, the quality of word knowledge is necessary for lexical knowledge transfer. It is suggested that the ability to transfer lexical knowledge to new contexts demands deep lexical knowledge, and transferable knowledge is possibly enhanced by setting optimum conditions for vocabulary learning. According to Cobb (1997a and b), learning words in various contexts can increase quality of word knowledge since students' ability to transfer their new lexical knowledge to reading comprehension appears. Similarly, Nagy (1997) suggests that the instruction should involve multiple exposures to the words in context, and require deep processing of information about the words. He insists that most lexical knowledge is attributed to encounters with the words in various contexts since no single encounter with a word can lead to any great depth of word knowledge.

2.3.2. Incremental nature of vocabulary acquisition and retention

Vocabulary acquisition and retention possesses *incremental* nature. Knowledge of each word feature needs to be accumulated with knowledge of other features before that word is properly acquired. Meeting a word only once is not sufficient for that word to be learned and retained well since each word possesses more than one feature such as form, pronunciation, meaning, grammatical function, collocation etc. Nation (2001) points out that there is so much to know about each word that one meeting with it is not sufficient to gain all necessary information because vocabulary items must not only be known but they must be known so well that they can be easily accessed. Similarly, Schmitt (2000) mentions that complete mastery of a word entails a number of components of word knowledge, not all of which can be completely learned simultaneously. At each encounter, only one or a few parts of a word can be acquired. However, such knowledge is not a guarantee of word use and retention at all. In order to consolidate word knowledge, the exposure to a particular word should be repeated. The accumulation of knowledge of different aspects of a word can strengthen retention as well as retrieval of such lexical knowledge. The more encounters of a word, the easier that word is likely to be acquired and retained.

Knowledge of vocabulary is accumulated at various levels. Initially, knowing a word definition is likely to take place at the early encounters of a particular word so such knowledge of definition is regarded as a shallow level of knowledge. As knowledge of other features is accumulated and consolidated, knowledge of the word will be increasingly deep. Word knowledge must be deep enough for ensuring lexical knowledge transfer to various language uses. This is concerned with definitional knowledge and lexical knowledge transfer. The incremental nature of vocabulary knowledge is also described by Henricksen (1999, cited in Schmitt, 2000), who identifies lexical knowledge in three dimensions. In the first dimension, learners can have knowledge ranging from zero to partial to precise. In the second dimension, depth of knowledge requires mastery of a number of lexical aspects. The last dimension is receptive and productive mastery. It is often found that a word is learned receptively before it can be used productively.

The incremental nature of vocabulary acquisition and retention has some implications for vocabulary teaching. This means that learners should be provided enough opportunities to repeatedly meet each to-be-learned word in order to consolidate their knowledge. It is very unlikely that a learner is able to grasp even one meaning of a word in one encounter. After the learner meets the words through a variety of activities and in different contexts, a more accurate understanding of its meaning and use will develop. According to Sokmen (1997), re-encountering a new word has significant reward in word retention and long-term memory. Therefore, the repetition of word encounters is important for facilitating learners to acquire lexical knowledge. In classroom practice, to provide multiple exposures of new words to students, the to-be-learned words should be recycled in every possible way. Coady (1997) suggests that proficiency results from a sufficient number of meaningful encounters with the target language. It can be concluded that the more students encounter each word in various contexts, the better they learn and remember it. However, the number of encounters necessary for learning a particular word is quite controversial. The minimum point is acceptable at 5 encounters. Cobb and Horst (2001) accept the idea that stable learning requires meeting a to-be-studied word at least five or eight times, and use this criterion in their development of lexical tutoring computer program to increase students' vocabulary size within limited time.

To summarize, the quality of lexical knowledge seems to take place and be strengthened through meeting the to-be-learned words in a variety of natural contexts several times so that such knowledge can be retained and retrieved for being transferred to new contexts. In other words, the number of word encounters in a variety of contexts is essential in facilitating word retention, retrieval and transfer to new contexts. Therefore, the lessons in the present study are designed according to these principles both in the concordance and non-concordance versions.

2.4. Vocabulary Instruction

In this topic, the background of vocabulary instruction is first highlighted to overview the different roles of vocabulary along various stages of ELT development. Then, the main current approaches to vocabulary instruction are reviewed to determine the strengths of each approach in their compatibility with the implementation of the concordance-based method. This is to enhance the effectiveness of the concordance-based method.

2.4.1. Background

Since the field of English as a second/foreign language (ESL/EFL) was developed as a discipline in the 1950s, there have been numerous different approaches to language teaching/learning, each with different perspectives on vocabulary. Trends in the contexts of ESL/EFL show that the vocabulary component has occupied different statuses in various approaches. Surprisingly, despite being regarded as an important component of language, the historical role of vocabulary in language instruction was frequently subservient to other components, according to Schmitt (2000), O'Dell (1997), and Zimmerman (1997). Most approaches did not explicitly state the methods in dealing with vocabulary. It was assumed that vocabulary learning could happen naturally alongside the other elements of language: grammar, structures, functions, notions, or communication strategies. In the traditional approaches whereby emphasis was shifted between *language analysis* and *language use*, vocabulary was often neglected. In grammar-translation and structural syllabuses, for example, syntax and phonology were given priority whereas language use and communication skills were predominant in function/notional and communicative syllabuses. In these syllabuses, vocabulary was usually introduced in such a way that suited the presentation of grammar or functions, or through texts used for various structural or communicative purposes.

It was not until the 1980s that attention was paid directly to vocabulary teaching. Schmitt (2000) and O'Dell (1997) mention that the increase of interest in vocabulary results from the influence of modern technology with the advent of computer analysis techniques. Huge language corpora of authentic data can be compiled conveniently. Consequently, it is possible for linguists and lexicographers to conduct extensive and objective studies based on large corpora with far more details than ever. Knowledge derived from corpus-based studies increases an awareness of the importance of vocabulary. Findings from the studies of actual language use have reflected the perceived need for more accurate language description. Some studies have led to considerable interest in the significance of large chunks of language, variously known as *lexical items*, *lexical phrases* and *prefabricated units*. It is even argued that lexical items are central to language use and should be central to language teaching (Zimmerman, 1997).

This changed perception in language description led to immediate effects in the area of English Language Teaching (ELT), and marked the turning points for syllabus designs and pedagogical practice. According to O'Dell (1997), four major new editions of EFL dictionaries were published in 1995 with significant features drawing on the lexical insights provided by massive language corpora. In addition, two tools for syllabus design have been improved with large corpora. One is the compilation of better word frequency lists that allow more confidence in word selection and grading. The other is concordance output that provides an overview of how a particular word is used and practised. In addition, more scholars encourage lexical syllabuses in EFL, which are based on frequency and concordance data.

As corpus-based studies have gained increasing popularity, Schmitt (2000) notices that lexical researches have been conducted in two major strands: the patterning of vocabulary and systematization of word selection. Such research is known as the '*Vocabulary Control Movement*'. According to Schmitt, there were two competing approaches to Vocabulary Movement. The first approach attempted to limit English vocabulary to the minimum necessary for the clear statement of ideas.

One result of this approach was *Basic English* of only 850 words devised for use in regular communication. However, this approach seemed unsuccessful and *Basic English* was perceived as '*unnatural'* English. On the other hand, the second approach was more convincing with the attempts to use systematic criteria based on frequency information in order to select the most useful words for language learning. Consequently, several lists of vocabulary useful for particular types of reading were developed. An outstanding sample of this approach is Michael West's (1953) *General Service List of English Words (GSL)* consisting of about 2,000 word families.

The trends over the past two decades have assigned an increasing importance to vocabulary work in teaching ESL/EFL. With the reorientation in language description based on corpus-based studies, the perception of language nature and vocabulary roles has changed remarkably. Schmitt (2000, p.68) mentions, "Insights from corpus research have revolutionized the way we view language, particularly words and their relationship". Currently, vocabulary occupies an outstanding position in ELT, and is no longer subservient to other components of language learning.

2.4.2 Approaches to vocabulary instruction

In current practice, the emphases in teaching vocabulary in second or foreign language are based on two extreme approaches. According to Coady's (1997) extensive review of published research in L2 vocabulary instruction, one extreme is '*incidental learning*' through exposure to language use in contexts whereas the other extreme is '*explicit learning*' through the focused study of words. Between both approaches is '*strategy learning*'. Viewed as a continuum based on instruction requirement, incidental learning does not need teaching at all, strategy learning demands some instruction, but explicit learning needs formal instruction. With incidental learning, vocabulary is learned incidentally or naturally from contexts and is not necessarily taught at all. With strategy learning, contextual learning is also valued but some learning strategies need to be taught for effective learning from contexts. In contrast to these two approaches, explicit learning argues for formal instruction of vocabulary by using a combination of techniques. These approaches are discussed in the following sub-sections.

2.4.2.1 Incidental learning

‘*Incidental learning*’ is ‘*contextual learning*’. It imitates a natural process of L1 acquisition by exposing learners to a variety of contexts when their attention is not on the language itself, but rather on the use of language. Exposure to a variety of contexts is assumed to contribute to the understanding of the depth of the word meaning. Schmitt (2000, p.120) explains, “Incidental learning can occur when one is using language for communicative purposes and so gives a double benefit for time expanded”. According to Coady (1997, p.286), the contextual acquisition research does demonstrate that most vocabulary knowledge comes from meaningful language encounters. Learning is more successful if the language is authentic, rich in content, enjoyable, and, above all, comprehensible. To enhance incidental learning, learners have to read a large number of texts or converse for quite some time to come across and acquire particular words.

One major method for enhancing incidental learning is ‘*extensive reading*’. This method is based on a content-based approach in which students are assigned to do a lot of extra reading. The materials are authentic texts which are not designed specifically for language learning. They may be any books or articles for academic reading in other subject matters or for pleasure reading in leisure time. In this approach, choices are also provided for students to select any texts they want to read. It is assumed that vocabulary is acquired incidentally and naturally when students encounter particular words in rich contexts. Nation (2001) mentions three reasons for its appeal i.e. allowing for learning at one’s own level, facilitating a variety of interests and motivation, and making it possible to learn outside classes.

However, the major disadvantages of incidental learning arise from its natural process which is slow and gradual. It takes a long time before successful learning takes place whereas students have limited time for study. In learning language for academic purposes, for example, students cannot learn the necessary skills fast and efficiently enough if they try to adopt this time-consuming approach. In addition, this approach lacks the focused attention for directing students in particular ways. Moreover, learning from contexts will be successful only if the occurrences of target words are incidentally frequent enough. This is not always the case, especially with relatively infrequent words.

2.4.2.2 Strategy learning

'*Strategy learning*' is related to the top-down, naturalistic, and communicative approaches of the 1970s and 1980s. Like the incidental learning approach, context is a major source of vocabulary learning. This approach is expected to compensate for the limitation of incidental learning by focusing on how well students can deal with contexts on their own. It emphasizes teaching specific learning strategies to enable students to learn from contexts effectively. Accordingly, inference skills are perceived as primary strategies to deal with new or unknown words. Learners are taught the strategies of '*inferring from contexts*' by recognizing clues in contexts, using monolingual dictionaries, and not defining words with their bilingual equivalents (Sokmen 1997). Vocabulary instruction is, therefore, implicit. Vocabulary acquisition is assumed to happen mainly through guessing words in contexts.

This approach is very appealing to many scholars so several EFL textbooks based on this approach have been published with the main focus on inferring word meaning from contexts. However, according to Coady (1997), academic reading research indicates that this natural learning cannot provide the literacy skills necessary for EAP students to cope with academic demands. At least five potential problems occur when focusing solely on inference skills. Strategy learning is a slow process and guessing word meaning from contexts is an error-prone process and does not guarantee long term-retention of word knowledge. In addition, it usually causes low proficiency students to become frustrated and ignores the fact that learners have different styles of learning (Sokmen, 1997).

2.4.2.3 Explicit learning

"*Explicit learning* focuses directly on the information to be learned, which gives the greatest chance for its acquisition" (Schmitt, 2000, p.120). In this approach, vocabulary is deliberately taught and students' attention is drawn directly to the lexical items being studied. The explicit instruction of vocabulary is the full attempt to teach certain types of vocabulary by using various teaching methods or techniques. This contrasts sharply with strategy learning and incidental learning which have either implicit or no instruction at all. More and more research studies emphasize the need for explicit vocabulary instruction. They point to the ineffectiveness of just using implicit vocabulary instruction and the need to accompany it with a much stronger word level or bottom-up approach than had been previously advocated (Sokmen, 1997). In ESL/EFL situations, the environments do not provide rich contexts and the major sources of language are from classrooms. Given a limited time in schools or universities, learning has to be accelerated and learners need formal instruction to prepare themselves to cope with the demand of real language use.

According to Coady (1997), findings from reading and lexicon size research suggest the need for explicit learning/instruction. The minimum requirements of vocabulary or lexical thresholds have been established from such studies. To cope with various kinds of language uses such as academic reading, students must possess a certain size of vocabulary, ranging from 2,000-3,000 word families. The establishment of vocabulary size is so convincing that certain types of vocabulary such as from the GSL, the UWL and the AWL are considered worth teaching. To ensure sufficient encounters of these words, explicit teaching is obviously needed.

With explicit instruction, any teaching techniques can be used, even direct memorization of certain words, if they serve particular learning purposes. For example, extensive reading for incidental learning can be integrated into this approach but in a controlled or simplified way such as glossing texts, using graded readers etc. Inferencing strategies can also be explicitly taught in combination with any other method. Currently, there are many more techniques for teaching vocabulary explicitly. Many studies related to vocabulary instruction have suggested various principles, guidelines, activities and tasks. For example, Nation (2001) recommends three important general processes that may lead to vocabulary acquisition. These processes include ‘*noticing*’, ‘*retrieval*’ and ‘*creative (generative) use*’. The first process of ‘*noticing*’ is to draw learners’ attention to the word as a useful language item. The second process of ‘*retrieval*’ is to arrange activities for new learned words to be subsequently retrieved during the tasks in order that the memory of those words will be strengthened. The last process of ‘*creative or generative use*’ is to provide chances for students to reproduce or use new learned words in subsequent activities. In addition, Coady (1997) indicates three main principles underlying effective teaching i.e. providing both definitional and contextual information, allowing students to process information, and facilitating multiple exposures of each word.

2.4.2.4 Learning vocabulary through reading

The trends in ESL/EFL contexts clearly show that the pendulum of vocabulary instruction has swung back and forth in language acquisition and instruction approaches. As mentioned earlier, the shift is from the direct teaching of vocabulary in the grammar-translation method to the incidental learning in the communicative approach, and now back to a compromise between implicit and explicit teaching. At present, it is accepted that incidental, strategy and explicit learning are all necessary for ESL/EFL learners, despite some limitations of each. All these three current approaches should be seen as distinct but complementary to one another. It is possible to integrate these approaches by '*learning vocabulary through reading*' and this seems to be the best practice at present. According to Schmitt (2000), there is plenty of evidence that learners can acquire vocabulary from reading. Moreover, Coady (1997) notices that related research seems to demonstrate that *systematic vocabulary instruction* together with *learning vocabulary through reading* is a more successful approach than simply learning through contexts alone.

With the method of learning vocabulary through reading, the integration of approaches in explicit learning, strategy learning and implicit learning is possible. Although explicit teaching is most appealing at present, it can cover teaching only some elements of lexical knowledge due to time limitation. Taking an incremental view of vocabulary acquisition, students have to meet a word in different contexts to expand what is known about it. In addition, to consolidate memory of that word, multiple exposures and creative/generative use of a word are needed. Therefore, it is impractical for explicit approach to contextualize all target words or practice all the creative uses of a word for students to totally master them.

To deal with such a problem, strategy learning as well as incidental learning should be promoted to foster students' independent learning. One possible way is to explicitly teach vocabulary through reading at the beginning level before moving to strategy training and finally to incidental learning at higher levels. Findings from lexical threshold research can be used as criteria for determining the boundary of each level. Many scholars such as Nation (2001), Cobb and Horst (2001), Coxhead and Nation (2001) and Nation and Waring (1997) suggest that about 2,000 word families of high frequency words should be properly mastered for general language use and about 3,000 word families for academic purposes. This means that before students are able to learn useful strategies for guessing word meaning from contexts effectively, about 3,000 word families should be acquired. After these 3,000 word families are explicitly and properly learned, students should be trained to use inference strategies so that they can deal with technical or low frequency words before moving on to incidental learning with extensive reading.

Many techniques have been suggested for the explicit instruction of vocabulary through reading. Nation (2001) and Schmitt (2000), for example, propose that certain words in authentic texts for reading may be made salient, such as by glossing them clearly at the books' margins, or the texts may be simplified. In addition, *intensive reading* of short texts is useful to facilitate text understanding as well as to direct a lot of attention to the vocabulary, grammar and discourse of the texts. With intensive reading, a number of vocabulary and reading exercises must be provided with each reading passage. Moreover, extensive reading is also possible by using *graded readers* with beginning students, *narrow reading* with intermediate students, and a wide variety of authentic texts with advanced students. *Graded readers* are authentic books which are graded according to levels of readability whereas *narrow reading* means reading numerous authentic texts, but all on the same topic in order that much of the topic-specific vocabulary will be repeated throughout the course of reading. Schmitt (2000) emphasizes the benefit of narrow reading in that it can accelerate access to authentic materials.

2.5 A Concordance-based Method

A '*concordance-based method*' is the method adapted from a corpus technique widely used for linguistic analysis in the fields of computational linguistics and lexicography. This method essentially involves corpus compilation from authentic texts and a concordancing program for accessing a corpus and then producing concordance output. Since a corpus and a concordancer are always used together in this method of language analysis, the terms '*corpus-based method*' and '*concordance-based method*' usually co-occur in related literature so they are often interchangeable in most cases. When language corpora were introduced to language instruction a few decades ago, the concordancer was also exploited in the pedagogical field as an indispensable corpus tool. In language pedagogy, the application of this method is underpinned by a learning approach called ‘*data-driven learning (DDL)*’. *DDL* is sometimes referred to in the literature as *classroom concordancing*, although a slight distinction can be made between the two terms. According to Sripicharn (2000), DDL refers to the methodological framework of the approach whereas classroom concordancing refers to the practical aspect of the approach. Thus, these two terms are used interchangeably in his Ph.D. thesis. Similarly, in this paper, these terms are mostly used interchangeably.

2.5.1 Background

Language corpora have long been exploited for language study. They were undertaken manually before computers were available. As technology advancement has increased the power and capacity of computers, corpora have increased dramatically in size, variety and ease of access. Simultaneously, an expanding range of software has been developed to process corpora and to access the information they contain. With the rapid advancement of computational linguistics, the computer-based corpora have led to a new discipline known as *corpus linguistics* since the last few decades (Kennedy, 1998). The field of study is based on bodies of texts as the domain of study and as the source of evidence for linguistic description and argumentation. Work related to corpus linguistics is being done in various fields and is multiplying at a very fast rate.

Considerable corpus-based work has been increasingly developed especially in the field of lexicography. Large-scale corpora have been exploited to investigate language as it is actually used. These corpora have dramatically improved the quality of reference materials. These references analyze and report precisely and confidently how language is actually used rather than providing prescribed information. Resulting from such corpus-based work, English descriptive grammar is reassessed as evident in the publications of the *Longman Grammar of Spoken and Written English* (Biber, Johansson, Leech, Conrad and Finegan 1999) and *An Empirical Grammar of the English Verb: Modal Verbs* (Mindt, 1995). Modern English dictionaries published currently all indicate that they are based on findings from corpus-based studies. These dictionaries, for example, are the *Longman Dictionary of Contemporary English* (2005) based on the Longman Corpus Network, the *Cambridge International Dictionary of English* (1995) based on the Cambridge Language Survey corpus, and the *Collins COBUILD English Language Dictionary* (1995) based on the Collins Cobuild Database. The number of corpus-related studies is good evidence of the growing interest in corpus-based research. Thus, the number of corpora has mushroomed considerably and they have become more widely accessible. At present, an electronic corpus has become a universal resource for most linguistic investigation.

However, the area of English Language Teaching (ELT) has been rather slow to incorporate corpus-based method into its working practice, compared to other related fields of study. Despite being introduced to ELT contexts in the 1980s, the application of concordances in EFL classroom in the 1990s was still in its infancy as a language teaching technique (Stevens, 1995; and Fox, 1998). At the initial stage of its arrival in ELT, the method was exploited exclusively by developers of curricula, syllabuses and materials in order to determine the representative language of their target language use. Later, language teachers were encouraged to exploit corpora as the linguistic informant to update their linguistic knowledge with current language use, and as a source of input for preparing classroom materials and for searching authentic linguistic examples. Recently the method has been used in language classrooms not only for materials preparation but also for language learning. Learners are given more opportunities to have direct contact with relevant authentic information in corpora. This has led to the emergence of a learning approach called ‘*Data-driven Learning’ (DDL)*, in which students are assigned to work with raw information taken directly from corpora. It is based on the assumption that students can acquire language effectively when they engage in language analysis. The method can draw students’ active involvement in the learning process by encouraging them to observe linguistic input, form hypotheses and draw their own conclusions about word/phrase meaning and grammar rules based on the examination of authentic linguistic evidence. Accordingly, learning and self-discovery possibly take place when the students are placed metaphorically in the position of researchers.

Currently, the role of language corpora in language teaching has gradually become prominent. Since corpora and concordancing programs have become available and more easily accessible for teachers and learners, their very potential application has been seen to offer new and exciting directions in developing curricula, syllabuses and teaching materials as well as facilitating students to make direct discoveries about language. The increase in the number of published works in ELT is good evidence of its rapid growth. Several papers such as in Gavioli and Aston (2001), Conrad (2000), Fox (1998) and Owen (1997) discuss the important roles of corpora in classroom pedagogy. It is now established that a basic corpus technique plays a major role in shaping pedagogical practice.

2.5.2 Description of the concordance-based method

The concordance-based method is a method of language analysis for linguistic study. It consists of three main components i.e. a corpus, a concordancer and a concordance. In language analysis, a *corpus* is like a database, a *concordancer* is a corpus-accessing tool working like a search engine for searching linguistic information of words or phrases to be studied, and a *concordance* is a formatted display where all occurrences of any particular word are listed together in the contexts.

2.5.2.1 A corpus

A corpus is a collection of texts compiled for linguistic study. The term '*corpus*' comes from the Latin word for '*body'* and it has retained this meaning i.e. '*any body of text*' (McEnery and Wilson, 2001). However, in the context of linguistic study, this simple definition is considered insufficient because a corpus cannot be seen as just a collection of texts but it should be gathered on a linguistic basis. The definition of a corpus as 'any body of text' may lead to confusion between the term '*corpus*' and '*archive*' so a distinction between them is made. Accordingly, a *corpus* is generally referred to as a collection of texts gathered according to particular principles for some particular purposes whereas an *archive* refers to a collection where various kinds of texts are stored simply because each individual text is interesting in itself.

Crystal (1994, p.410) stated that a *corpus* is 'a representative example of language, compiled for the purpose of linguistic analyses'. In his 1991 work, he also defines a corpus as "a collection of linguistic data, either written texts or a transcription of recorded speech, which can be used as a starting-point of linguistic description or a means of verifying hypotheses about a language". Leech (1997) pointed out two consecutive descriptions. According to him, linguists have traditionally used the term *corpus* to designate a body of naturally-occurring (authentic) language data which can be used as a basis for linguistic research. This body of data may consist of written texts, spoken discourses, or samples of spoken and/or written language. Later, the term *corpus* has been increasingly applied to a body of language material which exists in electronic form and which may be processed by computer for various purposes such as linguistic research and language engineering. Nevertheless, Kennedy (1998) explains that corpora are not necessarily stored electronically so that they can be machine-readable although this is nowadays the norm. According to him, corpus linguistics did not begin with the development of computers and some of the most revealing insights into language use have come from the blend of manual and computer analysis. Kennedy's (1998, p.1) brief definition of a *corpus* is "A body of written text or transcribed speech which can serve as a basis for linguistic analysis and description." Corpora may consist of whole texts or collections of whole texts. They may consist of continuous text samples taken from whole texts or even collection of citations.

Although there are a large number of corpora increasingly available at present, they will not always serve the need of every potential user. Some researchers, material developers, teachers or even students may need to compile their own corpora for particular purposes. In doing so, the criteria can vary from one to another. Prior to compiling a corpus, therefore, the objectives of the study must be clearly set and particular considerations must be taken to ensure the quality of a corpus. Such quality is mainly concerned with the issues of '*representativeness'* of the target language or the size of the corpus. "A corpus is *representative* in the sense that findings based on an analysis of it can be generalized to the language as whole or a specified part of it", according to Leech (1991, cited in Kennedy, 1998, p.62). Pearson (1998) suggests that a corpus must be as big as possible to carry out linguistic studies on language as a whole. In addition, to study on a subset of the language, the representative of the subset in question is another important factor in a corpus compilation.

Typically, most corpora are deliberately designed in a size as big as possible although in some cases the size is not necessarily the most important criteria. For purpose-built corpora in language learning, it is not always necessary to compile corpora as large as the general purpose ones. In such corpora, a large size is less important because the adequacy of a corpus depends on the intended application. Teachers and learners have rather different objectives from professional linguists so that a small corpus with less systematic analyses may still be sufficiently useful. An enormous size of a corpus may be too large for any practical handling of the students. Aston (1998, p.226) suggests, “small specific corpora have obvious virtues in highlighting recurrent specialised features, but only larger and more general ones seem able to capture less specialised ones, and to contextualise such features against a broader spectrum of abilities and awareness”. According to him, analyzing data in a small specialized corpus potentially allows teachers and learners to contextualize uses encountered against a broader linguistic background.

In compiling one’s own corpus, Aston (2002, p.14) suggests that the web is one excellent resource although complex searches and considerable adaptation are needed. According to him, dividing a corpus into sub-corpora is also an attractive strategy since a small size of a sub-corpus is more manageable and available for being selected according to the desired proportions. In addition, a small specialized corpus can offer a number of practical advantages over a large mixed one because it is relatively simple to compile, analyze, interpret and be familiar with (Aston 1997b and 2001). Accordingly, incidental learning of vocabulary is likely to be less dispersive since linguistic input is confined to specific text-types and more immediate to learners. In determining a corpus size, consideration should be taken as to whether a corpus is sufficient for serving the purpose of the study and for being representative of the target language (Aston, 2001). Many researchers tend to agree that smaller corpora can suffice and appropriate in cases that the investigated phenomena appear with sufficient frequency to provide adequate result. Most papers published in Aston, (ed.) (2001) use relatively small specialized corpora for language learning, ranging from 2,000 to 1,000,000 running words. Some of them are corpora of newspaper articles, transcribed speech, academic writing and classified advertisement.

2.5.2.2 A concordancer and a concordance

Most corpora are incredibly large and it is a formidable task to study corpus information without the help of a computer. An important tool for working with language corpora is a '*concordancer*', which is a computer program used to search, access and analyze corpus information, and then to display the output in concordance lines. A *concordance* is "an alphabetical listing of words in a text or collection of texts, together with the contexts in which they appear" (Godwin-Jones, 2001, p.8). In other words, a *concordance* is a list of occurrences of either a particular word, a part of a word, or a combination of words in context. An occurrence of a particular word is usually called a *keyword*.

A typical concordancer allows us to enter a word or phrase and search for multiple examples of how that word is used in speech and writing. More complex concordancers can help us to extract examples from very particular contexts and even discriminate between spoken and written language. With the use of a concordancer to access corpus information, concordances can be produced in a number of formats. The most useful form is a *Keyword in Context (KWIC)* format. A typical *KWIC format* displays the keyword in the center of the line with more contexts on each side of the keyword and each occurrence of the word is listed on a separate line. It is also possible to display the sequences of contexts either on the left or right of the keywords. Therefore, it is convenient to get a picture of the environments where a keyword occurs in a corpus.

Since a concordancer is capable of making a concordance list showing the contexts of every occurrence of a selected word or phrase in a text corpus, it is sometimes called a '*super-index*'. However, most concordancers are more capable than simply indexing words into lines. It is particularly useful in exploring the relationships between words, and it can provide very accurate information about the way language is authentically used. Sorted concordances can provide information on collocation patterning as well as reveal different senses of a word type. Moreover, the relative frequencies of different uses of a word type can be calculated.

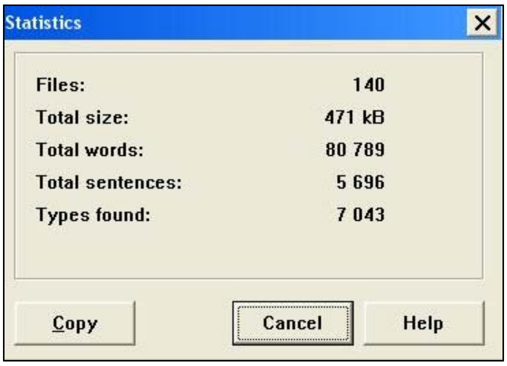
2.5.2.3 Basic functions of a concordancer

As corpus-based studies are becoming increasingly prominent, a wide range of concordancing programs have been continuously developed for operating sophisticated functions as well as for making them much more user-friendly. Therefore, the operation of different concordancers varies from system to system. Nevertheless, all fundamental principles are still common to all different concordancers, according to Tribble and Jones (1990). Some basic functions of most concordancers are described below. All examples illustrated below are from the use of *WCONCORD*, a concordancer developed by Martinek and Siegrist in 1999.

2.5.2.3.1 Displaying statistical information of a corpus

Most concordancers are very capable of counting words, word types and sentences in the corpus and then showing the statistical information of the corpus as illustrated in Figure 2.1. This information provides the overall idea about the size of a corpus and the total number of words, word types, files and sentences in that corpus. It is helpful in determining the size and reliability of the corpus.

Figure 2.1: Statistical information of a corpus



2.5.2.3.2 Building word frequency lists

With the capability of word counting, a concordancer can quickly build word frequency lists including all words occurring in a given corpus. When the wordlist is built, the resulting words are usually displayed alphabetically as in Figure 2.2. Apart from a word sort in an alphabetical order, the list can optionally be sorted either in a frequency order or in a retrograde order as illustrated in Figures 2.3 and 2.4. With frequency sort, words are displayed in a descending order ranging from the most frequently occurring words in the corpus to the least frequently occurring ones. When the retrograde order is selected, words are sorted alphabetically according to the endings of words. This type of data sorting is useful for studying the recurrent patterns of word suffixes.

Figure 2.2: A word frequency list sorted by alphabetical order

	Word	F	F %
1.	'applications'	1	0.001
2.	'both	1	0.001
3.	'brain'	1	0.001
4.	'chips'	1	0.001
5.	'computer'	1	0.001
6.	'contacts'	1	0.001
7.	'diode'	1	0.001
8.	'engine'	1	0.001
9.	'engineer'	1	0.001
10.	'engineering'	1	0.001
11.	'geometry'	1	0.001
12.	'gone'	1	0.001
13.	'information'	1	0.001
14.	'ingenious'	1	0.001
15.	'mechatronics'	1	0.001
16.	'national	1	0.001
17.	'power	1	0.001
18.	'ram'	1	0.001
19.	'random	1	0.001

Figure 2.3: A word frequency list sorted by word-frequency order

	Word	F	F %	CF	CF %
1.	the	5610	6.944	5610	6.94
2.	to	2479	3.068	8089	10.01
3.	a	2077	2.571	10166	12.58
4.	and	1891	2.341	12057	14.92
5.	of	1710	2.117	13767	17.04
6.	you	1234	1.527	15001	18.57
7.	is	1133	1.402	16134	19.97
8.	in	996	1.233	17130	21.20
9.	it	839	1.039	17969	22.24
10.	or	811	1.004	18780	23.25
11.	for	778	0.963	19558	24.21
12.	your	778	0.963	20336	25.17
13.	on	684	0.847	21020	26.02
14.	be	672	0.832	21692	26.85
15.	that	585	0.724	22277	27.57
16.	with	579	0.717	22856	28.29
17.	if	559	0.692	23415	28.98
18.	are	525	0.650	23940	29.63
19.	can	469	0.581	24409	30.21
20.	as	455	0.563	24864	30.78

Figure 2.4: A word frequency list sorted by retrograde order

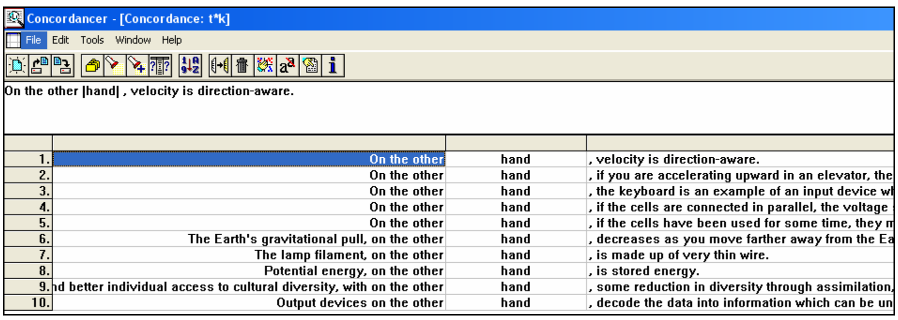
	Word	F	F %
1.	idea	14	0.010
2.	area	65	0.046
3.	giga	2	0.001
4.	media	17	0.012
5.	multimedia	3	0.002
6.	criteria	4	0.003
7.	via	31	0.022
8.	formula	31	0.022
9.	phenomena	21	0.015
10.	vocab	4	0.003
11.	grab	2	0.001
12.	tab	1	0.001
13.	web	48	0.034
14.	bulb	12	0.009
15.	limb	1	0.001
16.	climb	2	0.001
17.	bomb	4	0.003
18.	coulomb	12	0.009
19.	thumb	10	0.007
20.	absorb	1	0.001
21.	cubic	1	0.001
22.	periodic	2	0.001
23.	traffic	3	0.002
24.	specific	35	0.025

Frequency information is very helpful in word selection. By doing a frequency count, it is possible to find out the relative frequency of a word ranging from the most to the least frequent words. It is likely that the most frequent words are selected for study although this is not always the case since function words such as articles and prepositions are usually found in the top ranks of most corpora. For lexical words, however, high frequency words are most highly considered as being worth studying since they are more likely to be found in other contexts. It is also possible to see the frequent use among particular words such as synonyms and spelling variants. For example, a group of near synonyms e.g. ‘*start*’, ‘*begin*’, and ‘*commence*’ can be studied to see which one is used more/less frequently in an informal/formal situation or in a written/spoken mode. Tribble and Jones (1990) recommend that creating wordlists and frequency tables is often the best way to start. With frequency information, it is possible to have a much better idea of which particular items should be properly selected for further studying other aspects of those items. In addition, to set a cut-off point between maximum and minimum frequencies can prevent an overwhelming amount of data. Therefore, it saves a great deal of guesswork if we begin with wordlists and then move on to other types of analyses.

2.5.2.3.3 Searching words

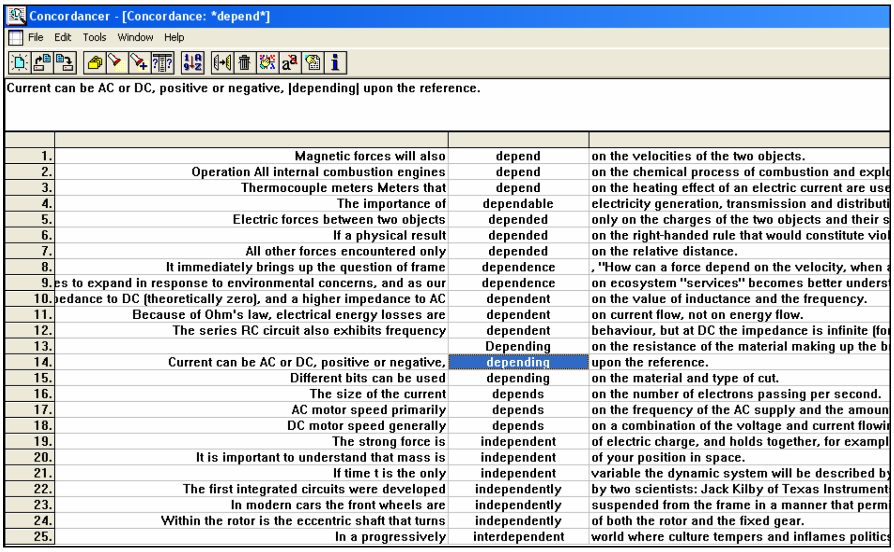
A *concordancer* is also capable of searching individual words, phrases and parts/combinations of words. Basically, after a particular to-be-studied word is typed into the program, a concordancer will compile a concordance list according to the occurrences of that word found in the corpus. More than one word can be searched for at a time and the search for collocations or groups of words is also possible. Figure 2.5 illustrates the result from searching the collocation of ‘*on the other hand*’.

Figure 2.5: The concordance output of searching ‘*on the other hand*’



A *wildcard search* of most concordancers can make the searches more specific and effective. This allows searching for a ‘*root’* word with a ‘*wildcard character*’ i.e. a symbol standing for one or more unspecified characters. Different symbols are used for the ‘*wildcard character’* depending on the concordancing programs. Typically, the question mark (?) is a substitute for a wildcard character for any single character and the asterisk (*) is a substitute for a wildcard character for any zero or more characters. These symbols can be put at the beginning of words, at the end of words, or in the middle of words. For example, a search for ‘*t??k*’ may find *talk*, *tank*, *task*, *took* etc whereas a search for ‘*t*k*’ may result in *talk*, *tank*, *task*, *teamwork*, *thank*, *thick*, *think*, *took*, *track*, *trademark*, *truck* etc. Another example is from the search of *‘?ing*’ which may find the word with one more character in front of ‘*-ing’* such as *king*, *ring* etc whereas the search of ‘**ing*’ may find all corpus words with the ‘*–ing’* endings. Similarly, the search of ‘*depend?*’ may result in *depends* whereas the search of ‘**depend**’ may find *independent, independence*, *depends*, *depended*, *depending*, *dependence*, *dependent* etc. as in Figure 2.6.

Figure 2.6: The wildcard search of ‘**depend**’ sorted by left contexts


Concordancer - [Concordance: *depend*]

File Edit Tools Window Help

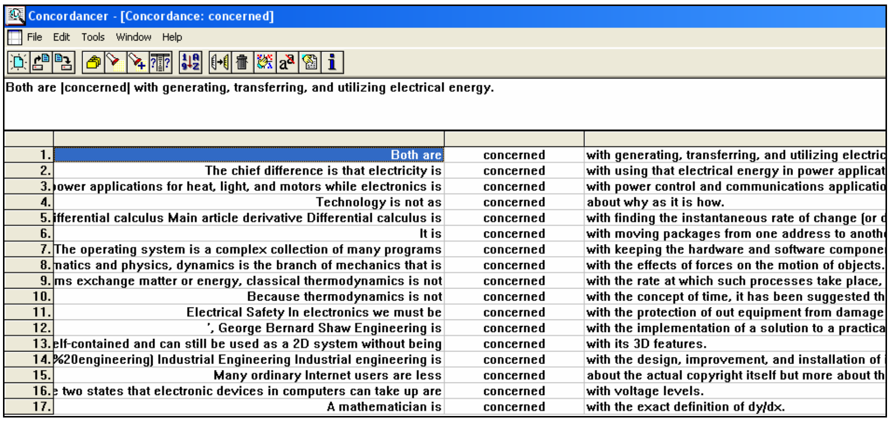
Current can be AC or DC, positive or negative, |depending| upon the reference.

1.	Magnetic forces will also	depend	on the velocities of the two objects.
2.	Operation All internal combustion engines	depend	on the chemical process of combustion and explo
3.	Thermocouple meters Meters that	depend	on the heating effect of an electric current are use
4.	The importance of	dependable	electricity generation, transmission and distributi
5.	Electric forces between two objects	depended	only on the charges of the two objects and their s
6.	If a physical result	depended	on the right-handed rule that would constitute viol
7.	All other forces encountered only	depended	on the relative distance.
8.	It immediately brings up the question of frame	dependence	, "How can a force depend on the velocity, when a
9.	es to expand in response to environmental concerns, and as our	dependence	on ecosystem "services" becomes better underst
10.	pedance to DC (theoretically zero), and a higher impedance to AC	dependent	on the value of inductance and the frequency.
11.	Because of Ohm's law, electrical energy losses are	dependent	on current flow, not on energy flow.
12.	The series RC circuit also exhibits frequency	dependent	behaviour, but at DC the impedance is infinite (fo
13.		Depending	on the resistance of the material making up the b
14.	Current can be AC or DC, positive or negative,	depending	upon the reference.
15.	Different bits can be used	depending	on the material and type of cut.
16.	The size of the current	depends	on the number of electrons passing per second.
17.	AC motor speed primarily	depends	on the frequency of the AC supply and the amoun
18.	DC motor speed generally	depends	on a combination of the voltage and current flowi
19.	The strong force is	independent	of electric charge, and holds together, for exampl
20.	It is important to understand that mass is	independent	of your position in space.
21.	If time t is the only	independent	variable the dynamic system will be described by
22.	The first integrated circuits were developed	independently	by two scientists: Jack Kilby of Texas Instrument
23.	In modern cars the front wheels are	independently	suspended from the frame in a manner that permi
24.	Within the rotor is the eccentric shaft that turns	independently	of both the rotor and the fixed gear.
25.	In a progressively	interdependent	world where culture tempers and inflames politics

2.5.2.3.4 Sorting concordance lists

When a concordance list is built, it is not sorted. The resulting list is normally displayed according to the order in which the program finds each word as in the output of searching ‘*concerned’* illustrated in Figure 2.7.

Figure 2.7: The unsorted output of searching '*concerned*'



Most concordancers allow the list to be sorted to make word observation more convenient. The concordances can be optionally sorted either by the left or the right contexts of the keywords. With the left sort, the first words on the left of the keyword are ordered alphabetically as in Figure 2.8. Similarly, if the right sort is selected, the first words on the right of the keywords are sorted alphabetically as in Figure 2.9.

Figure 2.8: The concordance list sorted by the left contexts

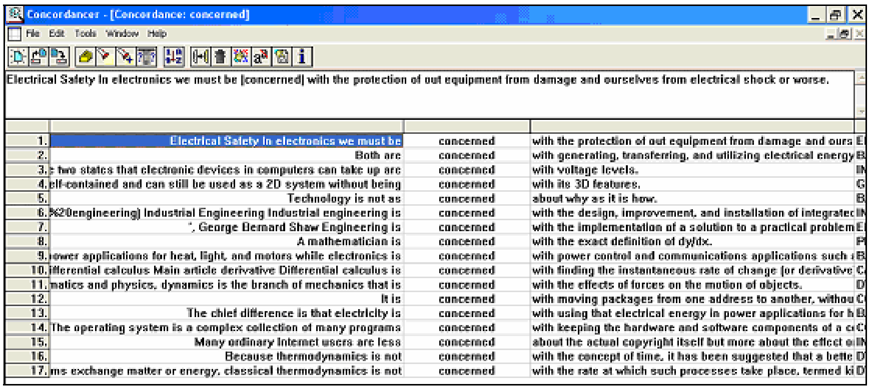
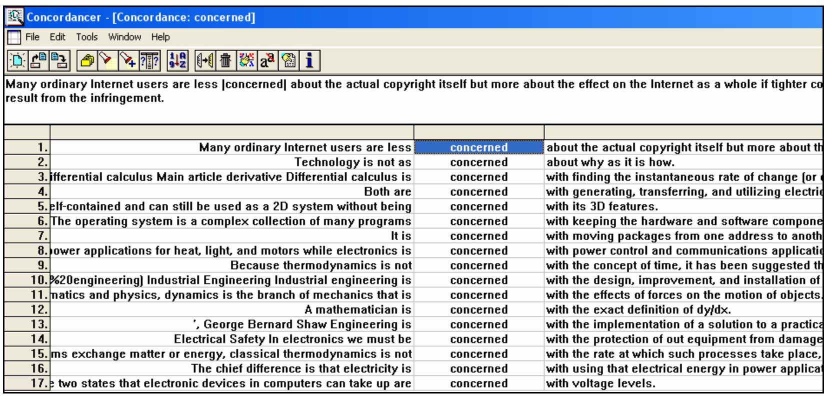


Figure 2.9: The concordance list sorted by the right contexts

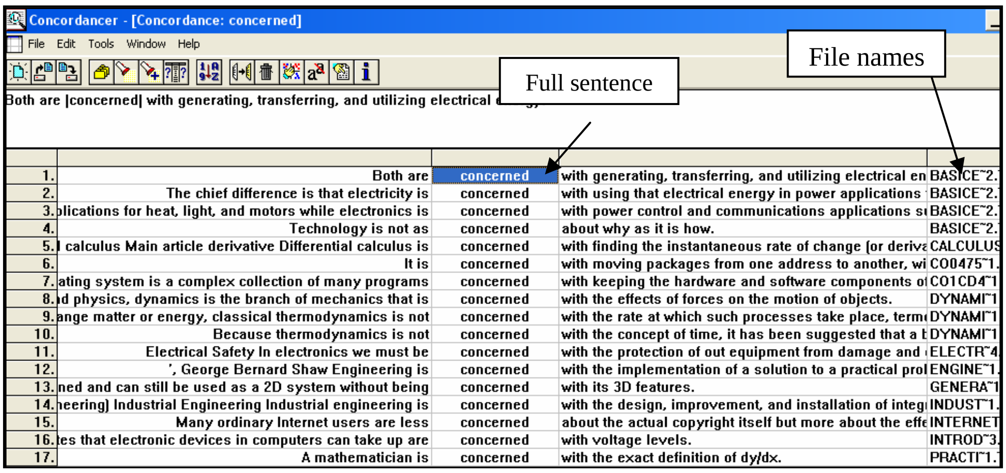


Sorting words makes it easier to find occurrences that are typical of a particular word such as grammatical information and collocations since possible recurrent patterns of words become more noticeable. For example, if a word ‘*concerned’* is the target word of study, sorting words is helpful for highlighting possible recurrent patterns. The left sort in Figure 2.8 is helpful for comparing the frequent use of ‘*concerned’* as a component of a passive form or as a modifier. In addition, students’ attention may be drawn to the components of the passive form in each concordance. On the other hand, the right sort in Figure 2.9 is helpful in identifying the typical co-occurring words or prepositions. With the left and right sort, the most frequent collocation of ‘*concerned*’ i.e. ‘*be concerned with*’ is easily identified. Therefore, word sort is very helpful for the study of significant collocations because typical co-occurring words can also be identified from the amount of context in which a keyword appears in concordances.

2.5.2.3.5 Providing more contexts and word information

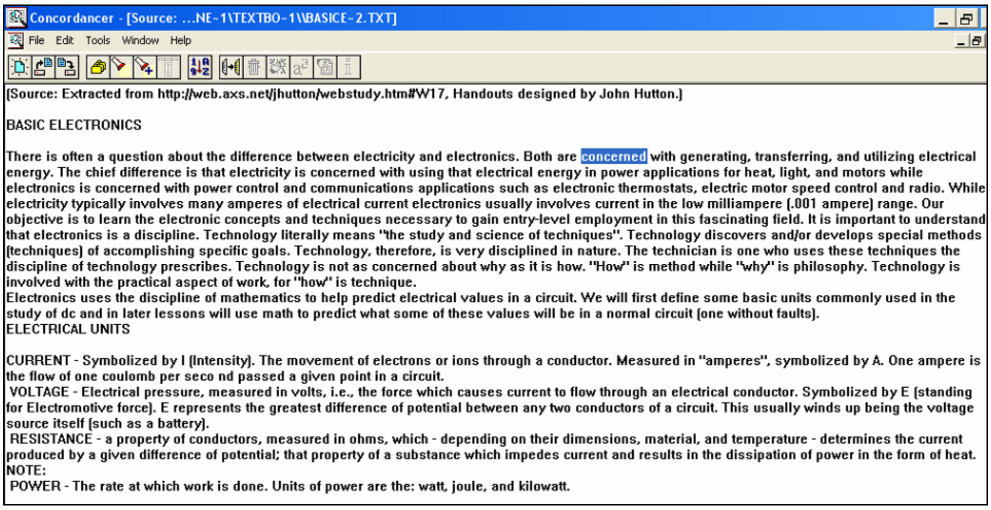
Most concordances are usually displayed in fragments rather than in complete sentences. Many concordancers allow the possibility of referring to the source texts to get more context and information about particular words if needed. With WCONCORD, for example, a full sentence of a selected concordance is displayed at the top of the concordance list whereas the computer file name is displayed at the end of each concordance as in Figure 2.10. In addition, the source text of the selected concordance can also be referred to. Figure 2.11 illustrates the source texts in which the keyword is highlighted.

Figure 2.10: The full sentence and the file name of the selected concordance



1.	Both are	concerned	with generating, transferring, and utilizing electrical en	BASICE~2.
2.	The chief difference is that electricity is	concerned	with using that electrical energy in power applications	BASICE~2.
3.	plications for heat, light, and motors while electronics is	concerned	with power control and communications applications su	BASICE~2.
4.	Technology is not as	concerned	about why as it is how.	BASICE~2.
5.	l calculus Main article derivative Differential calculus is	concerned	with finding the instantaneous rate of change (or deriva	CALCULUS
6.	It is	concerned	with moving packages from one address to another, wi	CO0475~1.
7.	ating system is a complex collection of many programs	concerned	with keeping the hardware and software components o	CO1CD4~1
8.	d physics, dynamics is the branch of mechanics that is	concerned	with the effects of forces on the motion of objects.	DYNAMI~1
9.	ange matter or energy, classical thermodynamics is not	concerned	with the rate at which such processes take place, term	DYNAMI~1
10.	Because thermodynamics is not	concerned	with the concept of time, it has been suggested that a b	DYNAMI~1
11.	Electrical Safety In electronics we must be	concerned	with the protection of out equipment from damage and	ELECTR~4.
12.	', George Bernard Shaw Engineering is	concerned	with the implementation of a solution to a practical prol	ENGINE~1.
13.	ned and can still be used as a 2D system without being	concerned	with its 3D features.	GENERA~1
14.	neering) Industrial Engineering Industrial engineering is	concerned	with the design, improvement, and installation of integ	INDUST~1.
15.	Many ordinary Internet users are less	concerned	about the actual copyright itself but more about the effe	INTERNET
16.	tes that electronic devices in computers can take up are	concerned	with voltage levels.	INTROD~3.
17.	A mathematician is	concerned	with the exact definition of dy/dx.	PRACTI~1.

Figure 2.11: The source text of the selected concordance



2.5.2.3.6 Manipulating output

Most concordancers also allow the concordance output to be manipulated for various purposes, especially for the preparation of class materials. Among these functions, some duplicate sentences or resulting concordances can be conveniently deleted. The output can also be copied and pasted in order to be converted into normal word-processing programs such as Microsoft Word or Microsoft Word Excel. This makes the practice of materials preparation convenient since linguistic samples can be easily transferred into typical paper-based materials.

2.5.3. A learning approach: Data-driven Learning (DDL)

‘*Data-driven Learning (DDL)*’ is a learning approach inherently associated with classroom concordancing. This approach was initiated by Tim John at the University of Birmingham. According to Murison-Bowie (1996, p.190), DDL is based on the concept originating from John’s statement ‘*research is too serious to be left to the researcher*’. His statement is commonly quoted in many published papers such as in Leech (1997) and Gavioli (1997). According to this statement, John (1991, p.2) considers language learners as being essentially “a research worker whose learning needs to be driven by access to linguistic data”. This means that in DDL the students are put in a position similar to that of a researcher in order to examine particular data through the observation of the corpus and then make sense of the available data. While exploring linguistic data, the students may form hypotheses and/or test them against the corpus data, or they may generalize or discover new rules/knowledge from such resources. Accordingly, the metaphorical concepts typically combined with DDL are '*discovery learning*' and '*learners as researchers*'. The researcher-like methodology of DDL is viewed as an important way to engage learners in the world of language knowledge.

The concepts of DDL, discovery learning and learners as researchers are typically put into action through the use of language corpora and concordance-based methods. Leech (1997, p.3) mentions, "The student-centered paradigm of *discovery learning* – or what John has called *data-driven learning* – can scarcely be better exemplified than through the use of the computer corpus". In DDL, data are naturally occurring texts so both teachers and students do not necessarily know what will be found in the corpus. In practice, learners become researchers into language, forming hypotheses and testing them against the authentic data provided by the corpus and the teacher becomes a research organizer. Robinson (1991, p.3) concludes, "An open-ended and uncensored supply of language data encourages students to explore and discover rules for themselves with the guidance of the teachers".

In DDL, it is assumed that learning takes place either deductively or inductively when students are engaged in language analysis from a particular corpus. The concordance-based method demands students to identify examples in the corpus that match particular categories or types (deductive approach), or to come up with patterns or generalizations (inductive approach). In other words, in a deductive approach, the teacher firstly teaches rules which can be tested and confirmed by the data. Then students are assigned to find evidence from authentic language use in the corpus. The rules are set as hypotheses for students to test whether the evidence from corpora will support or deny the given rules. It is believed that students are unlikely to understand the rule statement until they have tested it against various examples. However, McDonough (1995, cited in Stevens, 1995) argued that giving a rule first imposes a rule formation rather than encouraging the student to make one up in his own terms. On the other hand, without rule teaching in an inductive approach, learners explore available data from corpora to generalize or induce rules/patterns. Supporting an inductive approach, Shaffer (1989, cited in Todd, 2001) describes the nature of induction as a two-stage process. Firstly, learners focus their attention on examples illustrating the target language point, and then they consciously generate rules or patterns from these examples. To investigate students' inductive ability, Todd conducted a study with Thai postgraduate students. In his study, the students used self-selected concordances to carry out self-correction on their own writing. It was found that concordances could facilitate inductive learning because the students were generally able to induce valid patterns from their self-selected concordances and make valid self-corrections of their errors. However, despite much research on induction versus deduction, it is still unclear as to which one is more effective.

Currently, a shift in ELT moves towards a more learner-centered paradigm of '*discovery learning*', more pedagogical activities have required learners' involvement in order for them to make their own discoveries (Tomlinson, 2002) The role of the classroom and teaching materials is asserted to aid learners to make effective use of the resources in order to facilitate self-discovery. Similar views are also expressed in Todd (2001), Gavioli and Aston (2001), Thurstun and Candlin (1998), Fox (1998), Willis (1998), Cobb (1997a and b), Stevens (1995), and Tribble and Jones (1990). Therefore, it can be stated that '*discovery learning*' of the DDL approach conforms nicely with such currently popular ideas in ELT approaches, rather than being an activity in which knowledge is simply handed down from teacher to students.

2.5.4. Compatibility to various approaches to vocabulary instruction

Although the concordance-based method is closely associated with DDL, it is not necessarily restricted to only DDL. Its application can be used compatibly with all methodologies concerning explicit instruction (Gabrielatos, 2005). Equipped with a corpus and a concordancer, the concordance-based method is potentially applicable in vocabulary instruction. It is very promising in terms of arranging optimal conditions for enhancing vocabulary acquisition. Firstly, it can provide a unique resource of authentic and representative language specifically serving students' needs. Secondly, frequency wordlist can be quickly created to be used as one criterion in selecting target words. Thirdly, words can be easily contextualized since thousands of words in multiple contexts can be searched and obtained easily and quickly with a concordancer. With this method, the materials can be prepared much more conveniently and quickly in order to present target words in various authentic contexts with ample encounters of authentic language samples. This introduces learners to a large number of target words in a short time. Therefore, vocabulary learning in multiple contexts can be facilitated and a sufficient number of word encounters can be achieved.

Apart from providing optimal conditions, the corpus-based method fits well with the current approaches of vocabulary instruction i.e. explicit, strategy and implicit instructions as well as teaching vocabulary through reading as discussed in 2.4. In *explicit instruction*, target words can be made salient with the display of KWIC concordances where the target words are presented in the center with the contexts on each side. Accordingly, students' attention is drawn directly to the words being studied and at the same time students can easily observe word behaviors in multiple contexts. Drawing students' attention to target words conforms to '*noticing hypothesis*' by consciously focusing on both forms and meaning of words. Based on *noticing hypothesis*, what learners notice in input is what becomes intake for learning (Schmidt, 1995, p.20). Moreover, being assigned to observe contexts of keywords, students can study various features of each of the words to be learned such as its grammatical functions, various meanings, collocations etc. Meeting a word in different contexts expands lexical knowledge of that word with its various features and repeated encounters consolidate quality or depth of word knowledge. This accumulation of knowledge strengthens knowledge of a particular word. In addition, with the concordance-based method, the recycling of word encounters is very easy. Words newly learned likely become contexts of the next target words if such words are words frequently occurring in particular types or topics of texts. When *teaching vocabulary through reading*, the concordancer allows for referring to source texts, which can be a good resource for reading. With *intensive reading*, concordance vocabulary exercises associated with reading can be developed both in paper-based and computer-based formats. '*Narrow reading*' can be facilitated to enable low proficiency learners to access authentic texts by reading a number of short passages on the same topic. Short texts on the same topics can be compiled and stored in a corpus in order to ensure the recurrence of particular words and patterns.

In *strategy instruction*, the concordance-based method is also helpful in making the clue words salient. For example, students may inductively study words used as discourse markers by searching words such as '*however*' and '*known as*', and then infer how these words hint the meaning of unknown words. This is to strengthen students' *inference skills* in guessing unknown words from context clues. When students can infer or generalize rules by themselves, it seems that they are carrying out '*self-discovery learning*'. On the other hand, students may study deductively by initially studying the ways these clue words give hints to the meanings of other words, and then searching a corpus to find examples to verify whether it supports or denies the rules. This is like a researcher trying to test hypotheses as in the metaphor of '*learners as researchers*'.

In *incidental learning*, however, the concordance-based method does not play a large role in the part of classroom activities since in this approach means the students are assigned to read a lot of books. Instead, it may be helpful in grading texts according to the level of difficulty. In *teaching vocabulary through reading*, the corpus-based method is possibly applied in both bottom-up and top-down paradigms. With a bottom-up approach, it deals with the exercises of discrete elements of reading similar to the activities mentioned above in the explicit instruction. With a top-down approach, a word frequency list of the reading passage is a good starting point for discussion about the topic in order to practise overviewing or predicting skills on the text topic before reading. Vocabulary exercises may be inserted into the reading practice when feasible.

In the present study, the application of the concordance-based method is not restricted to any particular methodology. Therefore, the approach of DDL can be modified and expanded to incorporate other teaching techniques to increase the potential of the concordance-based method. In addition, the focus of the lesson can be made more flexible for facilitating students' direct access to the corpus (Gabrielatos, 2005). Accordingly, learning processes in dealing with the concordance output may vary from one situation to another, depending on the objectives of the study as well as the selected teaching techniques. With low-proficiency students, the present study adopted a deductive approach of DDL in explicitly teaching vocabulary through reading in concordance lines. This framework demands two basic skills of the students: skills in dealing with a computer concordancer to facilitate the observation of word behaviours in contexts and skills in dealing with concordances to learn vocabulary.

2.5.5 Previous application of the concordance-based method in ELT

At its early stage in ELT, the concordance-based method was applied exclusively among developers of curricula, syllabuses and materials. Recently, however, this method has increasingly applied directly in language classroom. It was not until Johns (1991) originated the approach of data-driven learning inherently associated with the concordance-based method that more empirical studies have been found. These previous studies are reviewed according to their types of work: development of syllabuses and materials, and classroom activities in order to overview the status of classroom concordancing in ELT as well as to find areas where further research is required.

2.5.5.1 Development of syllabuses and class materials

The interest in the use of authentic materials in language pedagogy has enhanced the role of corpora in language instruction because corpora are enormous resources of real language use. Moreover, the demand for specific purpose language further increases the use of corpora in order to identify specific language in particular target situations. In addition, research based on corpus evidence indicates the need to exploit corpus information in developing curricula, syllabuses and class materials. Findings from such research reveal that the standard account of certain grammatical patterns in English does not conform to those that are actually used in natural language (Conrad, 2000; and Fox, 1998). The grammatical usage of '*some*' and '*any*' is one example. In traditional grammar books, '*some*' is prescribed to be used in statements whereas '*any*' is used in interrogative and negative sentences. However, it is found from corpus-based data that '*any*' is much more frequently used in statements than the other patterns. Such discrepancy between prescribed grammatical usage and real language use has been increasingly found from corpus information. Previous studies (Fox, 1998; Willis, 1998; and Carter, Hughes and McCarthy, 1998) suggested that content selection and grading as well as materials development needs to be informed by some degree of corpus studies. It is argued that syllabuses and materials derived from concordance output in the corpus best serve pedagogical needs for guiding learners while still providing authentic and representative language.

However, the degree of text authenticity has been one controversy in the field of EFL instruction, according to Guariento and Morley (2001) and Tomlinson (2002), "One side argues that simplification and contrivance can facilitate learning; the other side argues that they can lead to faulty learning and that they deny the learners opportunities for informal learning and the development of self-esteem", (Tomlinson, 2003, p.5). On the one hand, it is considered that pedagogic simplification of real language use is necessary in order to protect learners from the apparent chaos of reality and to provide a sense of progress. In most cases, to avoid syntactic complexity, language input is constructed or composed rather than representing authentic contexts so that learners can focus their attention on the target language features (Bloor, 1998). On the other hand, the counter argument is that language inputs with composed texts over-protect learners and do not prepare them for real language use. Learners also need to be prepared for interaction in real situations. The lack of conformity makes English language in classes insufficient for preparing students to cope with their academic language in real situations. Students cannot be trained sufficiently if classroom English is learnt in one way but real language is used in another. In order for them to perform well in accomplishing academic tasks, language input must be similar to real language occurring in authentic texts.

At present, findings from large-scale corpora have been utilized to inform syllabuses and materials development. Word lists as discussed in 2.1, for example, are based on huge corpora which help define goals for vocabulary learning. In addition, Flowerdew (1993) demonstrates how to exploit a small corpus to draft a syllabus for a particular domain whereas Fuentes (2001) describes how the results of the contrastive study of lexical items in small specific corpora can become the basis for teaching/learning ESP at the tertiary level. More books are making use of corpus data reflecting actual language use rather than using non-authentic input. Stevens (1991a) develops vocabulary materials derived from relevant authentic texts in the corpus whereas Thurstan and Candlin (1998) used concordancing programs to develop academic materials for independent learning. Class exercises and activities in corpus-based materials are continuously designed. Typical exercises include vocabulary building, exploration of grammar and discourse features of texts. Specific description for designing classroom materials and exercises can be seen in the work of Tribble and Jones (1990), Fox (1998), Willis (1998), and Thurstan and Candlin (1998). In such works, concordancers exemplify how to highlight grammatical patterns, collocations and pragmatic aspects of lexical items. They are used as one form of text manipulation. The concordance output can be easily converted into teaching materials, either by editing with a word processor or by old-fashioned scissors and paste methods. These studies provide useful frameworks for the development of syllabuses and class materials.

2.5.5.2 Classroom activities

Current teaching methods have emphasized the importance of aiding learners to make effective use of the resources in order to facilitate self-discovery. Therefore, learning activities in which learners can access and make use of corpora in language learning have become more popular, and the use of such hands-on corpus-based activities in classroom is encouraged. This type of application can be summarized in two main aspects: a soft version and a hard version (Gabrielatos, 2005). In a '*soft version*', learners do not have a direct contact to language corpora, only using the paper-based materials derived from corpora which are prepared by the teachers (Sriphicharn, 2002; Fuentes, 2001; Fox, 1998; Willis, 1998; Carter, Hughes and McCarthy, 1998; Thurstan and Candlin, 1998; Flowerdew, 1993; Stevens, 1991b; and Tribble and Jones, 1990). On the other hand, in a '*hard version*', learners conducted hands-on activities to utilize corpus information for their learning (Chan and Liou, 2005; Kaur and Hegelheimer, 2005; Hadley, 2002 and 2001; Cobb and Horst, 2001; Todd, 2001; Cobb, 1997 a and b; and Somogyi, 1996).

Earlier related works in classroom concordancing were concerned mostly with evaluating the concordance-based materials or programs; and/or giving practical frameworks, guidelines and suggestions for applying the concordance-based method in the classrooms, rather than providing empirical evidence. Owen (1997) and Fox (1998), for example, advocate the use of corpora as a reliable reference. They argue for both teachers and learners to directly consult evidence in a corpus, rather than relying only on what is grammatically prescribed. According to them, differences are found between language use in classrooms and the use in the real world. As being evident from the corpus, there are more varieties of real language use than grammatical usage in classroom. Thus, consulting evidence in a corpus is much more reliable.

An application of concordances to ELT classroom activities is proposed by Tribble and Jones (1990). They trace the history of concordances from the 13th century when concordancing was originally a paper-based method of analyzing culturally valuable texts, and describe the features and the application of classroom concordancing with clear illustrations so that ELT teachers with no experience in this program can easily understand them. They also illustrate the utilization of concordance output in designing teaching materials as well as hands-on activities.

Specific descriptions of classroom activities can be seen in the works of Johns (1991), Fox (1998), and Willis (1998). In these works, concordancers are used to highlight grammatical patterns, collocations and pragmatic aspects of lexical items. They also serve as one form of text manipulation. All these researchers agree that learner training for concordancing application is necessary to prevent learners' confusion and prepare them to explore tasks. Some examples of training exercises are also provided. It is believed that once learners have become confident at using concordancers, they can develop their own research project. All their sample exercises provide good models for the practical application at a starting point.

Unlike computer concordancing, Willis (1998) suggested hand-concordancing, with concordances written on the blackboard. This type of concordance did not need the assistance of computer technology. The corpus derived from texts familiar to the learner from which linguistic patterns were selected by learners and used to compile concordances on the blackboard. She called it a '*pedagogic corpus*'. Similarly, Todd (2001) also used web-based texts for students to do hand-concordancing. The students '*self-selected*' the web-based texts to carry out hand-concordancing on their error words in report writing and then, tried to induced the meaning of these words for self-correcting these errors. It was found that the students could induce valid patterns in the carrying out of self-correction.

It was not until Johns (1991) originated the approach of data-driven learning inherently associated with the concordance-based method that more empirical studies have been carried out. Stevens (1991b) conducted a controlled experiment on students' offline concordancing. The students' task was to recall a known word to fill a gap in a text, either a gapped sentence or a set of gapped concordance lines for a single word. It was found that students could retrieve a word from memory more successfully when cued by the concordance lines. John (2001) used a parallel corpus with a concordancer. The study was aimed at determining how students dealt with the parallel corpus and what conclusions they come to when comparing the two languages, and in particular when investigating lexical items.

One distinctive series of studies was conducted by Cobb (1999a and b; and 1997a and b) as well as Cobb and Horst (2001). He developed a computer concordance-based tutoring program called *PET 200* in his doctoral study and the later version of *PET 2000*. These programs were tested with undergraduate students at Sultan Qaboos University in Oman to assess their learning effects on students' definitional and transferable knowledge. Hands-on activities were used for students to access the given corpus in order to accomplish the assigned tasks independently. Target wordlists were set for students to self-select words they would like to learn. Findings from Cobb's series of studies consistently showed that the concordance-based method could increase students' vocabulary knowledge significantly in a short time, especially transferable knowledge. In other words, hands-on concordancing helped them acquire more transferable knowledge.

Concordances were also successfully applied in academic writing (Todd, 2001; Tompson and Tribble, 2001; and Webber, 2001). Concordancers were used as references for students to discover their own weaknesses or errors in writing and then improve them. Webber (2001) advocated a concordance and genre-based approach to academic essay writing for non-native students. Students were required to identify some structural characteristics of a legal essay. Then they used concordances to explore possible correlations between the generic structures and particular lexical items. Next they were asked to rewrite an essay. Thomson and Tribble (2001) focused on citations from a corpus of doctoral theses. They introduced a number of class activities in which students conducted their own analyses of citation practices in small corpora, to develop genre awareness.

In two case studies of Hadley (2001 and 2002), data-driven learning was introduced to Japanese students using the paper-based *Concordance Sampler 2* as class materials. The students were exposed to a large amount of the pre-selected concordance materials to identify regularities in data for application to writing tasks. In both studies, students' attitudes were positive towards DDL, although the concordance materials were rated as '*difficult*' due to a large amount of data and the difficulty level of the materials.

In more recent studies, Chan and Liou (2005) and Kaur and Hegelheimer (2005) used web-based concordancers, *TOTALrecall* and *Compleat Lexical Tutor*, to investigate the learning effects on collocation learning and transfer of word knowledge to writing tasks respectively. Significant gains from the web-based concordancing were found in Chan and Liou's study but students' retention of knowledge was weaker although the residual effect was significantly high. In Kaur and Hegelheimer's study, students' performances in vocabulary tasks of the experimental group were not a significantly different from those of the control group. However, they outperformed the control group with significantly different transfer of vocabulary knowledge applied to the writing tasks.

Concordance-based activities were also found in Thai educational contexts in two classroom-based studies of Sripicharn (2002) and Todd (2001). Both studies were conducted with university students. In Sirpicharn's study, the use of DDL or classroom concordancing was evaluated in three aspects i.e. its learning effects, learners' attitudes and learners' performance during the use of classroom concordancing. Concordance materials were used in the experimental group about 10-15 minutes near the end of each lesson whereas the control group used non-concordance materials. It was found that students were able to make useful generalizations and adopt DDL in dealing with the concordance data. Although there was no marked difference in the learning effect between concordance and non-concordance methods, students' attitudes towards classroom concordancing tasks were positive. In a similar vein, in Todd's study, the method of self-selected hand-concordances was used for students' self-correction. Errors in students' written assignments were highlighted for students to correct themselves by comparing their use with that occurring in the concordances they selected from the Internet. It was found that the students were able to do self-correction by using self-selected concordances and their attitudes towards the method were positive.

2.6 The Present Study

Based on the literature review in this Chapter, there does not exist a great amount of empirical evidence concerning classroom concordancing due to its recent introduction to ELT. Therefore, there is plenty of research space in this area. The present study is distinctive from other previous studies at least in five aspects. Firstly, it has a different aspect of classroom application. In previous works, the method was mostly applied as a referential tool (Chan and Liou, 2005), as parts of the courses or supplementary to other teaching methods (Sriphicharn, 2002) for correcting errors in report writing (Todd, 2001) and/or as self-access or tutorials (Cobb, 1999a and b; and Cobb, 1997a and b). Only Kaur and Hegelheimer's (2005) study was implemented in regular class time with the focus on using concordances in the transfer of academic word knowledge to writing tasks. In contrast to these studies, the concordance-based method in the present study is applied as the main method fully integrated with the whole regular course in one academic semester.

Secondly, concordancing facilities in the present study are also different. Previous studies with hands-on concordances were mostly conducted with experimental or specifically designed concordancing programs: Tom Cobb's web-based Compleat Lexial Tutor in Kaur and Hegelheimer (2005) to learn verb-noun collocations; PET-2000 in Cobb (1999a and b) and PET-200 in Cobb (1997a and b) to learn words for Cambridge Preliminary English Test (PET); and TOTALrecall of Liou, Chan and Yeh et al. in Chan and Liou (2005) to learn academic words for writing. In contrast, the present study uses a simple freeware program, WCONCORD, with a small specialized corpus specifically compiled from engineering academic texts to select target words as well as to design learning materials and activities. This does not only make the concordancing application more practical in normal classroom practices, but it also makes the concordance-based lessons in the present study distinctive because target words can be contextualized within academic texts in engineering. Therefore, the students can learn these words in their familiar contexts, which is likely to encourage them to learn. Very few works have been done in developing concordance class materials for technical or engineering students, even in traditional paper-based textbooks.

Thirdly, the method of word selection and the designs of concordance-based materials and activities are based on various techniques from current teaching in order to enhance the effectiveness of the concordance-based method as well as to make its application conform to normal classroom practices. Although the method is related to an approach of Johns' (1991) '*data-driven learning*', Gabrielatos (2005) points out that its application is not necessarily restricted only to any single teaching methodology since it can be compatible with all methodologies that accept explicit learning/teaching. In addition, learning materials and activities are designed by using the contexts of engineering to serve the needs of the students in the study although the focus is on learning academic words in general. So far, these designs have not been found in any published papers.

Fourthly, the empirical data derived from the present study are distinctive from those of other previous studies in terms of learning outcomes. The study is aimed at dealing with three levels of lexical knowledge: definitional knowledge, transferable knowledge and retention rates. Compared to other vocabulary research, although Cobb's studies (1997a and b), also dealt with learning gains in definitional and transferable knowledge, the retention rates of such knowledge remained unknown since most of his studies were mostly conducted with one group of students, using only the pretest and the immediate posttest. In the present study, however, retention rates of both knowledge types after a month of the study are also estimated with a delayed posttest in comparison with those of the conventional teaching method. In addition, the focus of the present study is on academic vocabulary for academic reading, which included high frequency words in the engineering corpus whereas the focus of Cobb's studies was on vocabulary for PET. Regarding another study (Kaur and Hegelheimer, 2005) dealing with the transfer of academic knowledge, the focus of the studies are not identical since the present study focuses on transferring vocabulary knowledge to new academic reading contexts whereas the other study focused on transferring academic vocabulary to writing tasks.

The fifth aspect is that this present study explores the first classroom-based research, using hands-on concordancing in Thai educational contexts. So far, two classroom-based studies (Sriphicharn, 2002; and Todd, 2001) in Thailand have been published. Both studies, however, used paper-based concordances and hand-concordancing to supplement other teaching methods, not as the main method. Therefore, the present study provides original empirical data of using hands-on concordances as the main method of teaching vocabulary for academic reading in Thai classroom contexts.

Finally, many previous classroom-based studies were conducted with one group of students (Chan and Liou, 2005; Hadley, 2001 and 2002; Todd, 2001; Cobb and Horst, 2001; and Cobb, 1999a; Cobb 1999a and b), regardless of a control group. Therefore, the applications of the concordance-based method in these studies were not investigated in comparison with those of other teaching methods. Only a few studies have aimed at making such comparisons – the applications of a concordancer together with an online dictionary and only the online dictionary (Chan and Liou, 2005), the paper-based concordance and non-concordance materials (Sriphicharn, 2002), and a concordancing program and a wordlist with a dictionary (Cobb, 1999b). To provide empirical evidence in this gap, the present study is aimed at comparing the learning effects of the concordance-based method and the conventional teaching methods on learning vocabulary through reading, using the contexts in reading concordance lines in the former method and reading sentences or passages in the latter method.

To summarize, the present study attempts to bridge the gaps in this area of research. The effects of a hands-on concordance-based method are used as the main method in comparison with the conve0ntional teaching method on vocabulary learning in the whole regular course. The application of a simple concordancer and a small specialized corpus can provide a practical framework for most EFL academic situations, especially with engineering students. The findings of the study originally provide details about the effects of using the hands-on concordancing method in Thai classroom contexts. Accordingly, these findings of the study contribute to the area of teaching English for Academic Purposes (EAP) in providing useful implication as well as empirical evidence in the areas where research is lacking.

2.7 Summary

In this chapter, academic vocabulary is described in terms of word classification, lexical thresholds for academic reading and the assessment of vocabulary size. These matters are very useful in pedagogy for identifying and selecting target words suitable for the objectives of the study as well as in designing the instrument properly for assessing knowledge of the target words. Previous frequency-based studies have classified words into four types: high frequency words, academic words, technical words and low frequency words. Apart from word classification, frequency-based lexical thresholds have been established for academic reading, reading comprehension and vocabulary size. Currently, the established wordlists of the GSL and the UWL/AWL, which consist of around 3,000 word families, are widely acceptable as a lexical threshold for academic reading in all disciplines. As a result, measures assessing such vocabulary have been developed both in the forms of receptive and productive versions.

The literature on vocabulary acquisition and retention provides insights into how to enhance students' vocabulary learning and retention. In this topic, two vocabulary knowledge types: definitional and transferable knowledge are described: the former is knowledge of meaning whereas the latter is concerned with the ability to transfer lexical knowledge to new contexts. Regarding the nature of vocabulary acquisition and retention, learning particular words is incremental. To learn a word well is to learn various aspects of word. Thus, meeting a word only once is not sufficient for that word to be learnt properly. At the first encounter, definitional knowledge usually takes place since it is at a superficial level of knowledge concerned only with recognizing word forms and memorizing their meaning. For knowledge transfer, however, that word must be accumulatively learnt. Quality of lexical knowledge takes place and is strengthened through meeting the to-be-learnt words in a variety of natural contexts several times before such knowledge can be transferred to new contexts. Therefore, learning words in multiple contexts with a sufficient number of word encounters seems to be essential for vocabulary acquisition.

In ESL/EFL contexts, the status of vocabulary has changed over time before it becomes prominent at present. The vast improvement of corpora greatly contributes to vocabulary studies. Findings from corpus-based studies have reoriented perception on nature of language and vocabulary, and have made the status of vocabulary more distinct. Three teaching approaches have been developed with the increasing attention to vocabulary instruction, ranging from no instruction to formal instruction. The advantages of these approaches can be integrated into '*teaching vocabulary through reading*' and such integration seems to be the best approach to obtain optimum vocabulary learning.

With the rapid advancement of computer corpora, the corpus-based method was introduced to language instruction with a new promising direction of pedagogical practice. Frequency-based lexical thresholds and reliable wordlists are established. Words are selected for designing syllabuses, materials and classroom activities in a much more systematic way. Despite being new, the method conforms well to principles and methods of current teaching/learning approaches. It is useful not only in arranging optimal conditions for vocabulary acquisition, but also in arranging classroom activities. However, empirical evidence of its application in classroom is not abundant and models for such application with various levels of students are still needed. The present study is an attempt to apply the concordance-based lessons with undergraduate students with low proficiency. It is aimed at providing a practical framework as well as empirical evidence on the learning effects of the method, which currently are very rare.

CHAPTER III
RESEARCH METHODOLOGY

3.1 Introduction

This chapter describes the research methodology of the study. The description begins with research design, population and sample, and stages of research. After that, the pilot study is briefly described with results and suggestions for improving the main study. The description of the materials and instruments are divided into three main topics: the method of corpus compilation and word selection, classroom materials and research instruments. Regarding the corpus compilation, two main components i.e. the Engineering Corpus and two concordancers, are described. Then, the frequency-based method of word selection is explained on how to construct a target wordlist and weekly wordlists used in designing classroom materials and assessing instruments. The description of the classroom materials is concerned with the designs and validation of a lesson plan, handouts and activities in two version, and review tasks. That of the research instrument involves the design and validation of the tests, students' logs, teacher's field notes, questionnaires and interviews. Finally, the methods of data collection and analyses are presented.

3.2 Research Design

The study was conducted in the form of '*a matching-only pretest-posttest comparison group design*' (Fraenkel and Wallen, 2000). In this design, an experimental group was compared with a comparison group by matching students in pairs in terms of their proficiency levels of vocabulary. The design was represented as in Figure 3.1.

Figure 3.1: Representation of a research design

Experimental group	O_1	M	X_1	O_2	O_3
Comparison group	O_1	M	X_2	O_2	O_3

In this case, the Xs were independent variables referring to the teaching methods used in the study. The X_1 represented the concordance-based method whereas the X_2 referred to the conventional teaching method, in which vocabulary were taught through reading and vocabulary exercises without concordances. The M referred to the fact that the participants in each group had been matched according to certain variables i.e. their levels of vocabulary proficiency. The Os meant an observation whereby the O_1 represented the pretest, the O_2 referred to the posttest, and the O_3 meant the delayed test. The students' scores on these measures were dependent variables of the study. In the experiment, most learning conditions were similar in both groups. The difference was due to the demands of the different teaching methods used in the study. Table 3.1 summarizes the similarities and differences between them.

Table 3.1: Similarities and differences between the two sample groups

Similar Conditions
1. Teacher
2. Syllabus and lessons
3. Target wordlist
4. Period of time
5. Review tasks
6. Pretest/Posttest & delayed test

Different Conditions		
	Experimental group	**Comparison group**
Method	Concordance-based	Conventional
Classroom	Language laboratory	Normal classroom
Materials	Handouts with concordance information	Handouts without concordances
Activities	Hands-on & paper-based	Paper-based only
Teacher's roles	Supporter and facilitator	Knower

On the one hand, most learning conditions of both groups were the same. The researcher was the teacher teaching both groups using the RMUTL syllabus of Technical English Reading in one academic semester i.e. four months. The course description focused on reading articles, journals and textbooks related to the students' specialized fields. The vocabulary component was integrated, which was aimed at increasing vocabulary knowledge for academic reading. The same target wordlist was set as a learning goal for both groups and each weekly lesson focused on the same set of target words. In addition, each set of the review tasks and the tests were administered to both groups.

On the other hand, the differences between both groups were due to the demands of the used methods. The experimental group was exposed to '*a concordance-based method*' whereas the comparison group was taught with '*a conventional method of teaching vocabulary through reading'*. The differences included classroom settings, learning materials and activities. The experimental group studied in a multimedia language laboratory equipped with sufficient computers for facilitating hands-on activities. However, the comparison group studied in a normal classroom using a whiteboard and an overhead projector. Another difference was the formats of learning materials. The handouts used in the experimental group consisted of linguistic items mostly in a concordance format including instructions used as guidelines for students to accomplish the given tasks while dealing with corpus information. In the comparison group, the handouts were in a traditional paper-based format without concordances. These handouts included reading passages with reading and vocabulary exercises. The lessons for both groups were parallel in content but the presentation and practice stage was designed in different versions. The experimental group was trained through paper-based and hands-on activities to deal with corpus information with guidance from the teacher and the handouts. However, the comparison group was taught by the teacher in presenting, explaining, clarifying, illustrating and providing practice on language items. Both groups were assigned to do exercises or tasks outside class.

3.3 Population and Sample

3.3.1 Population

The population of the study consisted of about 1,000 engineering undergraduate students at Rajamangala University of Technology Lanna (RMUTL), Tak Campus. The population was students who studied in two main disciplines, namely, Engineering and Industrial Education. Students in both disciplines shared a lot of interests in their specialized fields since the students studied the same foundation courses, differing only in regard to their specialized subjects. In this paper, the students from both disciplines are referred to as engineering students. RMUTL engineering students were typically homogeneous in terms of age, gender, first language, level of present education and previous English study. All students were Thai between the ages of 18-25. Nearly all of them were males with very few females. These students were assigned to different classes according to their specialized fields of study, namely Electrical Power Engineering, Mechanical Engineering, Industrial Engineering, Civil Engineering, Computer Science and Telecommunication

Technology. In four-year undergraduate programs, the students studied the same English courses: two Foundation Courses, Technical Reading, and either Conversation or Technical Writing. Before entering the universities, most students graduated from local secondary schools or technical colleges whereas the others were from nearby provinces in the northern areas of Thailand. In general, their previous English study was not much different. English classes were the main source of their English exposure with little chance of using English outside classrooms.

3.3.2 Samples

The samples of the study consisted of 52 RMUTL engineering students who were studying in the third year of their undergraduate programs in the academic year of 2005. All students were studying the same course of Technical English Reading for one academic semester or four months. The participants were selected with a purposive sampling method, not randomly selected, since they had already been allocated into classes. The two intact groups were obtained according to the availability of the classes. One group was randomly assigned to be an experimental group while the other represented a comparison or control group. To equate both groups, the students were matched in pairs according to their English vocabulary proficiency based on the pretest scores. Then, group equality was statistically verified by comparing the pretest mean scores using the *independent-sample t-test* of the SPSS program at the significance level of 0.05.

In the study, the experimental group consisted of 28 students in Electrical Power Engineering whereas the comparison group included 26 students in Industrial Engineering. Since the students were matched in pairs between groups, there were a total of 26 pairs i.e. 52 students in the study. As the number of the students in each group was nearly the same, only two students were excluded from the study. However, the pretest scores of both groups were not significantly different at the beginning of the study. When the students were matched in pairs, the difference in each pair was not more or less than three scores. It was found from mean comparison that both groups were somewhat comparable on their vocabulary proficiency with the mean difference at 0.31, $t = 0.809$, and $p > 0.05$ as illustrated in Table 3.2.

Table 3.2: Mean comparison of pretest scores in the main study

	t-test for Equality of Means				
	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference
Pretest: Equal variances assumed	.243	50	.809	.31	1.267

$p > 0.05$

Specific information of the samples was obtained from the questionnaire (see Appendix B) administered at the beginning of the study. The questionnaire was aimed at eliciting the details of all participants in four main aspects: students' personal information, previous English study, reading background, and computer skills. The details of the samples are described as follows.

3.3.2.1 Personal information

In general, the participants had a lot in common. They were of an average age of about 20. More than half of them graduated from local schools or colleges whereas the others were from nearby provinces in the northern parts of Thailand. Their overall academic performance was average, according to their last Cumulative Grade Point Averages (GPAs) which were mostly clustered around 2.50 – 3.00 out of 4 points. Only one participant in the experimental group was female but she was excluded from the study because of her much higher scores on the pretest than the others. Therefore, all participants in the study were male students.

3.3.2.2 Previous English study

Most students i.e. 83.3% started learning English at primary schools whereas 13% started at kindergartens and about 3.7% started at secondary schools. The average length of previous English study ranged from 10 to 13 years. Only six students occasionally studied with English-native teachers whereas the others had never done so. Before the experiment, they had studied two English Foundation Courses, in which only three students got grade A whereas the others got grades B, C and D at 32%, 36% and 30% respectively. In terms of their attitudes, the students on average liked studying English. Their main motivation for studying was for studying in higher education and for improving their job prospects. Their past learning habits were fairly good. They usually attended English classes, somewhat actively joined class activities and could usually complete assignments in time and were rarely absent or late. However, they seldom had any chance to practise using English outside the classroom. The students rated their own English proficiency as good in reading and writing skills but poor in speaking and listening skills.

3.3.2.3 Reading background

About 70% of the students liked reading. They often read Thai newspapers, textbooks, advertisements, comics and cartoons. As for English texts, however, most students read at a sentence level and only 15 % of them read English texts longer than one page at a time and mostly with texts assigned in their specialized subjects. They indicated that the causes of their difficulties in reading were in the area of vocabulary and text organization.

3.3.2.4 Computer skills

In the experimental group, except for one student, all of them liked using computers and often used them in their daily lives. About 70% of the students had their own computers at home whereas the others usually accessed the computers at the university or computer-service shops. The students could use computers fairly well. The programs they mostly used were computer games, Microsoft Word, Power Point, Internet Explorer, Excel and CAD programs. These programs were often used for playing games, typing assignments, accessing websites and using technical programs. They sometimes used computers for e-mailing, chatting online or using self-study programs. Although all students had experience in applying computers to study different subjects in the forms of CD-ROMs and Internet webpages, not many of them used computers for studying English. None of them knew about language corpora.

3.4 Stages of Research

The Technical English Reading course used in the experiment was typically available only in the first semester of each academic year. Therefore, the procedure of the study was planned accordingly. The pilot study was implemented in the first semester in the academic year of 2004 whereas the main study was in that of 2005.

The main study was conducted within four months or one semester. After that, the data were analyzed and interpreted and the findings were reported.

3.5 Pilot Study

Before the main study was conducted, a pilot study was implemented to try out some concordance materials as well as to assess problems or difficulties which might arise during the experiment. The trial of materials was necessary because the concordance-based method was completely new in the experimental setting. Therefore, the implementation of the pilot study was expected to obtain insights and guidelines of how to design and improve the lessons including all necessary materials for the main study. In addition, problems concerning the use of them could be identified and tackled before the implementation of the main study. In this topic, the implementation of the pilot study is briefly described (see further details in Appendix C) with results and suggestions made for the main study.

The samples in the pilot study consisted of 21 pairs of RMUTL undergraduate engineering students similar to those in the main study. Before the pilot study, a small corpus of around 100,000 running words was compiled from academic texts in engineering. In text selection, the texts were randomly selected without grading or balancing in terms of text types and topics. After the corpus was compiled, 840 target words were selected on the criteria that they were words included in the GSL or the AWL (see these wordlists in Appendix D) which were also high frequency words in the corpus with at least 8 occurrences. Then, the resulting target wordlist was divided into 12 weekly wordlists, i.e. 70 words per list, used for designing weekly lessons and related materials. Four parallel lessons were designed in two versions: one with concordance information and the other without concordances. The lessons were planned with a strategies-based plan. The target words were presented in language input, activities and exercises.

A number of difficulties occurred in designing and implementing these lessons and materials. Firstly, the process of corpus compilation did not facilitate the designing practices and the corpus texts were very difficult for the students to read. Secondly, the number of target words was too large to cope with in each weekly lesson. Thirdly, language presentation in classes are not motivating, especially in the concordance-based group since the materials did not facilitate learning by linking various aspects of words to be learned together. Fourthly, the students were not properly prepared for the concordance-based method before the lessons started.

It was found that the students could not properly deal with the concordance outputs which seemed overwhelming and confusing for them due to the absence of learner training before the study. The students reported that the difficulty was on dealing with the linguistic information in the corpus. Unfamiliar words in contexts were so many that they were not helpful in interpreting the focused text. They thought that the main cause was their insufficient proficiency in English. However, their attitudes towards the method were fairly positive. They realized that the method was useful for studying English but they needed longer training before they could deal with it adequately.

According to these problems, suggestions were provided for the main study on corpus compilation, the number of target words, lesson plan, and the provision of learner training. Firstly, a corpus had to be carefully re-compiled with grading and balancing on text types and topics. To reduce the difficulty and facilitate reading comprehension in concordances, text topics should be concerned with fundamental knowledge and clustered in a few particular topics. Secondly, the number of target words had to be reduced in order to obtain more time for sufficient practice. Thirdly, the lessons should be planned according to particular themes in order that various aspects of target words could be learned together. Finally, learner training should be provided step by step.

3.6 The methods of a corpus compilation and word selection

Based on the framework and guidelines suggested in the pilot study, a new corpus was specifically compiled for the main study as an important linguistic resource for selecting words and designing lessons, classroom materials, and research instruments. After that, words were selected to establish a new target wordlist used as a goal for designing all lessons, materials, tests and tasks. This topic describes the corpus compilation of the Engineering corpus, freeware downloadable concordancers – *WCONCORD* and *AntConc*, and the frequency-based method of word selection.

3.6.1 The Engineering Corpus

The corpus used in the main study was entitled the '*Engineering Corpus*'. It was specifically compiled from academic texts in engineering fields. This corpus was used as a main linguistic resource for word selection as well as for designing all lessons, materials, activities, tasks and tests. In compiling the corpus, main considerations were on text selection as well as on a corpus size in order to make the corpus somewhat balanced and representative. In text selection, text topics and types were determined in order to obtain homogenous data clustered with typical recurrent features of a target language while the size of the corpus was kept small for making the corpus information manageable for the students, but still sufficient for particular recurrent features to be noticeable (cf. Aston, 2001).

3.6.1.1 Text selection

Text selection was based on sources recommended by RMUTL engineering instructors by using the questionnaire illustrated in Appendix E. Most texts in the corpus were from web-based resources (Aston, 2002). Only texts with topics concerning the fundamental knowledge of engineering such as *energy, technical drawing, engineering materials* etc. were selected in order to reduce a number of technical terms in the texts as well as to make the corpus information more readable for the students. Moreover, to obtain homogenous data in particular fields, Aston (2001) suggest that text topics should be clustered in particular areas. Accordingly, text topics in the present study were divided into four main areas which are common to the students. These topics included common interests in engineering, electrical power and electronics, mechanics and automotives, and computers and IT.

Topics concerning '*common interests in engineering*' were also restricted to five issues i.e. engineering fields, physics, materials, drawing and general matters. Topics such as '*electrical power and electronics*' and '*mechanics and automotives*' involved fundamental knowledge in the fields. The last topic, '*computers and IT*', involved the issues of using computers and IT in general. Apart from the text topics, only five text types were used: textbooks and handouts, manuals and handbooks, articles and news, advertisements, and abstracts of articles and research. Balance of text topics and text types were taken into consideration. Details about text topics and text types in the Engineering Corpus are illustrated in Appendix E.

3.6.1.2 Corpus size

In the Engineering Corpus, the length of each selected text ranged from half a page to three pages. However, most texts were kept not more than one page long. All texts were saved in the main corpus called '*Total'*. To reduce the overwhelming amount of data for students, Aston (2002) suggests that dividing a corpus into sub-corpora is a good strategy because a small size of each sub-corpus is more manageable and available to be selected according to the focus of the study. In the present study, all information in this main corpus was divided and kept in five sub-corpora, namely: Textbooks, Manuals, Articles, Advertisements and Abstracts. The sub-corpus '*Textbooks'* included texts from textbooks and handouts used for studying fundamental subjects in engineering. As this type of texts was more frequently used in academic study, the sub-corpus '*Textbooks*' was bigger than the other four sub-corpora. It consisted of 200 computer files with 50 files concerning topics in each of four specified areas i.e. common interests, electrical power and electronics, mechanics and automotives, and computers and IT.

The other sub-corpora were '*Manuals*', '*Articles*', '*Advertisements*' and '*Abstracts'*. These sub-corpora included text types as signified by their names. The sub-corpus '*Manuals*' consisted of texts from manuals and handbooks to give instructions or suggestions on how to do something. The sub-corpus '*Articles*' contained news and articles in engineering journals, magazines and newspapers. The sub-corpus '*Advertisements*' included advertisements of engineering products. The last sub-corpus '*Abstracts*' contained abstracts of articles and research published in online journals or webpages. Each of these sub-corpora contained 140 computer files with 35 files concerning topics in each specified area. As a result, the main corpus '*Total*' or '*The Engineering Corpus*' consisted of 760 files in grand total, containing around 500,000 running words with about 24,000 word types. Statistical information of the Corpus is shown in Table 3.3.

Table 3.3: Statistical information of the Engineering Corpus

Subcorpora	Text Types	Topic Areas	Files	Words	Word Types
Textbooks (39.56%)	Textbooks & Handouts	Common Interests	50	39462	4830
		Electrical Power & Electronics	50	59248	5826
		Mechanics & Automotives	50	48307	5717
		Computers & IT	50	53167	6626
		Total	**200**	**200184**	**12975**
Manuals (16.43%)	Manuals & Handbooks	Common Interests	35	22044	3773
		Electrical Power & Electronics	35	24540	3366
		Mechanics & Automotives	35	20104	3007
		Computers & IT	35	16457	2498
		Total	**140**	**83145**	**7482**
Articles (28.13%)	Articles & News	Common Interests	35	47678	6324
		Electrical Power & Electronics	35	35378	5517
		Mechanics & Automotives	35	41186	5512
		Computers & IT	35	18121	4059
		Total	**140**	**142363**	**12480**
Advertisements (9.4%)	Advertisements	Common Interests	35	10669	3080
		Electrical Power & Electronics	35	12093	3166
		Mechanics & Automotives	35	13362	3390
		Computers & IT	35	11455	2850
		Total	**140**	**47579**	**8111**
Abstracts (6.47%)	Abstracts of articles & research	Common Interests	35	11704	3137
		Electrical Power & Electronics	35	6572	1934
		Mechanics & Automotives	35	7388	2045
		Computers & IT	35	7096	2105
		Total	**140**	**32760**	**6066**
The whole Engineering Corpus		**Grand Total**	**760**	**506031**	**24725**

3.6.2 Concordancers

Two concordancers were used in the study i.e. '*WCONCORD 2.0*' and '*Antconc 3.0.1*'. Both programs were freeware which could be downloaded from the Internet. *WCONCORD* was available at http://www.linlit.tu-darmstadt.de/downloads/wconcord.zip whereas *Antconc* could be downloaded from http://www.antlab.sci.waseda.ac.jp/software/antconc3.0.1.exe. *WCONCORD* was developed in 1996 by Zdenek Martinek from West Bohemia University in Pilsen (Czech Repulbic) and Les Siegrist from the Technische Hochschule Darmstadt in Germany. *Antconc* was released in 2005 with the development of Laurence Anthony from the Center for English Language Education in Science and Engineering (CELESE), School of Science and Engineering at Waseda University in Japan.

Both programs were very user-friendly and suitable for beginners with little or no experience with this type of program. They could operate basic functions of general concordancers very well in building word frequency lists, displaying statistical information, searching words and collocations, sorting outputs, displaying *KWIC* concordances, displaying source texts, and manipulating outputs. Nevertheless, one limitation of *WCONCORD* was in its counting ability. The program would stop counting after around 16,000 lexical items. This made statistical information of a corpus that has more than 16,000 lexemes inaccurate, and not all concordances of the searched words could be displayed. Unlike *WCONCORD*, *Antconc* was more accurate in counting word frequency and more capable of displaying all concordances of the searched words. However, the concordance display of *WCONCORD* looked much simpler for beginners in observing word contexts than that of *Antconc* as seen in Figures 3.2 and 3.3 respectively.

Figure 3.2: A concordance display of *WCONCORD*

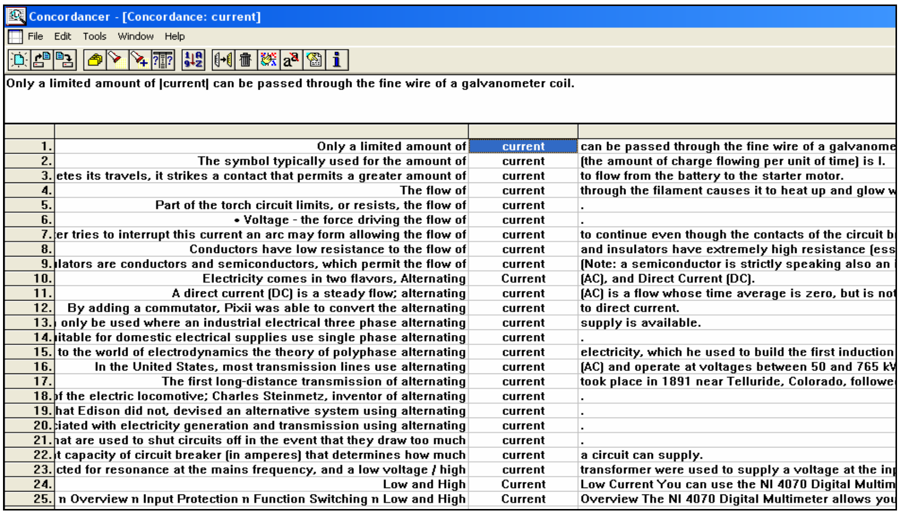
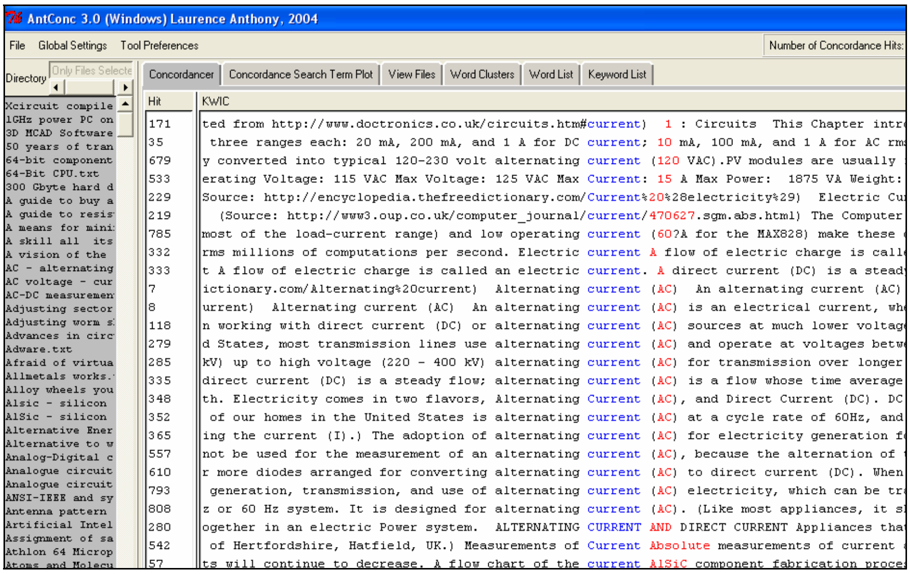


Figure 3.3: A concordance display of *Antconc*



In the study, therefore, *Antconc* was used by the teacher in selecting target words, designing lessons and preparing materials whereas *WCONCORD* was mostly used in classroom activities for training students to deal with corpus information. When students became more familiar with the operation of *WCONCORD*, they were encouraged to try using *Antconc*.

3.6.3 Word Selection

In the study, target words were identified to meet the goal of teaching academic vocabulary. These target words were aimed at words necessary for coping with academic texts as well as words frequently occurring in engineering academic texts. Thus the target words were selected on a frequency basis according to the following criteria: words in the lists of the GSL and the AWL, and words with high frequency i.e. at least 15 times in the Engineering Corpus. Two wordlists of the GSL and the AWL were set as '*reference lists*' since both lists together were regarded as lexical thresholds for academic reading as discussed in 2.2.2 in Chapter 2. These lists were used as criteria for selecting target words in a more manageable size (see Appendix D). In word selection, a word frequency list was built from the Engineering Corpus to check against the reference lists of the GSL and the AWL. The focus was more on the lexical words whereas most function words such as articles, pronouns, auxiliaries, prepositions and conjunctions were omitted. However, some function words which might pose problems to students such as '*despite, furthermore, regarding, except*' were also included in the target wordlist.

To select target words, words in the top ranks in a word frequency list of the Engineering Corpus were checked as to whether they were also words in the reference lists. If they were, the next consideration would be on whether they were words unknown by the students. Words predicted as students' known words were excluded whereas words predicted as unknown and useful would be included in the target wordlist. At this stage, teacher's discretion was important for determining students' known or unknown words by relying on her experience of teaching students at a similar level. The lexical word '*power'*, for example, was a word in the GSL and appeared at a high rank on the frequency list with 1,694 occurrences. However, this word was known well by the students as referring to '*electricity or energy*' and this was the only meaning found in the corpus. Therefore, it was excluded from the target wordlist. On the other hand, the word '*current*' was also known well by the engineering students as referring to '*movement of electricity*'. However, its other sense of '*at present or now*' was also found surprisingly in the Engineering Corpus and it was uncertain that students knew this sense of the word. Therefore, the word '*current*' with 812 occurrences in the Engineering Corpus was included in the target wordlist although it occurred less frequently than the word '*power*'.

3.6.3.1 Target wordlist

The resulting wordlist formed a '*target wordlist*' for vocabulary study in one semester. Therefore, the number of target words in the main study included 480 headwords, all of which were words in the GSL or the AWL with high frequency in the Engineering Corpus i.e. not less than 15 times (see Appendix G). With a frequency basis in word selection, the target wordlist was justified on the grounds that the words to be studied were necessary for academic reading and found often in engineering academic texts. This was one way to ensure that learners would get the best return for their vocabulary learning efforts

After the target wordlist was created, target words were used in designing weekly lessons, pretest/posttest and delayed test, and review tasks. The distribution of the target words in each practice is summarized in Table 3.4 whereas these distributed wordlists are illustrated in Appendix G.

Table 3.4: Distribution of target words

Items	**No. of items**	**No. of words in each item**	**Total No. of words in each type of items**	**No. of occurrences of each word in the Engineering Corpus**
Target wordlist	1	480	480	At least 15 times
Weekly Wordlists	12	40	480	At least 15 times
<u>Pretest/posttest/delayed test</u> 1. Definition part	1	51	101	At least 80 times
2. Cloze part		50		Depend
<u>Review Tasks</u> 1. Definition part	4	15	30 per task 120 in all four tasks	At least 50 times
2. Cloze part		15		Depend

To design weekly lessons, all 480 target words were distributed into 12 '*weekly wordlists*', each of which consisted of 40 words. Each weekly wordlist was a target of each weekly lesson. To design the pretest/posttest and delayed test, 8-9 words were selected from each of the 12 weekly wordlists. There were 101 tested words in total: 51 words for assessing definitional knowledge and 50 words for assessing the ability to transfer lexical knowledge in the form of cloze passages. Words tested in the definition part were words occurring in the Engineering Corpus not less than 80 times. However, words tested in the cloze part were words naturally co-occurring with a set of other tested words in particular passages used in the test. To design four review tasks, ten words were selected from each list of three-related weekly wordlists. There were 30 reviewed words in each task and a total of 120 reviewed words in all four tasks. The format of the task was similar to the test. However, words reviewed in the definitional part were words occurring in the corpus not less than 50 times whereas words reviewed in the cloze part were words naturally co-occurring with a set of other reviewed words in particular passages.

3.6.3.2 Weekly wordlists

After the target wordlist was created, the list was divided into twelve '*weekly wordlists*'. Each weekly wordlist consisted of 40 target words to be studied in each weekly lesson and there were a total of 480 target words in all lists (see Appendix G). Words from the target list were grouped in each weekly list depending on their similarities in meaning or grammatical functions.

For example:

- Words referring to things in engineering e.g. *object, component, element, device, instrument, equipment* etc.
- Words referring to engineering workplaces e.g. *site, firm, plant, manufacturer, factory, organization* etc.
- Words used for giving definitions and examples e.g. *mean, define, refer, represent, such as, for instance* etc.
- Words often used in mathematics e.g. *amount, quantity, symbol, divide, multiply, equal* etc.
- Words with similar endings or suffixes e.g. *definition, description, preparation, expression* etc.

Each weekly wordlist was intended for students to work on. Therefore, words in each list were used in designing a lesson, class activities and tasks in the related week.

3.7 Classroom Materials

Classroom materials consisted of lesson plans, handouts and task sheets, and review tasks, all of which were used for conducting classroom activities.

3.7.1 Lesson plan

The whole lesson plan was divided into 12 lessons taught in 12 weeks. The class was held once a week in three consecutive periods i.e. 150 minutes in total altogether. The content in each lesson was based on a particular theme with the main focus on 40 target words in a given weekly wordlist. The outline in Table 3.5 illustrates an overview of the whole lesson plan in one semester.

Table 3.5: Outline of the whole lesson plan in the main study

Weeks	Lessons	Themes	Weekly Wordlist
1	Introduction of course description Administration of the questionnaire and pretest		
2	Introduction	Introduction to the concordance-based method for the experimental group Introduction to reading in general for the comparison group	
3	1	Engineering Fields	Weekly wordlist 1
4	2	Engineering Drawing	Weekly wordlist 2
5	3	Computers in Engineering	Weekly wordlist 3
6	4	Machines & Engines	Weekly wordlist 4
7	5	Energy and Electricity	Weekly wordlist 5
8	6	Electrical Systems in Automobiles	Weekly wordlist 6
9	Midterm Exam: Review Tasks 1 and 2		
10	7	Engineering Products	Weekly wordlist 7
11	8	Power Transmission	Weekly wordlist 8
12	9	How to Build an Electric Motor	Weekly wordlist 9
13	Revision and Review Task 3		
14	10	Latest Technology	Weekly wordlist 10
15	11	Causes of Failure	Weekly wordlist 11
16	12	Electric Vehicles	Weekly wordlist 12
17	Revision and Review Task 4		
18	Final Examination: Posttest		

These lessons were planned by using text types in the corpus as contexts with a theme-based plan. In addition, the preparation for concordance-based activities was also planned for learner training in the form of paper-based activities. These details are in the following three sub-topics: text types used as contexts, a theme-based plan and preparation for concordance-based activities as follows.

3.7.1.1 Text type used as contexts

The twelve lessons were based on twelve themes i.e. engineering fields, engineering drawing, computers in engineering, machines and engines, energy and electricity, electrical systems in automobiles, engineering products, power transmission, how to build an electric motor, latest technology, causes of failure, and electric vehicles. These themes, which were familiar to RMUTL students who were studying electrical and industrial engineering, were primarily chosen to motivate students to study in their familiar contexts. It was planned the themes would be presented in various text types in order to make students aware of different writing styles of texts. The language used in presentation and examples was extracted from the text types as illustrated in Table 3.6.

Table 3.6: Themes relating to text types used as contexts in lessons

Lessons	Themes	Genre / Text Types
1	Engineering Fields	Textbooks and Handouts
2	Engineering Drawing	Textbooks and Handouts
3	Computers in Engineering	Textbooks and Handouts
4	Machines and Engines	Textbooks and Handouts
5	Energy and Electricity	Textbooks and Handouts
6	Electrical System in Automobiles	Textbooks and Handouts
7	Engineering Products	Advertisements
8	Power Transmission	Articles
9	How to build an electric motor	Manuals and Handbooks
10	Latest Technology	News and Articles
11	Causes of Failure	Articles
12	Electric Vehicles	Abstracts of articles or research

The majority of texts were texts extracted from textbooks and handouts since they were used more often in fundamental subjects in engineering. The other text types were sometimes used for completing assignments in engineering courses but less often than textbooks and handouts. All texts which were planned to be presented in English classes had already been saved in the Engineering Corpus and had also been classified into its sub-corpora as described in 3.6.1.2. This made each type of text convenient for references when needed. In the comparison group, such types of language were prepared by the teachers to be presented in the classroom handouts. In the experimental group, however, texts might be presented either in the handouts or in hands-on activity while accessing the sub-corpus of each text type.

3.7.1.2 Theme-based plan

As the lessons were organized on particular themes, the target words were grouped in terms of the related themes as much as possible. The details of word groups in each lesson are illustrated in Table 3.7.

Table 3.7: Words grouped according to themes in the lessons

Lessons	Themes	Vocabulary
1	Engineering Fields	Words referring to engineering contexts, objects, workplaces, studies and practices
2	Engineering Drawing	Words concerned with technical drawing
3	Computers in Engineering	Words concerned with computers, their ability and features
4	Machines and Engines	Words used for giving definitions and examples
5	Energy and Electricity	Words concerned with calculation and ways of grouping things
6	Electrical Systems in Automobiles	Words used for describing equipment's parts, components, position, material property and ways of putting things together
7	Engineering Products	Common words in advertisements for describing good features of products
8	Power Transmission	Words used for describing processes
9	How to build an Electric Motor	Words used for giving instructions, suggestions and warning as well as for emphasizing instructions
10	Latest Technology	Words used for comparison and contrast
11	Causes of Failure	Words used for describing causes and effects, concerning damage and malfunction
12	Electric Vehicles	Words concerned with estimation and publication

The theme '*Engineering Fields*', for example, consisted of words concerned with tools, workplace or study which was often found in engineering contexts. Regarding the theme '*Engineering Drawing*', words often found in such contexts e.g. '*dimension*', '*measurement'*, '*distance'*, '*angle*' etc. were grouped together. Words unable to be grouped by their meaning might be categorized by their functions or uses which were useful for reading, for example, the use of the past participle which might cause problems for Thai students in interpreting reading texts. In addition, words used as discourse markers might be grouped together since they were useful for training students how to guess unknown words from contexts. Another example was one lesson based on the theme of '*Causes of Failures*'. The focus of the lesson was on studying vocabulary concerned with causes and effects e.g. '*cause*', '*lead*', '*due to*', '*result*', '*therefore*' etc. as well as words concerned with damage e.g. '*failure*', '*damage*', '*faulty*', '*injury*' etc.. At the same time, students would learn how to use cause and effect clues to infer the meaning of texts.

Grouping words by themes and their functions made it possible for word meanings to be studied simultaneously with some language points necessary to learn various aspects of words, rendering more meaningful learning activities (see Appendix H for more details). One example activity in which more than one aspect of words was studied was a lesson based on the theme '*Engineering Fields*'. In this unit, the target words were concerned with engineering contexts including the words '*condition*', '*situation*' and '*context*'. When the word '*context*' was introduced in some sample sentences or concordances, students were trained to deduce its meaning from the immediate contexts which were highlighted. Then, the concept of using context clues for guessing the meaning of unknown words was pointed out as an important strategy in reading. After that, students practised deducing the word meanings of the other two words '*condition'* and '*situation*' and then comparing the meanings and usage of these words. In some cases, words were grouped according to their similar grammatical function or word parts in order to teach word-attack skills by recognizing word parts. Thus, words with similar suffixes such as '*definition'*, '*description'*, '*demonstration'*, '*preparation'* etc. were grouped together.

3.7.1.3 Preparation for concordance-based activities

To properly prepare students for concordance-based activities, before the first lesson began, an introduction lesson was planned for fully training students to deal with computer concordancing skills. At this stage, attention was entirely paid to the application and usefulness of the method rather than language study. In the same week, the other group was introduced to general concepts in reading academic texts. After the introduction lesson, the first two lessons were planned for gradually moving the students forward in dealing with the observation of concordances. These lessons were aimed at training them to observe the contexts of the keywords. In both lessons, paper-based concordances were mostly used since they were suitable for preparing students in observation skills for two main reasons. Firstly, some concordances could be graded and only the ones containing full sentences would be selected to prevent confusion or the students being overwhelmed. Also, it usually appears in fragmented data. Secondly, contexts of the keywords could be highlighted in bold or italic in order to draw students' attention to the language point focused on at that time. In training students to deduce word meaning from contexts, for example, the context clues useful for the guesses were highlighted as in the sample activity in Figure 3.4.

Figure 3.4: Sample of a paper-based concordance activity

Activity: Guess the meaning of the keywords in the following concordances by using the bold words to help your guesses. Then match the keywords with their definitions.

Keywords	Definitions
………… 1. object	a. a thing
…………2. device	b. a part of something
………… 3. component	c. an electrical or mechanical tool

1	An	object	**is something** which can be seen or touched.
2	A falling	object	is a **thing** moving downwards.
3	A fast-moving	object	has a high speed.
4	A slow-moving	object	has a low speed.
5	A **switch** is a	device	**for** making or braking an electric circuit.
6	A **voltage regulator** is a	device	**to** keep the power stabilized.
7	An **electric motor** is a	device	**to** convert energy into mechanical power.
8	A **dynamometer** is a	device	**to** measure an engine's torque.
9	A **bearing** is one of a machine	component	used **to** reduce friction.
10	A **battery** is a major	component	**of** an electrical system in automobiles.
11	A **screen** is a displaying	component	**of** a computer.
12	A **capacitor** is a reactive	component	**of** an electric circuit.

In such activity, both language and concordancing skills were learned simultaneously. On the one hand, they were trained in a reading strategy for deducing word meaning from contexts. Thus, word meaning and the reading strategy were learnt together. On the other hand, they were trained to make use of a concordance format in observing the contexts for language study. With paper-based activities, context observation could be facilitated by highlighting key context clues as well as by selecting short concordances with simple language. Therefore, paper-based activities were proper for preparing students for hands-on activities by making them gradually familiar with the concordances step by step (see the sample plan in Appendix I).

3.7.2 Handouts and activities

Classroom materials used in each lesson included a single set comprising a handout and a task sheet. The handout was used during class activities whereas the task sheet was used as an assignment outside classes. Language items used for presentation and exercises were extracted and adapted from the Engineering Corpus. An individual lesson was designed in two versions: one with concordances used in the experimental group whereas the one without concordances was used in the comparison group. The lessons of both versions were parallel in terms of target words from the beginning to the end of the semester. Accordingly, the same weekly wordlist of each lesson was given at the beginning of each handout to call students' attention to the target words when they found or revised them during or after the lesson. Despite focusing on the same set of target words, the presentation of them is not necessarily in the same order, depending on the contexts of each version. It was planned that most words in a given weekly wordlist were to be studied during class activities whereas some words were assigned for extra practice outside classes.

Activities in one lesson of both versions were divided into three main parts: *Warm Up, Presentation and Practice,* and *Application*. Only in the part of *Presentation and Practice*, were the activities in each version different whereas those of the *Warm Up* and *Application* were the same because these two parts had the same focuses for both groups on activating students' ideas at the beginning of the lesson, and on practising the transfer of lexical knowledge to new contexts at the end. Firstly, the part of *Warm Up* activities usually begins with class discussion to elicit students' participation as well as to raise their awareness on some points of language. This part is similar in both versions, except that one version uses concordance items but the other uses sentences.

The part of *Presentation and Practice* was aimed at practising some language points. In both versions, this part was typically divided into 5-6 activities in each lesson and each activity might include a few sub-activities. In the handouts, when new key concepts were introduced, written explanation and examples were also provided. However, the differences between them were the different formats of language presentation and activity types. The experimental group was trained to deal with concordance information in the corpus both in paper-based and hands-on activities using the guidelines and support from the teacher and the handouts. On the other hand, the comparison group studied vocabulary through reading together with the teacher's teaching and explanations. Nevertheless, in a concordance version, the presentation of language and examples was increasingly reduced in the subsequent lessons in order for students to complete tasks more independently from the teacher. The concordance handouts at the later lessons were used for assigning tasks, rather than providing guidelines and explanation as in the earlier lessons.

The last part of Application was similarly designed for students in both groups to practise transferring their newly learnt lexical knowledge in a particular lesson to new reading contexts. The activities were in the form of cloze passages with dense clusters of missing target words at a length of about 100-250 words per passage. In one lesson, there were about 1-2 passages with the topics corresponding to the theme of the lesson. The students' task was to fix the newly learnt words in the gaps of the passages. More details and examples of each part in both versions are presented below, starting from a concordance version in the experimental group and then followed by a non-concordance version in the comparison group. To highlight the different types of activities in both versions, these samples are extracted from the same lesson i.e. '*Lesson 4: Machines and Engines*' (see Appendices J and K) for illustrating the parallel lessons of both groups.

3.7.2.1 A sample concordance version

Despite the same focus in each lesson, the students in the experimental group were trained both in language and concordancing skills. They were assigned to explore language information from the corpus rather than obtaining language input from the teacher. The handouts were used as guidelines for the students to study from the corpus information. To complete the assigned tasks, they were encouraged to observe contexts in concordances and find information, examples and answers from the corpus. During classroom activities, the teacher acted as a facilitator and supporter to facilitate the activities and to provide help, if needed.

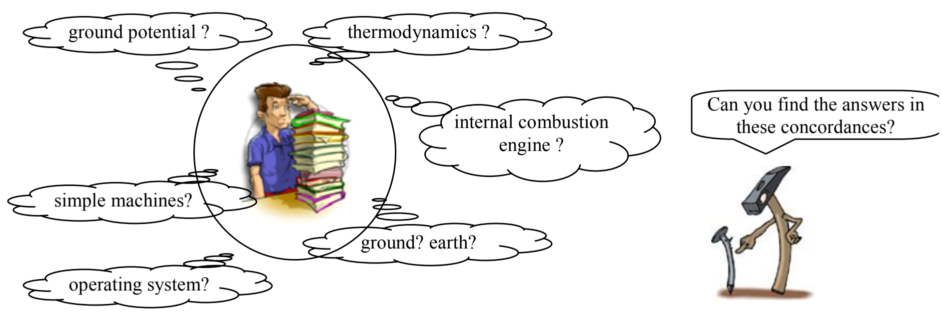
There were two main types of activities: paper-based and hands-on activities. In paper-based activities, target words were contextualized and prepared by the teacher. As discussed in 3.7.1.3, these paper-based activities was used in the first two lessons in order to prepare students for hands-on activities by making them gradually familiar with observation and concordancing skills. In the later lessons, paper-based concordances were used only when some language points needed to be clarified or when on-screen concordances of particular keywords would be too overwhelming for the students. To prevent students' confusion, concordances with full sentences and simple structures were selected to be presented in the handouts rather than those with fragments. However, fragmented concordances were increasingly included in the later lessons when students became more familiar with them in order to make them aware of the nature of the corpus output.

The hands-on activities were introduced in Lesson 3 and then their application was gradually increased in the later lessons whereas the paper-based concordance was proportionally decreased. The sample handout of paper-based activities has already been illustrated and described in 3.7.1.3. Here, the description is on the lesson with hands-on activities (see a sample handout of the whole lesson in Appendix J). The sample lesson was based on the theme '*Machines and Engines*' with the focus on training reading strategies of guessing the meaning of unknown words from definition, description and example clues as well as from word parts. Generally, the *Warm up* activity in each lesson was aimed at eliciting students' existing knowledge for discussion in order to lead to new language points. A sample of this activity is illustrated in Figure 3.5.

Figure 3.5: Sample of a warm up activity in a concordance version

Warm Up

What do these words mean?



The	**term**	"*thermodynamics*" usually **refers to** the physical study of the state of a system.
The	**term**	"*internal combustion engine*" normally **refers to** any engine operating by burning fuel inside.
The	**term**	"*operating system*" **means** a computer software used for the direct control of basic system.
The	**term**	"*ground* (**or** *earth*)" usually **means** a common return in circuits.
The	**term**	"*ground potential*" **means** there is no difference in potential between a circuit point and earth.
The	**term**	"*simple machines*" **means** any devices required only a single force to work.

In this sample lesson, the technical terms were used to activate students' ideas and to draw their attention to the target words used as definition clues of the given technical terms. The concordance format made it easy to observe the contexts of the target word '*term*' and deduce its meaning. The other two target words i.e. '*refer*' and '*mean*' were highlighted in bold. In deducing word meaning and uses, the whole class discussed them together with some hints from the teacher. Then, the concept of using context clues to guess the meaning of unknown words was introduced as an important strategy in reading. A written explanation and examples of such concept were also provided in the handout for students to review later, if needed.

Figure 3.6: Sample of learning activities in a concordance version

Activity 1: Studying context clues of definitions

Activity 1.1: Search the words '*refer**', '*define**', and '*mean**' to find the answers to the following questions.

1. Which form of each searched word, active or passive, is mostly used?
2. Which keyword is often followed by '*to*'?
3. Which keywords are often followed by '*as*'?
4. When is '*as*' used after these searched words?
5. What are typical collocations of these searched words?

Activity 1.2: Complete the definitions of the given words in the following concordances, using the information from the corpus. Then guess the meaning of the technical terms highlighted in ***italics***.

1	***Microfarad***	means	millionths of a Farad.
2	***Kinetic energy***	means	movement …………………………………………..
3	In RF circuits, ***Fo***	means	…………………………………………………….
4	***AutoCAD*** is	defined	as interactive drawing ………………………………..
5	***Power*** is	defined	formerly as …………………………... per unit time.
6	***Energy*** is	defined	as '……………………………………..………….'.
7	***Currents***	refer	to …………………………………………………..
8	***Primary storages***	refer	to ……………………………………………………
9	***Engineering drawing***	refer	to ……………………………………………………
10	***The flow of electrons*** is	referred	to as ………………..…………………………… .
11	A ***CPU design*** is often	referred	to as ....
12	A ***semiconductor*** is	referred	to as a ………. that may act as a conductor or insulator.

Activity 1.3: Each set of the given concordances has the same keywords which are missing from the lines. Read the concordances and determine which given keyword is missing from each set.

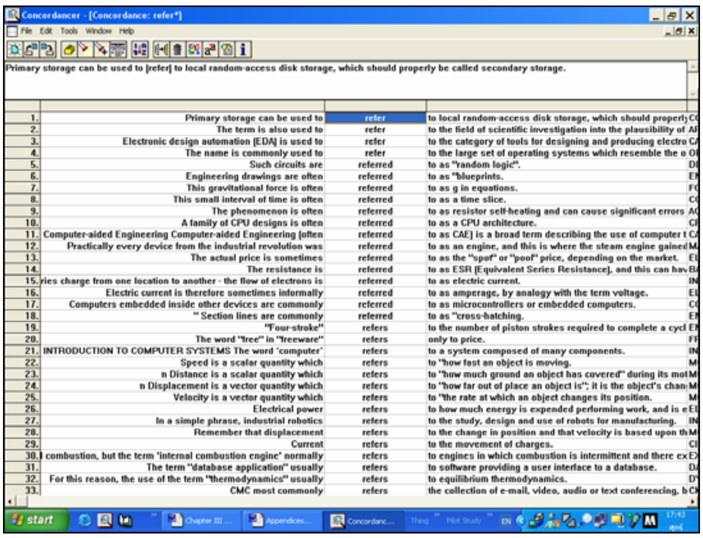
means defined referred

Set 1	Q is	……	as the frequency divided by the bandwidth, measured
	One horsepower was	……	as the amount of power needed to lift 33,000 pounds
	The volt was	……	as the potential difference across a conductor when a
	The potential difference is	……	as the amount of work per change.
Set 2	"Q = 0.5 C"	……	the quantity of electric charge is 0.
	An intangible thing	……	a thing you can't grab it and throw it against the wall.
	Work	……	moving something, lifting something, warming something,
	The term 'ground potential'	……	there is no difference in potential (voltage) between a circuit
Set 3	Historically, 'memory'	……	to "magnetic core memory" in the 1950s.
	Engineering drawing are	……	to as "blue prints'.
	Such circuits are	……	to as 'conventional' current as opposed to electron flow.
	A family of CPU designs is	……	to as a CPU architecture

The next activity was Activity 1 with three sub-activities. The students were assigned to explore the information from the Engineering Corpus used as their linguistic input rather than being presented with a reading passage. The handout as illustrated in Figure 3.6 was used to provide guidelines to do these activities. According to the handout, Activity 1.1 directed the students to study the target words '*refer*', '*define*' and '*mean*' by accessing the corpus to answer the given questions. The questions were provided to guide them step by step in observing the contexts of each keyword. As this lesson was at the beginning of applying hands-on activities, the teacher demonstrated how to operate the method and asked the whole class to follow the practice immediately after each step of the demonstration. At this stage, clarification and class discussion were often used. However, in the later lessons, a number of guided questions and the demonstration were reduced as students became more familiar with the method.

With the use of the concordancer, the information needed to answer the questions in Activity 1.1 could be searched and obtained quickly. After sorting the concordances by their left and right contexts, the typical patterns and collocations of the keywords were noticeable. With a wildcard search of '*refer**', for example, all word types of *refer* such as *reference*, *references*, *referred*, *refers* in the corpus would firstly appear on the screen. As the focus at this time was on a verb, two unfocused types i.e. '*reference*' and '*references*' were suggested to be deleted in order to make the language in focus more distinct. To answer the first question of whether an active or passive form of '*refer*' was mostly used, students were advised to sort the left contexts to get the output as in Figure 3.7.

Figure 3.7: Concordance output of '*refer**' with the left sort.



The sorted concordances made it convenient for students to identify language components of active and passive form of the keywords before inferring which form was mostly used. In addition, the comparison of the number of uses of each word type was also easy when using the number of concordance lines indicated at the left side of the screen and the scroll bar. Next, to answer the other given questions, the right sort would allow students to see which words often came after the keywords. In this case, even with the left sort, the preposition '*to*' was clearly seen as always coming after '*refer'* whereas '*to as*' usually comes only after its passive form. In such an activity, students were expected to quickly observe recurrent patterns of '*refer'*, compare which form was mostly used, and infer its typical collocations i.e. '*refer(s) to*' and '*be referred to as*'. After obtaining all answers concerned with '*refer*', students repeated the same practice by themselves to find the answers concerned with '*define*' and '*mean*'. The answers from all given questions would make them aware of the different collocations among these target words.

In Activity 1.2, students further practised finding the definitions of the given technical terms by accessing the corpus. With the facility of a computer, it did not take long for students to complete the tasks. Then, they were asked to practice interpreting the completed concordances containing definitions of the given terms. In the last activity i.e. Activity 1.3, students were encouraged to retrieve this new lexical knowledge by finding the missing keywords from the given sets of the concordances. If students could remember that the typical collocations of '*refer'* were '*refer to*' and '*be referred to as*', it would not be difficult for them to fix the word '*referred*' in the gaps of concordances in set 3. This would happen similarly with the cases of '*mean*' and '*define*'.

The last part was Application, which was aimed at encouraging students to apply new lexical knowledge in reading. In other words, they practised retrieving word knowledge learned in the lesson and using the words in different contexts. The Application part was in the form of rational-deletion cloze passages where target words studied in the lesson were omitted from the passage. Words learned in previous lessons were highlighted in *italics* to remind the students. Some sentences found in earlier activities might be repeatedly found in cloze passages in order to recycle encounters of words and sentences, reduce difficulties in reading, and facilitate their understanding of the reading texts. Most weekly target words were studied during classes but if all activities could not be finished in time, students would be assigned to do them outside classes.

3.7.2.2 A sample non-concordance version

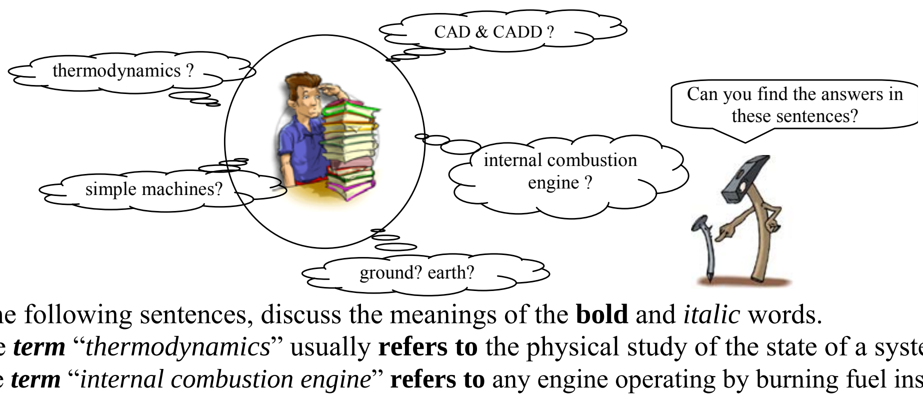
The materials for the comparison group were paper-based only and aimed at teaching various aspects of words through the contexts of short reading passages. Therefore, after the Warm Up activities, the lessons usually started with a short reading passage with a dense cluster of target words in that lesson. The questions following the passages were used to guide students on some new concepts concerning vocabulary learning, rather than to check reading comprehension. The tasks in each activity were concerned with strategies to guess the meaning of unknown words by using word-attack skills (e.g., breaking down word parts to guess word meaning) or using context clues (e.g., definitional clues and example clues). Target words might be either presented in the reading passage or vocabulary exercises. All of them were pre-selected and contextualized by the teacher. The teaching method is like many other conventional methods which include the teacher presenting, explaining, clarifying, illustrating, and the students practicing language items.

To highlight the different types of activities in two parallel lessons, the whole sample non-concordance version in Appendix K was extracted from the same lesson i.e. '*Lesson 4: Machines and Engines*' as illustrated in a sample concordance version. The sample *Warm Up* activity of a non-concordance version is shown in Figure 3.8.

Figure 3.8: Sample of a warm up activity in the handout of the comparison group

Warm Up

What do these words mean?



From the following sentences, discuss the meanings of the **bold** and *italic* words.

- The ***term*** "*thermodynamics*" usually **refers to** the physical study of the state of a system.
- The ***term*** "*internal combustion engine*" **refers to** any engine operating by burning fuel inside.
- All these ***terms*** , "*CAD and CADD*", **refer to** the designing and technical drawing.
- The ***term*** "*ground* (**or** *earth*)" usually **means** a common return in circuits.
- The ***term*** "*simple machines*" **means** any devices or mechanical components required only a single force to work.

As mentioned earlier, in this version the activity was not much different from that in the other group, except that the linguistic examples were not in a concordance format. Students' existing knowledge was elicited for discussion in order to draw their attention to new target words: '*term*', '*refer*' and '*mean*' highlighted in **bold** and a strategy to use these words as definition clues to guess the meaning of some technical terms highlighted in *italics*. During this activity, it was pointed out to students that most technical terms frequently occurring in academic texts were defined and they could find the meaning of the words without referring to a dictionary if they knew how to use the definition clues. Written explanation on the concept of context clues and some examples were provided in the handout for the students to review, when needed.

The following activities were included in the part of *Presentation and Practice*. This part consisted of six activities in this lesson. Activity 1 was selected for discussion here with the related handout illustrated in Figure 3.9. This activity was divided into three sub-activities focusing on teaching a set of target words '*mean*', '*define*' and '*refer*' in terms of their meanings, collocations and uses for giving definitions to other words. In addition, skills of getting information and using definition clues were integrated.

In Activity 1.1, a short reading passage entitled '*Machine'* was presented with the target words highlighted in *italics*. Pre-&post-questions were used for drawing attention to the language in focus as well as for checking reading comprehension. Class discussion was used to introduce the concept of definition clues as well as to compare the answers. Then, Activity 1.2 was aimed at drawing attention to different collocations of the target words. Students studied typical collocations of each word in three given sentences which were nearly the same and then identified the differences among them i.e. '*means'*, '*be defined as*', and '*be referred to as*'. After that, they matched the given technical terms with their definitions and practised using these collocations in constructing sentences. In Activity 1.3, the practice was on observing collocations of the target words before completing the given sentences. At this stage, students were told to pay attention to the immediate contexts of the omitted words and then use their new knowledge of the word collocations to complete the gaps with the given words.

Figure 3.9: Sample of learning activities in a non-concordance version

Activity 1: Studying context clues of definitions

Activity 1.1: Read the following passage and answer the questions.
1. How many words are defined in the following passage?
2. What are they?

Machines

The *term* 'machine' *means* an assembly of parts operating together to perform work. A machine *is* generally *referred to as* any mechanical or electrical device that transmits or modifies energy to perform or assist in the performance of tasks.

A simple machine is *defined as* a mechanical component *such as* bearing, gear, lever, screw whereas a machine tool *is defined as* a powered mechanical device *such as* lathe, mill, drill etc. The term 'machine tool' *is* usually *referred to as* tools that used a power source.

A computer-controlled machine *is known as* a computer-numerical-controlled (CNC) machine. A CNC machine *refers* specifically *to* the machine tools which are controlled by computers in manufacturing work. It *is* sometimes *called* machine intelligence or artificial intelligence. In one sense, CNC machines may be said to *represent* special industrial robot systems.

Answer the following questions.
1. What is a machine?
2. What is a simple machine?
3. What are examples of a simple machine?
4. What is a machine tool?
5. What are examples of a machine tool?
6. What is a CNC machine?
7. What is another name for a CNC machine?
8. What may a CNC machine stand for?

Activity 1.2: Study the following sentences.
- A machine **means** an assembly of parts operating together to perform work.
- A machine **is defined as** an assembly of parts operating together to perform work.
- A machine **is referred to as** an assembly of parts operating together to perform work.

Match the words in column A with their definitions in column B. Then make up sentences as in the above sentences.

A	B
………. Power	a. movement energy
………. Energy	b. an electric current.
………. Kinetic energy	c. an ability to do work.
………. A semiconductor	d. units of energy per unit time
……….. The flow of electron	e. a material that may act as a conductor or as an insulator.

Activity 1.3: Complete the following sentences with the given words.

means *defined* *referred*

1. 'Binary', coming from the Latin, ………………… twice or two.
2. In this context, data is …………………… as a collection of numbers or characters.
3. A device from the industrial revolution was ………………….. to as an engine.
4. Technology ……………………… the study and science of techniques.
5. Random Access Memory (RAM) ……… that the memory cells can be accessed in any order.
6. Artificial intelligence is …………as intelligence shown by anything manufactured by humans.
7. One AMP is ………………as 625,000,000,000,000,000,000 electrons moving across a circuit every second!

The other activities in this lesson were on studying other sets of target words i.e. sets of words used for giving descriptions and examples and words with similar suffixes. Some words presented in the previous activities might be studied again but with a different focus. For example, the words '*define*', '*describe*', '*express*', and '*represent*' had already been introduced as markers of definition and description clues in Activity 1 but they were also grouped with another set of target words for studying word parts or similar suffixes of '*-ion*' i.e. '*definition*', '*description*', '*expression*', '*representation*' etc. Similarly, the word '*refer*' had been grouped with the words ending with '*-ce*' or '*-ence/-ance*' e.g. '*reference*', '*acceptance*' and '*existence*'. The last part of the lesson, i.e. Application, was similar to that of the experimental group since the objective of the activity was to encourage students to apply or transfer new knowledge just learnt in the lesson to reading contexts.

3.7.2.3 Validation of classroom materials

The validity of the lesson plan, handouts and task sheets was established by consulting three experts in the fields of EFL teaching and classroom concordancing. The assessment focused on content selection, activity design, the consistency of lessons in the two groups, and the justification of the content selection and the activity design in serving the objectives of the study (see the checklist in Appendix L). The results from the checklist revealed that there was no controversy among the experts' opinions although their suggestions were different in the details. Overall, all experts agreed that content selection and activity design were justified in nearly all areas and could well serve the objectives of the study. Regarding the difficulty level of the content, however, one expert rated this issue as unsure and gave comments on an activity concerned with the skill of deducing word meaning with limited citations as well as suggested ways for improving it. On the other hand, all of them were much concerned about the length of time available. Regarding the assessment of an individual activity in each lesson, about 90% of opinions agreed that the activity design was justified and could cover the necessary issues which should be learnt.

Useful suggestions were given for improving the materials on four issues: to simplify written instructions and explanations, include more variety in language presentation and practice, reduce the difficulty level of the content in some activities, and reduce the amount of content in each lesson to obtain sufficient time for all activities. Based on these suggestions, the lesson plan and classroom materials were modified accordingly. The main problem was the lessons did not match the time provided. With such available time, each lesson was crammed with a lot of activities due to the attempts to contextualize and cover all given weekly target words. Although the number of the weekly target words was reduced from 70 words a week in the pilot study to 50 words a week in the materials being assessed, the problem of crammed lessons could not be solved. Therefore, in the main study, the number of the weekly target words was reduced further to 40 words a week.

3.7.3 Review tasks

Four review tasks designed by the teacher were used as on-going assessments (see Appendix M) to track learning development at different stages of the study. An individual review task was initially planned to be assigned to both groups for reviewing words in three related lessons. However, due to the time limitation, the first two tasks had to be used together as the mid-term exam whereas the other two tasks were assigned separately in the subsequent three weeks respectively. Like the tests, an individual task was divided into two parts: one for reviewing definitional knowledge and the other for reviewing transferable knowledge. The definitional part was designed in the form of matching words to the right definitions whereas the other part concerned with knowledge transfer was in the form of rational-deletion cloze passages.

All four review tasks consisted of 120 reviewed words in total i.e. 30 words per task. In the word selection for designing each task, 30 words were selected from three related weekly wordlists i.e. 10 words from each. Then, half of the selected words were used in each part of the task. Fifteen words reviewed in the definition part were words occurring in the Engineering Corpus not less than 50 times whereas words used in the transferable knowledge part were words naturally co-occurring with a set of other reviewed words in particular passages. The details on word selection for designing the tasks were summarized in Table 3.8 (see all 120 reviewed words in Appendix G).

Table 3.8: Details on word selection for designing the tasks

Weekly Wordlist (40 words per list)	**Number of Selected Words Per Review Task**	**Total Number of Words Per Review Task**	**Number of Words in Each Part of the Task**	**Number of Each Word's Occurrences in the Corpus**
Weekly wordlist 1	10	30 words in Review Task 1	Part I = 15	At least 50 times
Weekly wordlist 2	10			
Weekly wordlist 3	10		Part II = 15	Depend
Weekly wordlist 4	10	30 words in Review Task 2	Part I = 15	At least 50 times
Weekly wordlist 5	10			
Weekly wordlist 6	10		Part II = 15	Depend
Weekly wordlist 7	10	30 words in Review Task 3	Part I = 15	At least 50 times
Weekly wordlist 8	10			
Weekly wordlist 9	10		Part II = 15	Depend
Weekly wordlist 10	10	30 words in Review Task 4	Part I = 15	At least 50 times
Weekly wordlist 11	10			
Weekly wordlist 12	10		Part II = 15	Depend
	Grand Total	**120 words from all target words of 480 words**		

3.7.3.1 Definition Part

The definition part was designed to include 15 items making up 5 sets of 3 definitions and 6 words as options. In other words, 3 definitions were provided in each set whereas the three target words were given as options together with the other three distractors. The students had to match the given definitions to the right words in order to get a score on each item as in the following sample set of three items.

Example:

	Definitions	Words	
....c...1	a thing	a. fact	d. task
…a...2	Information	b. edge	e. condition
…d...3	a piece of work	c. object	f. organization

The given definitions were mainly based on two online dictionaries i.e. the *Cambridge Dictionary Online* and the *Newbury House Dictionary of American English*. The definitions given were short and simple in order not to overload students with reading. The optional words in the same set were words with the same grammatical function but with clear-cut meanings to eliminate ambiguity.

3.7.3.2 Cloze Part

The second part which was in a cloze format consisted of 3 short rational-deletion cloze passages with 3 reviewed words in each. In each passage, 5 reviewed words were deleted and were given as choices plus three other distractors, making up 8 options in total. The following sample is extracted from one cloze passage from Review Task 1.

Example:

I. Electric Current

(Source: Adapted from a passage available at http://encyclopedia.thefreedictionary.com)

advantage as conduction corrected defined internal means original

Electric current is any flow of charge, usually through some electrical conductors. In the past, current was (1)…………… in the history of electrical science (2)…………… a flow of positive charge. However, in the case of metallic (3)……………, current is caused by a flow of negatively charged electrons in the opposite direction. Despite this misunderstanding, the (4)…………… definition of current still stands.

The symbol *'I'* is typically used for the amount of current or charge flowing per unit of time. Historically, the symbol for current, *I*, came from the German word *Intensität*, which (5)…………… *'intensity'*. The SI unit of electrical current is called the *ampere*.

In total, there were 3 cloze passages in each task and 12 passages in all four review tasks. The used passages were semi-authentic with a length of around 100-170 words. The readability of each passage was calculated for *The Flesch-Kincaid Grade Level* and *The Flesch Reading Ease Scores* by using the calculating program of '*Flesh 1.5*' developed by Jack Frink (2005). According to Frink (2005), *The Grade Level* indicates an index that gives the years of education required to comprehend a document whereas *The Reading Ease Scores* rates text on a 100-point scale; the higher the score, the easier it is to understand the document. These two indices of scores are often found in comparison with each other, which can be summarized for convenient interpretation as shown in Table 3.9.

Table 3.9: Interpretation of readability value

Reading Ease Scores	**Reading Grade Level**	**Reading Difficulty**
90-100	5^{th} grade	Very easy
80-90	6^{th} grade	Easy
70-80	7^{th} grade	Fairly easy
60-70	8^{th} – 9^{th} grade	Standard
50-60	10^{th} -12^{th} grade (High school)	Fairly difficult
30-50	13^{th} -16^{th} (Some college)	Difficult
0-30	Graduate level	Very difficult

The average readability values of twelve passages used in the Review Tasks were calculated and illustrated in Table 3.10. The Reading Ease Scores ranged from 35.59 to 70.34 with the mean score at 48.27. The passages with the scores nearly reaching the cutting points of 50 were interpreted as suitable for students at a college level and perhaps at high schools as well. The average Grade Level of 9.84 confirmed that the passages were suitable for students in the 9^{th} – 10^{th} grades in the US high school level system. Therefore, the texts were considered as being suitable for the present study dealing with undergraduate students.

Table 3.10: The average readability values of the passages in the review tasks

	N	Minimum	Maximum	Mean	Std. Deviation
Reading Grade Level	12	7.11	11.55	9.8483	1.37644
Reading Ease Scores	12	35.59	70.34	48.2717	9.58689

In scoring, each correct item in the tests was marked and given a score of 1 score whereas a wrong item was marked as 0. Then, all the correct items of an individual student were totaled to determine his gained scores: A total score of 15 on the Definition Part and 15 on the Cloze Part. All review tasks were validated together with the pretest/posttest and delayed test. The validation of these instruments is described later in 3.8.1.3.

3.8 Research Instruments

There were five main types of instruments for collecting data in this study: pretest/posttest and delayed posttest, students' logs, teacher's field notes, questionnaires, and interviews.

3.8.1 Pretest, immediate posttest and delayed posttest

The pretest, immediate posttest and delayed posttest (see Appendix N) were teacher-designed in the same paper used as achievement tests for assessing definitional and transferable knowledge at different stages of the study. The pretest was administered at the beginning of the study, the immediate posttest was at the end, and the delayed posttest was a month after the study. In administering the delayed posttest, the students were not told in advance in order to prevent any effects of students behaving differently from normal such as reviewing the lessons more than usual or memorizing some points from the previous posttest. The pretest was used to assess students' vocabulary knowledge before the experiment. After finishing the study, the results from the immediate posttest of both groups were compared to assess the differences in learning effects on definitional knowledge and transferable knowledge. In addition, the comparisons between the average scores of the immediate and delayed posttests were used to determine the retention percentages of the two teaching methods as well as the difference in retention rates between groups.

The test format was similar to that of the review tasks i.e. divided into two parts: the Definition Part for measuring the definitional knowledge and the Cloze Part for measuring transferable knowledge. The Definition Part was in a matching format, slightly adapted from the Vocabulary Level Tests of Schmitt et al. (2000) whereas the Cloze Part included rational-deletion cloze passages, similar to those used in Cobb's studies (1999a and b; and 1997a and b). Regarding the tested words, 8-9 words from each weekly wordlist were selected to make up 101 tested words in total. Then, 51 words were used in the Definition Part whereas the other 50 words were used in the Cloze Part. Words already used in the review tasks were excluded from the test. The words tested in the Definition Part were target words with high frequency in the Engineering Corpus i.e. at least 80 occurrences whereas words in the Cloze Part were words naturally occurring together with other target words in the same set. The details on word selection for designing the test were summarized in Table 3.11 (see all 101 tested words in Appendix G).

Table 3.11: Details on word selection for designing the test

Weekly Wordlist (40 words per list)	**Number of Selected Words**	**Total Number of Tested Words**	**Number of Words in Each Part of the Test**	**Number of Each Word's Occurrences in the Corpus**
Weekly wordlist 1	9	101 words in total	Part I = 51 (17 sets of 3 words)	At least 80 times
Weekly wordlist 2	8			
Weekly wordlist 3	9			
Weekly wordlist 4	8			
Weekly wordlist 5	9			
Weekly wordlist 6	8			
Weekly wordlist 7	9		Part II = 50 (5 words / passage)	Depend
Weekly wordlist 8	8			
Weekly wordlist 9	9			
Weekly wordlist 10	8			
Weekly wordlist 11	8			
Weekly wordlist 12	8			

3.8.1.1 Definition Part

In designing the Definition Part, 51 test items were made up of 17 sets of 3 definitions and 6 words as options. The given definitions in the test were based on online dictionaries i.e. the *Cambridge Dictionary Online* and the *Newbury House Dictionary of American English*. A set of 6 options consisted of 3 tested words and 3 distractors. The options in the same set were words with similar grammatical functions and clear-cut meanings to prevent ambiguity. The test-takers' task was to match the given definitions with the right target words as in the following two sets of examples.

Example:

	Definitions	Words	
....f...1	Give	a. improve	d. press
…e...2	Receive	b. bend	e. obtain
…a...3	make better	c. detect	f. provide
…a….4	Look for	a. search	d. decrease
…f….5	tell about	b. permit	e. shift
…e….6	make change	c. satisfy	f. describe

3.8.1.2 Cloze Part

The last part was for testing the ability to transfer lexical knowledge to reading contexts in the form of the rational-deletion cloze passages. This part consisted of 10 short cloze passages, in each of which five tested words were omitted. Therefore, there were 50 tested words in total in this part. The omitted words were among the choices provided. The test-taker's task was to reconstruct the text by putting the tested words in the right gaps of the passage. One sample cloze passage of the test was illustrated below.

Example:

II. Energy

(Source: Adapted from a passage available at http://www.energyquest.ca.gov/story/chapter01.html)

amount different element equal integral invented measured medium

Energy causes things to happen around us. It can be found in several (6)………….. forms. It can be chemical energy, electrical energy, heat (thermal) energy, light (radiant) energy, mechanical energy, and nuclear energy.

Energy is measured in many ways. One of the basic measuring units is called a Btu. Btu stands for 'British thermal unit', and was (7)………….. by the English scientist. Btu is the (8)………….. of heat energy used to raise the temperature of one pound of water by one degree Fahrenheit, at sea level.

Energy also can be (9)………….. in joules. A thousand joules is (10)………….. to a British thermal unit (i.e. 1,000 joules = 1 Btu).

The Cloze Part of the test consisted of 10 passages in total. These passages were semi-authentic and were about 100 – 223 words in length. The average readability values of the passages as illustrated in Table 3.12 was 9.42 in Reading Grade Level and 52.06 in Reading Ease Scores. These values were approximately similar to those of the review tasks which meant that the ease/difficulty level of the passage was considered suitable for students at 9th Grade of the US high school level. Although the reading ease scores of 52.06 indicated that the texts were fairly difficult, they were justified in the study as all of them are authentic academic texts appropriate for undergraduate students.

Table 3.12: The average readability values of the passages used in the test

	N	Minimum	Maximum	Mean	Std. Deviation
Reading Grade Level	10	6.33	11.95	9.42	1.52631
Reading Ease Scores	10	40.14	66.96	52.06	7.74173

In scoring, each correct item in the tests was marked and given a score of 1 whereas a wrong item was marked as 0. Then, all the correct items of an individual student were totaled to determine his gained scores: a total score of 51 on the Definition Part and 50 on the Cloze Part.

3.8.1.3 Validation of the test and the review tasks

After the test and all review tasks were constructed, they were assessed for their validity and reliability. To validate the contents, two experts in the fields of testing and assessment were consulted. For item validation, three English instructors at RMUTL were also requested to validate these measures (see validation checklists and results in Appendix O). Regarding the content validation, the experts gave their opinions on the checklists on the issues of word selection, format and design, and consistency to the objectives of the study. To calculate the data from the checklists, the items marked indicating agreement on justification are rated 1, those indicating disagreement are -1, and those indicating unsure are 0. Then, these results were calculated for their means and the overall results are shown in Table 3.13. The issues were considered justified if the mean values were not less than 0.5.

Table 3.13: Results from the content validation of the test and review tasks

	Minimum	Maximum	Mean	Std. Deviation
1. Word Selection: Criteria	1	1	1.00	.000
Representativeness	0	1	.50	.707
2. Part I: Instructions	-1	0	-.50	.707
Test format	0	1	.50	.707
Definitions	0	1	.50	.707
Distractors	0	0	.00	.000
3. Part II: Instructions	-1	0	-.50	.707
Test format	0	1	.50	.707
Length of passage	1	1	1.00	.000
Enough contexts	1	1	1.00	.000
Variety of text types	1	1	1.00	.000
Topics of passage	1	1	1.00	.000
Contents	0	1	.50	.707
4. Overall: Conform to objectives	1	1	1.00	.000
Time	0	0	.00	.000

(N = 2)

According to the results in Table 3.13, all issues were justified because their means were not less than 0.5, except the issues of the instructions in Part I and II. The criteria for word selection were considered appropriate. Regarding representativeness, however, different ratings were received. One expert agreed that the number of tested and reviewed words i.e. over 30% of all target words was statistically enough to represent the entire target words whereas the other expert rated this issue as '*unsure*'. He mentioned that although such a number seemed justified, there was no rule of thumb to ensure such representativeness. In fact, after the validation of classroom materials, the number of target words was reduced from 600 to 480 words. As a result, the total number of tested and reviewed words i.e. 101 and 120 words respectively formed 221 words which were about 46% of the target words. Such number was nearly half of the target words and all these words were also balanced in terms of word presentation at different stages of the study. Therefore, this number may be claimed to represent the target words.

In Part I of the measure, nearly all issues obtained different ratings, except for the appropriateness of distractors which were similarly rated as '*unsure*'. In cases of distractors, it was suggested that options in each set should be grouped according to similar grammatical functions to prevent confusion. Based on their suggestions, distractors in Part I were modified as suggested. The remaining three aspects being assessed were instructions, test format and given definitions. Firstly, it was suggested that the instructions should be made simpler and clearer both in Part I and II. Secondly, the format of the test, as suggested by one expert, should be improved in terms of a typing format, not a design format. Finally, some definitions given in the measures were considered ambiguous and had to be modified to make them clearer. Based on these comments and suggestions, Part I in all measures was modified accordingly.

In Part II, nearly all issues were similarly rated as being justified, except for three issues on instructions, test format and contents selection. The instructions and the test format received the same comments and suggestions as those in Part I whereas finding reliability value of the contents in gapped passages was suggested to ensure that they matched students' proficiency level. In addition, it was suggested that more distractors be included in each passage in order to reduce the chance of guessing. All the remaining issues i.e. length of the passage, contexts of each gap in the cloze, variety of text types and topics of the passages were agreed upon as being justified. According to these suggestions, the cloze passages were calculated for their readability values and then were slightly simplified in order to make them more suitable for the students in the study while maintaining as much authenticity appropriate for academic texts as possible. Moreover, one more distractor was included for each cloze passage.

Regarding the overall design, both experts agreed that these measures met the objectives of the study. However, the length of test-taking time was considered insufficient since many items as well as cloze passages were included in these measures. Therefore, the time set for the test was changed from 2 hours to 3 hours and that of the tasks was changed from 40 minutes to 1 hour. Apart from all the suggestions mentioned above, various details from other suggestions were also taken into consideration in modifying the test and all review tasks.

After such modification, test and task items were validated by three RMUTL English instructors. These instructors tried to do the test and tasks to assess whether each item of these measures was clear or ambiguous in test taking. The checklist for item validation in Appendix O was used for these instructors to give comments. Similar to the calculation of content validation, the items indicating agreement on justification are rated 1, those indicating disagreement are -1, and those indicating unsure are 0. The results were calculated for their means and the test items were considered justified if the mean values were not less than 0.5. These results are shown in Appendix O. It was evident that the means of all items were justified because they were over 0.5 although a few items were marked as ambiguous by one of these experts. The ambiguous items were modified accordingly in order to ensure the clarity of the measures although each of them was rated as '*unsure*' by only one expert from three.

3.8.1.4 Reliability of the pretest/posttest and delayed test

After the contents and items were validated, the reliability of the test was also established. The measure was piloted with a sampling group of 34 engineering students who were of a similar level to the participants in the main study. The review tasks were not piloted because they were used as classroom materials rather than research instruments and their data were mainly supplementary. After the piloted test was administered, the test scores were calculated with a statistical method called an *alpha coefficient* or *Cronbach's Alpha* to find out the reliability value in terms of the test internal consistency. As a result, the obtained Alpha value was 0.7254. Despite being slightly lower than the expected value of 0.75, the derived value was acceptable in the study for two reasons. Firstly, in many published research papers, the reliability values between 0.7-0.8 were typically acceptable for Cronbach's Alpha, according to Field (2005). In addition, Santos (1999) cites that 'Nunnaly (1978) had indicated 0.7 to be an acceptable reliability coefficient but lower thresholds are sometimes used in the literature'.

Secondly, it was assumed that the low reliability value was due to the lack of heterogeneity of RMUTL students' vocabulary proficiency. Ary et al. (2002, p.261) mentioned, 'The reliability coefficient increases as the spread, or heterogeneity, of the subjects who take the test increases. Conversely, the more homogeneous the group is with respect to the trait being measured, the lower will be the reliability coefficient'. RMUTL students' vocabulary size was limited, as evidenced from the study for assessing their vocabulary size described in 1.1 in Chapter I. Therefore, their performance resulted in the low reliability value of the piloted test. With these assumptions, the test reliability value which was slightly lower than the estimation was considered acceptable.

In the study, the overall reliability value of the test was calculated without discriminating individual items. It was assumed that students' performance on the piloted test might not be a good index for discriminating the test items. On the one hand, the test was aimed at assessing achievement on specific lexical knowledge which most RMUTL students did not possess. Although the test contents were strongly considered by the researcher as something necessary to be learned, the students had not yet had any chance to learn them. On the other hand, with limited vocabulary size, students would not put their full effort into doing the test since most of the tested words were unknown to them and the gain in scores did not have any effects on them in any way. However, the test had to be piloted with these students since they were the sampling group which was similar to the participants of the study in many important aspects. As a result, their average derived scores were very low and some scores were due to guessing rather than true performance. Accordingly, the indices of the test items could not precisely indicate whether the items were proper or not. Therefore, the test items which had already been validated were not discriminated against or omitted.

3.8.2 Students' logs

Students' logs were used only by students in the experimental group to reflect their opinions, comments and suggestions while dealing with the concordance-based method. After every lesson, about 10 students were requested to record the data. These students were randomly selected but some students might volunteer later to write their information in the logs. Some students might write the logs immediately after the classes but some might ask to do it at home and returned the completed logs on the next day. There were 12 logs in total as there were 12 lessons. Each log included a set of questions and some examples used as guidelines for recalling and recording data, and students were advised to write and reflect upon their opinions and comments in Thai. This was to ensure that students' records would cover the needed information (see Appendix P).

3.8.3 Teacher's field notes

Teacher's field notes were detailed notes with a checklist of observation. A checklist was used as a set of guidelines and supplementary data for the observation on students' processes and attitudes while dealing with the concordance-based method. This was to ensure that as much information as needed would be obtained from the observation as possible. In the observation checklist, five main points were listed i.e. students' participation in general, dealing with a concordancer, dealing with corpus information, feelings and problems. These points were observed according to some questions used as guidelines for the observation (see Appendix Q). The data from the teacher's records were useful in describing and interpreting students' processes and attitudes in dealing with the concordance-based method. These data were triangulated with students' logs and interviews as well as their performance on the tests and tasks in order to find out whether there was any controversy or congruence among them.

3.8.4 Questionnaires

Two sets of questionnaires were administered in the present study. The first questionnaire was administered with both groups of students at the beginning of the study to collect the participants' information before the study. The second questionnaire was used only with the experimental group at the end of the study in order to obtain information about their processes and attitudes while dealing with the concordance-based method. The description of both questionnaires is as follows.

3.8.4.1 Questionnaire I

The first set of the questionnaire was aimed at eliciting students' data on areas of general information, previous English study, reading background, and computer skills (see Appendix B). These initial data were necessary for identifying students' background enough for determining whether some factors might relate to the effects of the treatment or not. For example, if they were unfamiliar with computers, they might not like using a concordancer to study English; or if they did not like reading in general, it was likely that they would not attempt to read a lot of corpus information while dealing with the method. With knowledge of students' background on such data, the outcome of the study could be interpreted more precisely.

Questionnaire I was designed in the form of a checklist combined with a rating scale and an open-ended section for comments and suggestions. It was divided into five main parts: general information, previous English study, reading background, computer skills, and comments and suggestions. The part of general information consisted of four items concerned with students' bio-data: name, age, field of study, previous schools/institution, and last GPAs. The second part of previous English study involved students' previous background in studying English. This part included nine items. The first six items were checklists for students to give information on their initial introduction to English study, length of studying time, possible exemption from studying English, previous native-English teachers, two previous English Grades, attitude towards English study, and motivation to learn English. In the last two items, students were requested to rate their previous participation in English classes in terms of frequency as well as to rate their four skills of English on a 5-point rating scale.

The third part of Questionnaire I was concerned with students' reading background to elicit their habits and attitude on reading in general. There were ten items of checklists to seek information on their attitudes towards reading; experience in reading texts in Thai in terms of frequency and text types; and experience in reading texts in English in terms of frequency, length of texts, English texts in engineering courses, difficulty, and strategies used to solve problems. The fourth part included checklist items on students' computer skills. There were twelve items to elicit information on students' attitude towards using computers, frequency of access, possession of computers, places for access, basic computer skills, types of used programs, types of activities, experience in using computers to learn other subjects and types of materials used, experience in using computers to learn English and types of materials used, and experience with a corpus or a concordancer. The last part was open-ended for students to freely give comments and suggestions concerning English study.

3.8.4.2 Questionnaire II

Questionnaire II was administered at the end of the study in order to elicit students' information about their processes and attitudes while dealing with the concordance-based method (see Appendix R). This questionnaire was divided into five main parts: students' studying performance, computer skills, concordancing skills, attitudes towards the method, and comments and suggestions. Regarding studying performance, students were requested to rate their performance in terms of their class attendance, participation in activities, understanding of the lessons, ways to deal with problems, frequency of revision and assignment completion. The second part was concerned with computer skills. It consisted of 8 items in a 5-point rating scale, except item 3 which included 11 sub-items in the form of a checklist. The issues involved students' skills in dealing with computers in general, a concordancer, concordance-based activities, frequency of using concordancing skills, skills in dealing with concordancing activities, frequency of accessing the corpus, confidence and the preference in using the concordancer.

The third part dealt with concordancing skills in terms of context observation in the form of a checklist and a 5-point rating scale. The questions dealt with students' strategies in reading a concordance format, making use of the concordance information, performance in dealing with the concordance activities, problems in dealing with concordance information, ways to solve such problems, and opinions on the use of the concordance format. The fourth part involved students' attitudes towards the concordance-based method. In the first three items, students were asked to rate their opinions on usefulness, ease/difficulty, and their preference in using the concordance-based method. The last question was a checklist asking whether the students would continue using the method for their own study in English. The last part was open-ended for students to freely give comments and suggestions for improving the concordance-based method.

3.8.4.3 Validation of the questionnaires

The questionnaires were validated together with the lesson plans and the classroom materials by the same group of three experts in the fields of EFL teaching and classroom concordancing. Checklists (in Appendix S) were used for validating both questionnaires and it was divided into three main parts: assessment of each questionnaire item, overall aspect, and comments and suggestions. According to the results, all items in Questionnaire I and II were rated as justified by all three experts.

3.8.4.4 Reliability of the questionnaires

The reliability of both Questionnaires I and II was established by piloting them with 21 students who had been the participants in the experimental group in the pilot study. Despite being small in number, this group of students was considered to be the best option for piloting the questionnaires, especially Questionnaire II as they had experience in dealing with the concordance-based method. After these questionnaires were tried out, only the items in the form of a 5-point rating scale were calculated for the reliability value by using the method of an *alpha coefficient* or *Cronbach's Alpha* at the set point of 0.75 (see the results in Appendix S).

In Questionnaire I, there were 8 scaled items and two of them included 7 sub-items. Thus, there were 23 items altogether to be calculated. Questionnaire I appeared to have good internal consistency with the Alpha value at 0.8593, which was much higher than the set point. No items were deleted although the deletion of some items might have slightly increased the reliability value of the questionnaire. Such deletion was considered as not being worthwhile since the possible increase in Alpha value would be slightly higher whereas data derived from such items were still considered as being useful. Questionnaire II had 18 items and three of them had 29 sub-items so there were 44 items altogether for calculation. It appeared that Questionnaire II had better internal consistency i.e. Alpha value at 0.9117. The results were illustrated in Appendix S and no items in this questionnaire were deleted for the same reasons as for Questionnaire I.

3.8.5 Interview

The semi-structured interview was carried out with audiotape recordings on a one-to-one discussion basis. The interview was conducted in Thai in order to obtain as much information as possible. Nearly half of the students i.e. 11 students in the experimental group were interviewed by appointment within one week after the completion of the study. The interviewees were randomly selected so some of them might or might not be the same students who wrote the students' logs. A set of questions was designed as an interview framework and these questions were aimed at eliciting students' information in four main areas: computer concordancing skills, observing skills in concordances, and attitudes and opinions (see Appendix T). At the beginning of the interview, they were asked about their computer concordancing skills. During this stage, students were asked to recall their performance while operating the concordancer and specify which activities they performed in operating the programs in order to assess how well they could use it. To facilitate students in recalling and giving examples of their performance, either or both illustrations of on-screen concordances as in Figure 3.10 and 3.11 were provided.

Figure 3.10: The on-screen concordance of '*depend**' used in the interview

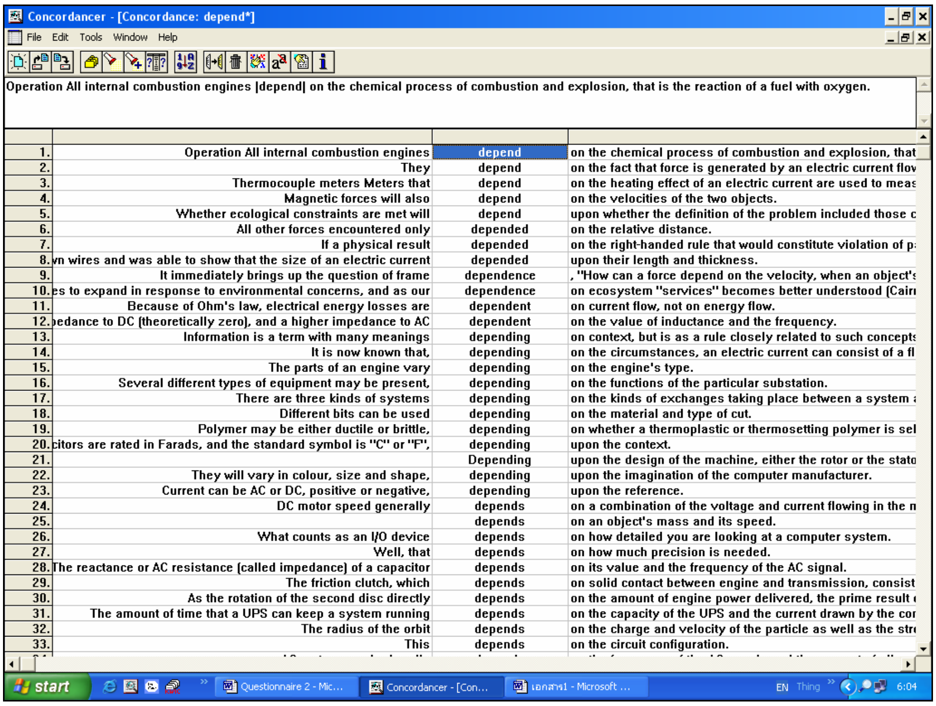
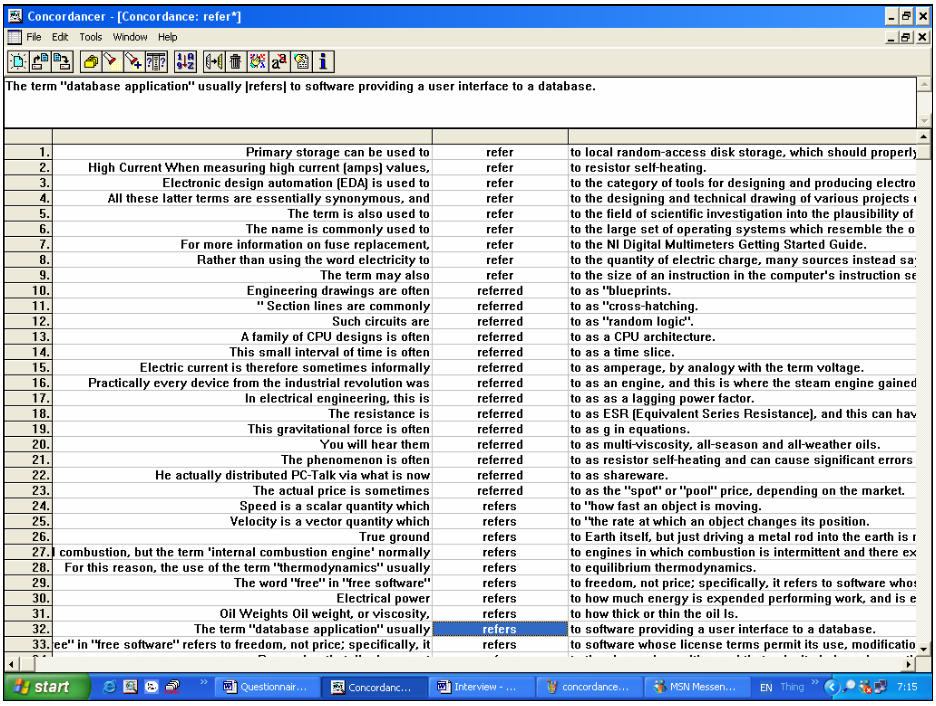


Figure 3.11: The on-screen concordance of '*refer**' used in the interview



After sufficiently discussing students' computer concordancing skills, the interview moved on to elicit details about students' observing skills in regard to concordances. One or two illustrations of '*refer**' and '*depend**' concordances were used to help them specify how they observed the contexts of the keywords in order to assess in what ways as well as how well they could make use of the context observation in studying vocabulary for reading. Then, the students were asked about their feelings and opinions towards the method in terms of usefulness and ease/difficulty of the method, preference and problems in dealing with the method, and the probability of them in continuing to use the method for their own study. Finally, they were requested to give comments and suggestions about how to improve the concordance-based lessons.

3.6.4 Data Collection

As mentioned earlier, the duration of the experiment was one academic semester or 18 weeks. The English class met once a week for a 150-minute session. The stages of data collection can be seen in Table 3.14.

Table 3.14: Stages of data collection

Weeks	**Lessons**	**Themes**	**The experimental group only**
1	Introduction of course description Administration of the questionnaire and pretest		
2	Introduction	Introduction to the concordance-based method for the experimental group Introduction to reading in general for the comparison group	
3	1	Engineering Fields	Field note and log 1
4	2	Engineering Drawing	Field note and log 2
5	3	Computers in Engineering	Field note and log 3
6	4	Machines and Engines	Field note and log 4
7	5	Energy and Electricity	Field note and log 5
8	6	Electrical Systems in Automobiles	Field note and log 6
9	Midterm Exam: Review Tasks 1 and 2		
10	7	Engineering Products	Field note and log 7
11	8	Power Transmission	Field note and log 8
12	9	How to Build an Electric Motor	Field note and log 9
13	Revision and Review Task 3		
14	10	Latest Technology	Field note and log 10
15	11	Causes of Failure	Field note and log 11
16	12	Electric Vehicles	Field note and log 12
17	Revision and Review Task 4		
18	Final Examination: Immediate Posttest		
Interview within a week after the study Delayed Posttest one month after the study			

At the beginning of the study, the pretest and the first set of the questionnaire were administered for obtaining students' information on their existing vocabulary proficiency as well as on their personal information before the study. Then, during the study, twelve sets of teacher's field notes and students' logs were recorded after each lesson with the concordance-based method. Four review tasks were administered: the first two tasks were used together as the midterm exam whereas the other two tasks were used as quizzes after three later lessons. Next, the immediate posttest was used as a final exam and the interview was conducted within a week after the final exam. Finally, the delayed posttest was administered within a month after the study i.e. the beginning of the following semester.

3.10 Data Analysis

The data analysis is described according to five research questions proposed in the study (see 1.3, Chapter 1). Since the first three questions dealt with a quantitative study on the learning effects of vocabulary learning, the method of data analyses for these questions are described together under the same sub-topic. On the other hand, the analyses for the last two questions are explained separately on exploring students' learning processes and attitudes in dealing with the concordance-based method.

3.10.1 Data analysis for Research Questions 1 – 3

The first three research questions were concerned with learning effects of two teaching methods on vocabulary learning in the areas of definitional knowledge, transferable knowledge and retention rates of both knowledge types. These three questions had one independent variable (IV) with two levels of teaching methods: the concordance-based method used in the experimental group and the conventional teaching method used in the comparison group. In addition, four dependent variables (DVs) included the learning effects of these methods on the measures of definitional knowledge, transferable knowledge and retention rates of both knowledge types. The definitional and transferable knowledge were represented by the average scores on the Definition Part and the Cloze Part in the immediate posttest respectively. The retention rates of both knowledge types were from the average scores on their corresponding parts of the delayed posttest. These variables are summarized in Table 3.15.

Table 3.15: Independent and dependent variables in Research Questions 1-3

1 IV with 2 levels	**A Concordance-based Method** (An experimental group)				**A Conventional Teaching Method** (A comparison group)			
4 DVs	**DV1**	**DV2**	**DV3**	**DV4**	**DV1**	**DV2**	**DV3**	**DV4**
	Scores on Definition Part in the immediate posttest	Scores on Cloze Part in the immediate posttest	Scores on Definition Part in the delayed posttest	Scores on Cloze Part in the delayed posttest	Scores on Definition Part in the immediate posttest	Scores on Cloze Part in the immediate posttest	Scores on Definition Part in the delayed posttest	Scores on Cloze Part in the delayed posttest

Note: DV1 = measure of definitional knowledge on the immediate posttest
DV2 = measure of transferable knowledge on the immediate posttest
DV3 = measure of definitional knowledge on the delayed posttest
DV4 = measure of transferable knowledge on the delayed posttest

Because there were multiple DVs, to analyze the data, a multivariate analysis of variance (MANOVA) was conducted to determine the differences between the learning effects of the two teaching methods on definitional knowledge, transferable knowledge and retention rates of both knowledge types. The focus of each analysis of variance was on the extent to which these teaching methods affected each of the knowledge types, regardless of the interaction effects among them. In running the SPSS program, the teaching methods were defined as the fixed factors whereas the average scores on four measures were dependent variables. To control the overall error rate, the Bonferroni method was used to adjust the selected significance level (0.05). To interpret the results of MANOVA, the basic assumptions on the equality of covariance matrices were tested before the learning effects of both methods on each measure were considered separately from the tests of between-subjects effects. If significant differences in learning effects were found on any measures, these differences would be calculated to find the magnitudes of their effect sizes and the relative non-overlap indexes between groups. Regarding the retention effects, apart from conducting MANOVA and calculating effect sizes, the retention percentages of both methods on both measures of knowledge types were also calculated. Details about this procedure are as follows.

Firstly, the basic assumption of MANOVA was tested on the equality of covariance matrices, using the *p*-value of the Box' *M* test. Its insignificance *p*-value (*p(M)* > 0.05) indexed the support of this assumption that the covariances in the matrices were equal whereas its significance *p*-value (*p(M)* < 0.05) indexed the violation of this assumption. With the equality of the sample sizes in the present study, however, Tabachnick and Fidell (2001) point out that MANOVA is fairly robust because the interpretation of MANOVA results usually rests on the interpretation of significant univariate effects after the overall test is significant. Regarding a multivariate test, the Wilk's Lambda method was used in the present study to test whether the means of both methods were equal across all of the measures. This method was selected because of its popular use and robustness to the violation of assumption (Lewicki and Hill, 2006; Tabachnick and Fidell, 2001; and Hinto, Brownlow, McMurray and Cozens, 2004). The significant *p*-value of Wilk's Lambda (Λ) indicated that there would be the effects of the teaching methods on the measures in general. However, it would not indicate exactly where the effects lied in which measures.

Therefore, learning effects of both teaching methods on each measure were considered separately, based on the obtained *F*-value and *p*-value from the tests of between-subjects effects. Each difference was significant if the *p*-value was less than 0.05 ($p < 0.05$). When a significant difference was found, its magnitude was determined in terms of *effect sizes*. The SPSS program also provides the MANOVA effect size values in *Partial Eta Squared* (η_p^2) i.e. 0.01 = small effect, 0.06 = medium effect, and 0.14 = large effect, according to Cohen's effect sizes (cited in Coetzee, 2005). However, the values of η_p^2 do not index the description of additional measures on non-overlap or percentile standing between groups. Therefore, in the present study, the Cohen's *effect sizes* (*d*) were calculated instead, by using the following formula proposed by Cohen (1988, cited on the webpage http://web.uccs.edu/lbecker/Psy590/es.htm).

$$d = M_1 - M_2 / \sigma$$

Where $\sigma = \sqrt{[\Sigma(X - M)^2 / N]}$

Where X is the raw score, M is the mean, and N is the number of cases.

Accordingly, the difference between the means, M_1 - M_2, was divided by standard deviations, σ, of both groups. The interpretation of Cohen's *d* and the relative percentile standing values are shown in Table 3.16.

Table 3.16: Interpretation of Cohen's *d* effect size and the relative percentile standing

Cohen's Standard	Effect Size	Percentile Standing	Percent of Non-overlap
	2.0	97.7	81.1%
	1.9	97.1	79.4%
	1.8	96.4	77.4%
	1.7	95.5	75.4%
	1.6	94.5	73.1%
	1.5	93.3	70.7%
	1.4	91.9	68.1%
	1.3	90	65.3%
	1.2	88	62.2%
	1.1	86	58.9%
	1.0	84	55.4%
	0.9	82	51.6%
LARGE	0.8	79	47.4%
	0.7	76	43.0%
	0.6	73	38.2%
MEDIUM	0.5	69	33.0%
	0.4	66	27.4%
	0.3	62	21.3%
SMALL	0.2	58	14.7%
	0.1	54	7.7%
	0.0	50	0%

To interpret the result, the values of 0.2, 0.5 and 0.8 are generally regarded as small, medium and large effect sizes, based on Cohen's description. Moreover, the percentile standing provides more information on the relative difference between both groups. For example, the effect size of 0.0 indicates that the distribution of scores for the group with higher scores overlap completely with the other group i.e. 0% of non-overlap. The mean score of the former is at the 50th percentile of the latter. Another example effect size of 0.8 indicates that the magnitude difference between both groups is large and its relative percentile standing of 79 means that the mean of the group with higher scores is at 79th percentile of the other group.

Finally, to answer the first three research questions, the results of the between-groups effects on the following DVs or measures were used as indicated in Table 3.17.

Table 3.17: Data for answering the first three research questions

Research Questions	Data for providing the answers to the questions
Question 1	DV1 (measure on definitional knowledge in the immediate posttest)
Question 2	DV2 (measure on transferable knowledge in the immediate posttest)
Question 3	DV 3 (measure on retention rates of definitional knowledge in the delayed posttest)
	DV 4 (measure on retention rates of transferable knowledge in the delayed posttest)

Regarding retention rates, apart from conducting MANOVA and estimating the effect size, the retention percentage of each knowledge type was also calculated from the mean scores of each group on the corresponding part of the immediate posttest and the delayed posttest.

3.10.2 Data analysis for Research Question 4

Question 4 was aimed at exploring students' learning processes in dealing with the concordance inputs. Students' learning processes in the present study were operationally defined as students' performances in dealing with dealing with a computer concordancer and that in dealing with concordance information. Dealing with a computer concordancer refers to students' abilities to operate a concordancer to find corpus information, display and manipulate concordance output for facilitating the observation of word behaviours in various concordance contexts. On the other hand, dealing with concordance information is concerned with students' abilities to utilize the concordance facilities and the observation of word contexts to enhance their vocabulary learning by identifying various aspects of words to interpret texts and deduce word meaning. Learning processes were assessed by the relevant data from Questionnaire II, teacher's field notes, students' logs and interview. In addition, the average total scores from all measures were also used as supplementary data to reveal students' overall learning development.

To analyze the data, the descriptive data from the open-ended sections of the questionnaire, teacher's field notes, students' logs and interview were grouped according to the students' performances in dealing with a computer concordancer and those in dealing with concordance information. On the other hand, all items in the questionnaire were summarized in percentages according to students' rating the frequency and quality of their performances in dealing with a computer concordancer and concordance information. In addition, the scaled items were labeled 1 to 5 points respectively from negative to positive aspects or less to most frequency. Only item 4 in Part 3 was labeled in the reverse order since it carried negative connotations concerning how many problems the students faced. Then, each scaled item was calculated for the mean and interpreted with the given point closet to the mean as in Table 3.18.

Table 3.18: Interpretation of the results from scaled items

Means of Scaled items	**Interpretation**				
Between 4.5 and 5	Always	Very Quick	Very Much	Very Well	Very Easy
Between 3.5 and 4.4	Often	Quick	Much	Well	Easy
Between 2.5 and 3.4	Sometimes	Moderately Quick	Average	Fairly	Average
Between 1.5 and 2.4	Rarely	Slow	A Little	Poorly	Difficult
Between 1 and 1.4	Never	Very Slow	Very Little	Very Poorly	Very Difficult

All these data were grouped together for being interpreted respectively on students' performances in dealing with the computer concordancer and the concordance information in acquiring skills for vocabulary learning. In addition, to reveal the overall learning development, the average total scores from all measures were also used as supplementary data. To analyze the data, the average total scores on all measures of both groups from the beginning through the end of the study were compared, using the MANOVA similarly to that described in 3.10.1. In this analysis, there were 7 DVs: the average total scores of the pretest, review tasks 1 to 4, the immediate posttest and the delayed posttest. The results from the MANOVA were used to reveal the students' overall learning development as well as to identify when the significant difference between groups occurred.

3.10.3 Data analysis for Research Question 5

Question 5 was aimed at exploring students' attitudes towards the application of the concordance-based method. In the present study, students' attitudes refer to their opinions in terms of the method's usefulness for vocabulary learning and level of difficulty as well as the students' degree of preferences in dealing with the method. The investigation on students' attitudes was based on students' opinions found in students' logs, Questionnaire II and the interview.

The data from all items of the questionnaire were summarized in percentages to reveal the frequency of students' opinions towards the concordance-based method. The scaled items were labeled 1 to 5 points respectively from negative to positive aspects. Then, each scaled item was calculated for the mean and interpreted with the given point closet to the mean as in Table 3.18. The students' attitudes were considered positive if each mean was not less than the middle point of 3 on the 5-point rating scales. Then, the descriptive data from the open-ended sections of the questionnaire and from the interview were grouped together according to the students' opinions in terms of the method's usefulness for vocabulary learning and level of difficulty as well as the students' degree of preference in dealing with the method.

3.11 Summary

This chapter describes the research methodology of the study. The research was designed in the form of '*a matching-only pretest-posttest comparison group design*'. The population consisted of around 1,000 RMUTL engineering students at undergraduate level and the samples were two intact groups in the academic year of 2005. One group was randomly assigned to the experimental group studying with the concordance-based method whereas the other group represented the comparison group studying with the conventional teaching method. The students were matched in 26 pairs according to their vocabulary proficiency in the pretest. A pilot study was conducted in order to try out classroom materials. The results were used to provide guidelines for the implementation of the main study.

In the main study, the Engineering Corpus of around 500,000 running words was compiled from academic texts in engineering. Then, 480 target words belonging to the GSL or AWL wordlists were selected from high frequency words in the corpus. The resulting target wordlist was divided into 12 weekly wordlists i.e. 40 words per week. Then, these target wordlists were used to design all classroom materials and research instruments. Regarding classroom materials, the lesson plans and class handouts were designed in two versions: one for the experimental group and the other for the comparison group. Four review tasks were developed for ongoing assessments whereas the pretest, the immediate posttest and the delayed posttest were designed in the same paper for assessing the overall learning effects on definitional knowledge, transferable knowledge and retention rates. The other instruments were the teacher's field notes and students' logs to be recorded after each concordance-based lesson whereas the questionnaire and the interview were used to collect data at the end of the study.

In data collection, Questionnaire I and the pretest were administered at the beginning of the study. During the experiment, the teacher's field notes and the students' logs were recorded after every concordance-based lesson. The first two review tasks were used as the midterm exam whereas the other two tasks were separately administered after every three lessons. At the end of the study, the immediate posttest was administered with both groups whereas Questionnaire II and the Interview were arranged only with the experimental group. Finally, both groups took the delayed posttest about one month after the study.

For data analysis, the data for answering Research Questions 1-3 were based on the average scores on the Definition Part and the Cloze Part in the immediate posttest and the delayed posttest. The multivariate analysis of variance (MANOVA) was used to compare learning effects of the concordance-based method and the conventional teaching method in the areas of definitional knowledge, transferable knowledge and retention rates of both knowledge types. Research Question 4 was concerned with exploring students' learning processes in dealing with concordance input to acquire concordancing skills and vocabulary knowledge. The processes were examined in two areas: students' performances in dealing with a computer concordancer and those in dealing with concordance information. The analysis of the learning processes was based on the data collected from teacher's field notes, students' logs, Questionnaire II and interview. In addition, averages total scores from all measures administered from the beginning to the end of the study were also used as supplementary data to reveal students' overall learning development as well as to identify the stage in which the significant difference occurred between both groups. The last Research Question 5 was dealt with students' attitudes towards the application of the concordance-based method. The analysis was based on the descriptive data from the students' logs, questionnaire and interview. These data were grouped according to students' opinions in terms of the method's usefulness and level of difficulty as well as their degree of preference to deal with the concordance-based method.

CHAPTER IV
FINDINGS

4.1. Introduction

This chapter presents the findings from the study according to the focuses of the five proposed research questions i.e. learning effects, learning processes and learners' attitudes. On the one hand, the first three questions focused on comparing the learning effects of the concordance-based method and the conventional teaching method on vocabulary learning. On the other hand, the fourth and fifth questions dealt with students' learning processes and attitudes in dealing with the concordance-based method. Therefore, the findings of the learning effects, learning processes and learners' attitudes are presented respectively.

4.2. Learning Effects

The first three research questions focused on comparing the learning effects from the application of the concordance-based method and the conventional teaching method on definitional knowledge, transferable knowledge and retention rates of both knowledge types. It was hypothesized as in the following representations that significant differences were present between students' average scores of the experimental group and the comparison group on the measures of their vocabulary size, ability to transfer lexical knowledge to new contexts and retention rates of both knowledge types.

$$H_1: \overline{X}_{\text{definitional knowledge scores (E)}} \neq \overline{X}_{\text{definitional knowledge scores (C)}}$$

$$H_2: \overline{X}_{\text{transferable knowledge scores (E)}} \neq \overline{X}_{\text{transferable knowledge scores (C)}}$$

$$H_3: \overline{X}_{\text{retention rates (E)}} \neq \overline{X}_{\text{retention rates (C)}}$$

To test these hypotheses, the data were collected from four measures of two lexical knowledge types being studied. A MANOVA with the Bonferroni correction method (p = 0.05) was performed to examine the learning effects of the concordance-based method and the conventional teaching methods on vocabulary learning. On testing the basic assumption of MANOVA, it was found that the p–value of Box'M in Table 4.1 was significant ($p(M) < 0.05$), indexing that the assumption on the equality of covariance matrices was not met so the covariances were not equal.

Table 4.1: Results of Box's test of equality of covariance Matrices

Box's M	60.562
F	5.530
df1	10
df2	11952.191
Sig.	.000

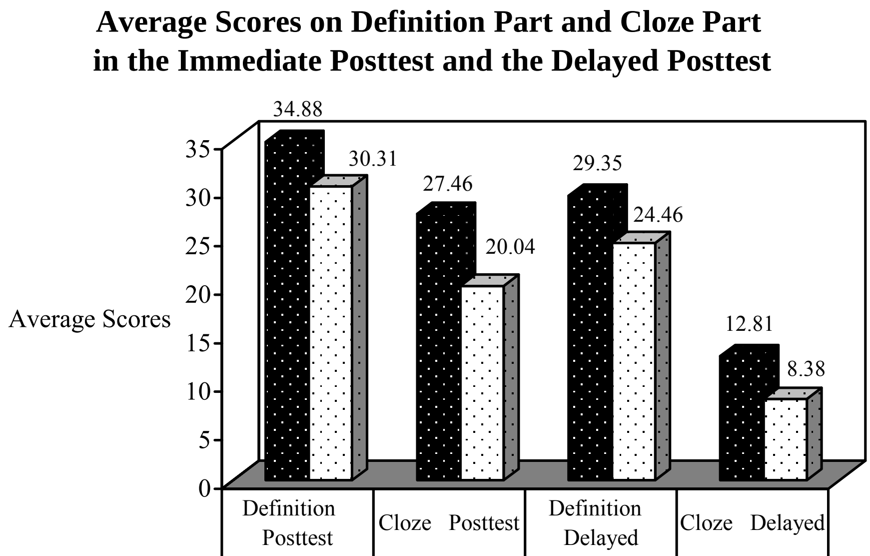
Although this assumption was not met, the violation did not have much effect on the results of MANOVA because the equality of the sample sizes and the use of Wilk's Lambda as a multivariate test were fairly robust (Lewicki and Hill, 2006; Hinto et al, 2004; and Tabachnick and Fidell, 2001). Regarding the multivariate test (see Table 4.2), a significant difference was found at Wilk's $\Lambda = 0.253$, $F(4, 47) = 34.609$, $p < 0.05$, and $\eta_p^2 = 0.747$, indicating that the two methods had different learning effects with a large effect size.

Table 4.2: Results of multivariate tests

Effect		Value	F	Hypothesis df	Error df	Sig.	Partial Eta Squared
Intercept	Wilks' Lambda	.006	1806.041	4.000	47.000	.000	.994
Group	Wilks' Lambda	.253	34.609	4.000	47.000	.000	.747

However, the Wilk's test could not exactly specify which method could increase significantly the scores on which measure. Therefore, an analysis of variance on each measure was needed to examine the effects of the methods on each measure. Descriptive statistics in Figure 4.1 show that the average scores of the experimental group were higher than those of the comparison group in all measures. It was also found that the average scores of both groups on the Definition Part were higher than their scores on the Cloze Part in the same tests.

Figure 4.1: Average scores on four measures of definitional and transferable knowledge



	Definition Posttest	Cloze Posttest	Definition Delayed	Cloze Delayed
■ Experimental Group	34.88	27.46	29.35	12.81
□ Comparison Group	30.31	20.04	24.46	8.38
Mean difference	4.57	7.42	4.89	4.43
Standard error	1.30	1.00	2.06	0.59

(Note: Total scores on Definition Part = 51 scores, Total scores of Cloze Part = 50 scores)

An analysis of variance on each measure was illustrated in Table 4.3. The results revealed that the differences between the learning effects of both teaching methods were significant in all four measures.

Table 4.3: The results of tests of between-subjects effects

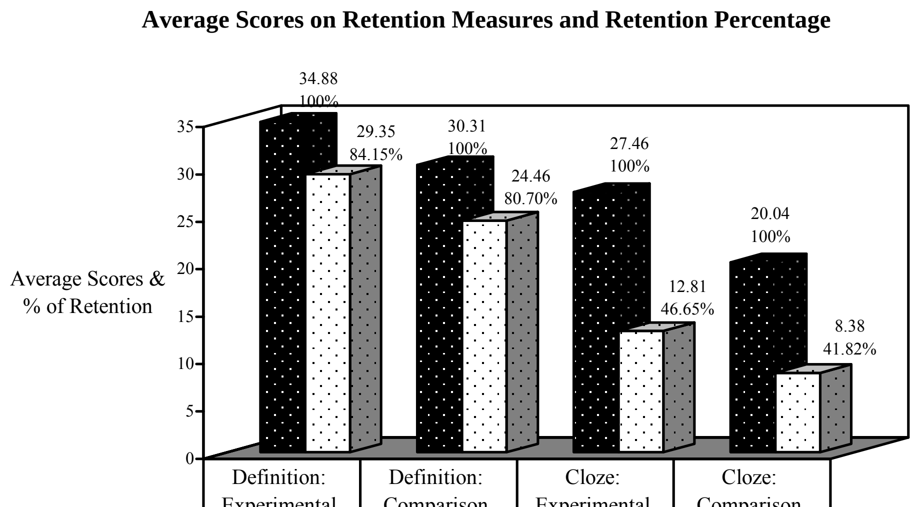
Source	Dependent Variable	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Methods or Groups	Definition Part: Posttest	272.327	1	272.327	12.376	.001*	.198
	Cloze Part: Posttest	716.327	1	716.327	54.480	.000*	.521
	Definition Part: Delayed Posttest	310.173	1	310.173	5.598	.022*	.101
	Cloze Part: Delayed Posttest	254.327	1	254.327	57.231	.000*	.534
Error	Definition Part: Posttest	1100.192	50	22.004			
	Cloze Part: Posttest	657.423	50	13.148			
	Definition Part: Delayed Posttest	2770.346	50	55.407			
	Cloze Part: Delayed Posttest	222.192	50	4.444			

*$p < 0.05$

On the measure of definitional knowledge, it was found that the average scores of the experimental group were significantly higher than those of the comparison group with a large effect size; F (1, 50) = 12.376, $p < 0.05$, $\eta_p^2 = 0.198$ / d = 0.97, percentile standing = 52, and % of non-overlap = 51.6%. Similarly, on the measure of transferable knowledge, their average scores were also significantly higher than those of the other group with a large effect size; F (1, 50) = 54.480, $p < 0.05$, $\eta_p^2 = 0.521$ / d = 2.0, percentile standing = 97.7, and % of non-overlap = 81.1%. These results provided answers to Research Questions 1 and 2 that there were significant differences between the effects of the concordance-based method and the conventional teaching method on students' average scores on the measures of their vocabulary size and their ability to transfer vocabulary knowledge to new contexts.

Regarding retention rates, Figure 4.2 revealed that the retention percentages of the experimental group about a month after the study were higher than those of the comparison group on both measures of definitional and transferable knowledge, with the differences between these two pairs of percentages at 3.45% and 4.83% respectively.

Figure 4.2: Average scores on retention measures and retention percentages



	Definition: Experimental	Definition: Comparison	Cloze: Experimental	Cloze: Comparison
Posttest	34.88	30.31	27.46	20.04
Delayed Test	29.35	24.46	12.81	8.38

(Note: Total scores on Definition Part = 51 scores, Total scores of Cloze Part = 50 scores)

The results on each measure in the delayed posttest in Table 4.3 confirmed that these differences were significant with a medium effect size on definitional knowledge, F (1, 50) = 5.598, $p < 0.05$, and $\eta_p^2 = 0.101$ / $d = 0.66$, percentile standing = 73, and % of non-overlap = 38.2%; and with a large effect size on transferable knowledge, F (1, 50) = 57.231, $p < 0.05$, $\eta_p^2 = 0.534$ / $d = 2.0$, percentile standing = 97.7, and % of non-overlap = 81.1%. Therefore, the difference in word retention was found to be significant between both groups, and the concordance-based method was proven to have better effects on students' retention rates than the conventional teaching method.

One interesting finding was on the effect sizes of transferable knowledge. It was noted that the differences on transferable knowledge had the effect sizes at the maximum point of Cohen'*d*, $d = 2.0$ both in the immediate posttest and the delayed posttest. These differences were considerably greater than those of the definitional knowledge in the immediate posttest ($d = 0.97$) and in the delayed posttest ($d = 0.66$) respectively. This meant that the concordance-based method was much more effective in increasing students' transferable knowledge than the conventional teaching method.

To summarize, it was found that the students' average scores between the experimental and the comparison groups were significantly different in all measures of their definitional knowledge, transferable knowledge and retention rates of both knowledge types. These significant differences were large in magnitude, except the retention rate of the definitional knowledge of which the difference was of a medium effect size. One interesting finding was on the effect sizes of the transferable knowledge which were found to be very large and were much greater than those of the definitional knowledge both in the immediate posttest and the delayed posttest. These findings supported the three hypotheses proposed in the study. Based on these findings, it can be concluded that the application of the concordance-based method was more effective than the conventional teaching method in increasing students' definitional knowledge, transferable knowledge and retention rates of both knowledge types.

4.3. Learning Processes

Students' learning processes while dealing with the concordance-based input are explored in students' performances in dealing with a computer concordancer and concordance information for learning vocabulary. Dealing with a concordancer referred to students' abilities to operate a concordancer to find corpus information, display and manipulate concordance output for facilitating the observation of word behaviours in various concordance contexts. On the other hand, dealing with concordance information was concerned with students' abilities to utilize the concordance facilities i.e. a corpus, a concordancer and a concordance display format for enhancing their vocabulary learning. The second type of performances involved strategies used in reading concordances, observing contexts of keywords to identify word parts, functions, chunks or collocations in order to deduce or interpret word meaning from context clues. Apart from these performances, students' difficulties or problems arising during these processes were also explored. Moreover, their learning development at different stages of the experiment was examined.

In this topic, findings on students' learning processes are presented respectively on a process in dealing with a computer concordancer and concordance information including problems and difficulties found in each process. After that, an overall learning development is revealed.

4.3.1 Process in dealing with a computer concordancer

It was found that the students could deal with a concordancer well and did not have problems in dealing with it. According to the teacher's observations, students showed enthusiasm to deal with a concordancer when the training to use it was introduced. At the beginning stage, they actively followed the teacher's demonstration step by step. When being assigned to complete particular concordancing tasks, they could somewhat operate a concordancer to build a word frequency list, searching corpus information, displaying and sorting concordance outputs etc. The data from students' logs at the initial stage were consistent with the teacher's observation. One of them reported that:

S1: Today, I enjoy following the teacher's demonstration to access a corpus, build word frequency lists, search and sort words to produce the concordances. I can somewhat operate it myself when being assigned at the end of the lesson. A concordancer is not difficult to operate as I had expected.

Students' performances at this stage were moderate because the method was unfamiliar to them. After a few lessons, the teacher observed that their computer concordancing skills improved noticeably and they could operate a concordancer more skillfully at the middle stage. For example, they were quicker in turning on the concordancer, importing the corpus, searching words, and sorting concordances. Without being guided at the last stage, they could decide which sub-corpus should be accessed and/or which concordancer's instructions should be used. In other words, they could identify the functions of a concordancer suitable for particular tasks. When being asked to select a type of search for studying different parts or affixes of the given root words, for example, the students could explain and demonstrate how to search information for such a task. In addition, their ability to search words to find specific information to complete the given tasks was notably quicker and most students could complete the tasks in time. To find some words or information missing from the given concordances, students reported that they located some words in immediate contexts to be searched and sorted to obtain the missing information.

In students' logs, however, students did not explicitly mention on what and how they dealt with a concordancer. Instead, data seemed to suggest that students had no problems in operating it since the word '*interesting*', '*enjoy*' and '*like*' were often found in their logs. Nevertheless, the results from the analyses of the questionnaire data in Table 4.4 clearly shows that the students were able to use all eleven basic concordancing sub-skills necessary for studying the concordance lessons in the experiment.

Table 4.4: Analysis of students' computer concordancing skills (1)

	Percentages		
Items with '*yes-unsure-no*' questions in Part 2 of Questionnaire II	**Yes**	**Unsure**	**No**
3. Can you use a concordancer to do the following activities?			
* Finding statistical information of the corpus	81	19	-
* Building word frequency lists	69	27	4
* Finding frequency information of words	100	-	-
* Sorting word frequency lists	100	-	-
* Searching words	96	4	-
* Searching collocations	62	35	4
* Searching words with a wildcard	73	27	-
* Sorting contexts of keywords	92	4	4
* Finding more contexts in full sentences	89	11	-
* Finding more contexts in the source texts	69	23	8
* Deleting duplicate/unnecessary sentences	46	50	4

(Note: N = 26)

According to Table 4.4, it was found that students could use the concordancer to operate all listed activities. All of them (100%) could operate a concordancer to find frequency information of words and sort the lists. Nearly all of them (over 90%) used it to search words and sort contexts of the keywords and over 80% of them used it to find more contexts in full sentences and to find statistic information of the corpus. More than half (over 50%) of the students reported that they could use these concordancing sub-skills, except the sub-skill of deleting duplicate/unnecessary sentences which was utilized by 46% of students for dealing with a large amount of corpus information. More details in Items 1 and 2 in Table 4.5 support the evidence on students' ability to deal with a computer concordancer. About 60% of the students rated their abilities to operate general computer programs and a concordancer well whereas the others rated as average, except for two students (7%) who rated their operation on the concordancer as poor.

Table 4.5: Analysis of students' computer concordancing skills (2)

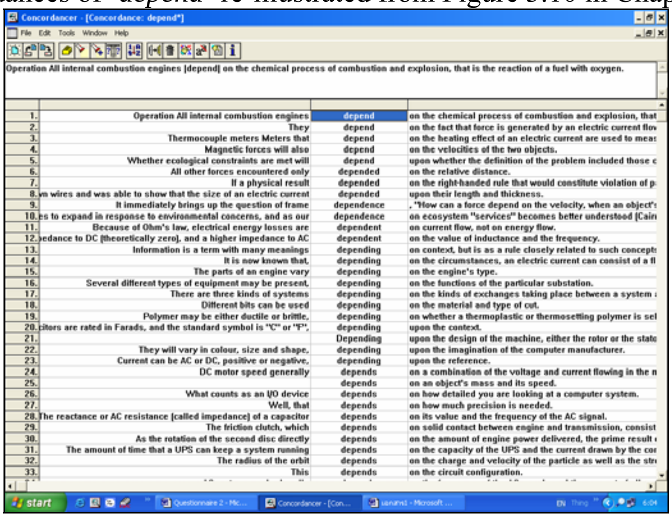
Scaled items in Part 2 of Questionnaire II	Percentages				
	5	**4**	**3**	**2**	**1**
1. How well can you use general computer programs?	4	54	42	-	-
2. How well can you use a concordancer?	4	58	31	7	-
4. How often do you use a concordancer to do the following activities?					
* Finding statistical information of the corpus	8	46	35	11	-
* Building word frequency lists	27	39	31	4	-
* Finding frequency information of words	27	50	16	7	-
* Sorting word frequency lists	50	42	8	-	-
* Searching words	58	42	-	-	-
* Searching collocations	4	62	19	12	4
* Searching words with a wildcard	12	58	19	8	3
* Sorting contexts of keywords	65	31	4	-	-
* Finding more contexts in full sentences	31	50	15	4	-
* Finding more contexts in the source texts	12	50	23	15	-
* Deleting duplicate/unnecessary sentences	19	19	35	12	15
5. How quick can you do the following activities?					
* Finding statistical information of the corpus	4	46	46	4	-
* Building word frequency lists	12	50	35	1	-
* Finding frequency information of words	23	45	27	4	-
* Sorting word frequency lists	31	42	19	8	-
* Searching words	35	35	30	-	-
* Searching collocations	8	31	42	15	4
* Searching words with a wildcard	15	31	42	8	4
* Sorting contexts of keywords	46	35	12	7	-
* Finding more contexts in full sentences	19	35	31	12	3
* Finding more contexts in the source texts	15	27	35	23	-
* Deleting duplicate/unnecessary sentences	12	23	42	15	8
6. How often do you access a corpus for your self-study?	-	-	54	19	27

(Note: N = 26; 5 = always, very well or very quick; 4 = frequent, well, or quick; 3 = average or sometimes; 2 = rarely, poor or slow; and 1 = never, very poor or very slow)

In addition, the results of Items 4 and 5 in Table 4.5 revealed more details on these activities in terms of their frequency and quality of uses. The majority of the students (more than 70%) rated their frequency of uses of these sub-skills ranging from ‘*always*’, ‘*frequent*’ to ‘*average*’. As most of them frequently performed these activities, their performances in dealing with most activities were consequently rated as ‘*very quick*’, ‘*quick*’ and ‘*average*’. In fact, more than half of them reported their frequent uses in a quick manner. These results indicated that the students could deal with the concordancer well for facilitating their vocabulary learning, resulting from their frequent uses. However, one sub-skill which was less frequently used i.e. deleting duplicate/unnecessary sentences also indicated that the students did not fully utilize this concordancer’s function for screening out irrelevant information from a vast amount of data. In addition, the results in Item 6 revealed that only half of the students occasionally practicing these skills outside class whereas the others did not.

Apart from the data from the teacher’s field notes and questionnaire, the interview data also supported the evidence that the students could deal with a computer concordancer well without problems. All interviewees reported together with a demonstration that they could operate the concordancer with no difficulty. These interviewees could explain and demonstrate clearly how to operate the concordancer. In the demonstration, they could quickly point to the icons on the computer screen in the illustration in order to indicate the particular purpose of using each icon. The following translated transcript was extracted from an interview with one student. The transcript exemplified how the students dealt with the concordancing program. Before the interview, the on-screen concordance information such as in Figure 3.10 in Chapter III was illustrated as follows.

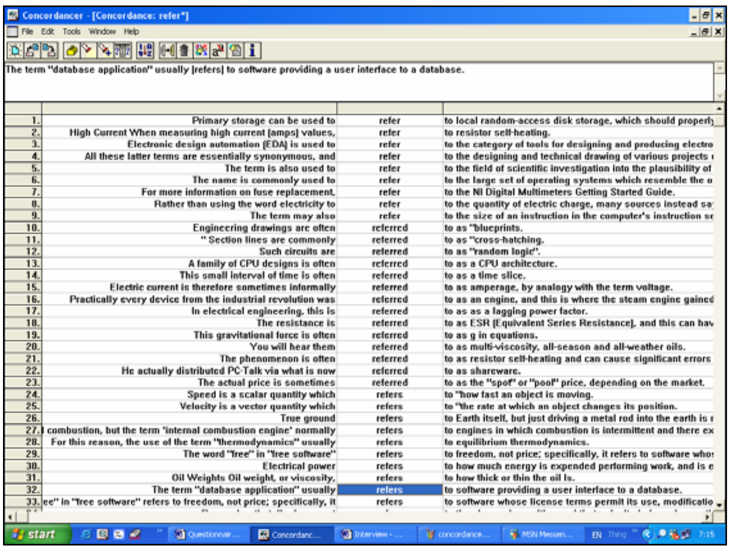
On-screen concordances of ‘*depend*’ re-illustrated from Figure 3.10 in Chapter III



T: (Gives the illustration of the concordance output of 'depend')
If we want to study the word '*depend*', how can we do that?
S1: Just click this icon. (Points to the icon for a simple search.)
T: And then?
S1: Then, type the word we want to search in the pop-up box.
T: How many words do we have to type in if we want the output with many keywords like this? (Points to the illustration.)
S1: Just one word, but with the asterisk.
T: Where should we put it?
S1: At the end of the searched word.
T: Do you know what the asterisk represents?
S1: Er..represents ..er.. similar characters ..er. different.
T: What do you mean? Does it represent similar or different characters from the typed words?
S1: Different. Yes, any more possible characters which are different from '*depend*'.
T: If we want to know how many occurrences of these words in the Corpus, what should we do?
S1: Look at these numbers to help in counting. (Points to the left side of the computer screen.)
T: But if there are more word occurrences than the ones appearing on the screen, how could we count them?
S1: That's so simple. Just scroll down the screen by using the scroll bar. (Points to the scroll bar at the right side of the screen.)

One more example is from the interview transcript of another student. It illustrates how well the students dealt with the concordancer. In this case, the concordance information such as in Figure 3.11 in Chapter III was illustrated.

On-screen concordances of '*refer*' re-illustrated from Figure 3.11 in Chapter III



T: After dealing with the concordancer for one semester, how well do you think you can operate the program?
S2: I think I can do it quite well.
T: Quick?
S2: Yes, rather quick.
T: Can you tell me what you have used the program for?
S2: Umm. I use it for searching words and observing the contexts.
T: You observe contexts before searching, right?
S2: I think so.
T: How?
S2: I observed the immediate contexts of the missing words or the gaps (in the given tasks) and then located one or two words for searching. In many cases, I use an advanced search to reduce some irrelevant output as well as to make the needed information easier to spot.
T: Right. Do you sort the output?
S2: Yes, of course.
T: What happens if you don't sort the output?
S2: It is much more difficult to observe the focused points of language.
T: You mostly search words and find specific information quickly, right? Can you give me one example of your search?
S2: Certainly. I searched 'in order to', for example.
T: This means that you know this collocation, don't you?
S2: Right. In the case of knowing particular collocations, we can use an advanced search. However, if we don't know particular collocations, we could use a simple search and then sort the output by the left or the right parts of the keywords before locating some recurrent patterns.
T: You seem to deal with the program very well and can explain it clearly. For what purposes, do you use the concordancer?
S2: To specify chunks of words.
T: Can you do that?
S2: Yes. Very easily.
T: Suppose that you found a very long sentence such as in concordance line number 27 of '*refer*'. (Points to line number 27 in the illustration.) And you want to read its full sentence, how can you do that?
S2: Just click the line.
T: Which part?
S2: Any part of the line in question.
T: All right. And where is the full sentence?
S2: Here. It appears at the top. (Points to the top box on the screen.)
T: Good. Is this the full sentence of number 27? (Points to the top box.)
S2: It belongs to this line. (Points to the concordance line32.)
T: Yes, but how do you know that?
S2: Because its keyword was selected.
T: Well done. If we want to find more contexts of the keyword than one full sentence, can we do that?
S2: Just click 'Edit' (Points to the menu bar.) and then select 'Display source texts'. We can see the whole passages or articles containing this keyword.

The above samples clearly show that the students' computer concordancing skills were quite good although some students might be humble in expressing themselves. The demonstration during the interview revealed that they could operate the computer concordancing program quite well. Therefore, all data concerning students' performances in dealing with computer concordancing skills were consistent and it could be summarized that the students' computer concordancing skills were not obstacles in studying the concordance-based lessons

4.3.2 Process in dealing with concordance information

It was found that the students' performances in dealing with concordance information developed gradually until they appeared to have gained studying skills in vocabulary learning at the end of the study. When initially dealing with the concordance information, these performances were marginal because of their unfamiliarity of the concordance format, the difficulty of authentic texts in concordances, and a large amount of on-screen concordances. However, after being trained, they could cope with the concordance information better. They learnt how to cope with difficulty in dealing with concordance texts as well as with a lot of concordance information, and utilize concordance facilities for acquiring vocabulary knowledge. At the end of the study, the students rated their performance as having substantially improved both in their vocabulary and reading proficiency. In this section, findings on students' performances in coping with the concordance information are presented, which reveal how students deal with such difficulty before they could utilize the concordance information to gain vocabulary knowledge at the end.

4.3.2.1 Performances in coping with a large amount of concordance information

The data from teacher's field notes and students' logs were consistent in revealing students' performances during the experiment. At the first encounter to paper-based concordances, the teacher observed that students looked puzzled and nervous when dealing with the concordance information. Although the concordance examples were pre-selected from full short sentences with simple language structures, they contained a lot of words unknown to the students. When students tried to read all the words in the concordances, they appeared more discouraged. This evidence is congruent with data from students' logs regarding the first paper-based lesson as in the following two examples.

> S3: At the beginning of the lesson, I was confused with the strange appearance of the concordances and the vocabulary in the concordances looked formidable for me since there are a lot of unknown words. Therefore, I could not concentrate on the lesson and felt nervous.

> S4: At the first encounter, the concordance format and context observation looked very difficult. When I tried to read the concordances, I felt discouraged since I could not interpret the concordance texts.

Accordingly, the students were given a demonstration on how to cope with text difficulty by utilizing the concordance format to observe the immediate contexts of the keywords and break down the texts into manageable chunks. In other words, they were trained to screen out irrelevant information and pay attention only to the word chunks in focus. Instead of reading all the words in the given concordances, the teacher focused their attention on the highlighted contexts and the focused chunks of words. As a result, the students began to utilize the concordance format to identify word chunks for being interpretable as evidenced in one of students' log shows.

> S5: Previously, I did not know how to identify word chunks while reading so I was often confused and misinterpreted the texts. I find from the lesson today that words such as '*current*' mostly familiar to me as meaning '*electric power*' has another meaning when it functions as an adjective. I have become aware that identifying its chunks can help me identify its function in interpreting its meanings in various concordances more accurately.

However, when the first hands-on lesson was introduced after two paper-based lessons, the students consistently reported the difficulty of authentic texts due to the nature of on-screen concordances which mainly contained authentic texts without simplification and highlights. Moreover, the output of each search included a large number of concordance lines in fragments. The students complained about such difficulty in their logs as shown in the following example.

S6: I have limited vocabulary knowledge so I am unable to understand the concordance texts. Dealing with concordance information is complicated because the concordance texts are strange, difficult and overwhelming for me to read them all.

In training students to cope with these difficulties, some useful strategies to screen out irrelevant information were taught such as selecting to read only comprehensible word chunks or concordances, locating word chunks or context clues to help in interpretation. It was evident in the later stages of the study that the students gradually learnt how to use these strategies for coping with their difficulties. The following records from students' logs described how the students dealt with the concordance information in the middle stage.

S7: Instead of reading all on-screen concordances, I pay more attention to the language points in focus and select only short simple concordances to interpret.

S8: Although I still have the problem of improperly interpreting all the concordances, I have realized how to ignore irrelevant information. Today, I learnt more about words for classifying things and I started to notice that the immediate contexts of the keywords in the on-screen concordances were useful for studying the uses of the keywords. Therefore, I tried to observe the contexts of the verbs such as '*classify*', '*categorize*', '*divide*' and I found that I could identify their typical collocations. A concordance format makes the contexts of '*classify*' so clear that its recurrent collocations mostly in passive form are detected i.e. '*be classified according to*', '*be classified into/to*' etc..

Similarly, data from the interview also confirmed their ability to cope with a large amount of corpus data. One of the interviewees reported his way in dealing with plenty of texts as follows.

T: After searching, we often find that there are so many concordance lines on the screen. How can you cope with such a lot of information?
S5: I just pay attention to only the necessary contexts. Sort the texts by the left or the right parts of the keywords and then try to specify words in chunks. These chunks can be found easily.
T: Do you select any part of texts or words to read?
S5: Yes. I try to find short words or sentences which I can somewhat interpret.

Despite being trained, it was observed that some students still had the habit of reading all the words in concordances and forgot to make use of strategies helpful for coping with difficult and large data. The questionnaire data in Table 4.6 provide details on how students used these strategies in coping with the concordance texts. Similar to the teacher's observation, the questionnaire data at the end of the study revealed that nearly half of the students (46%) still had the habit of reading word by word. In addition, 65% of them forgot to screen out unnecessary information and 31% were unaware of finding some clues to facilitate their interpretation of concordance texts. However, some useful strategies were also made use of. Nearly all students (96%) selected to find information by reading only short comprehensible concordances whereas over 60% of them utilized the concordance format to locate word chunks and collocations to facilitate reading comprehension.

Table 4.6: Analysis of students' strategies in concordance reading

Items with '*yes-unsure-no*' questions in Part 3 of Questionnaire II	**Percentages**		
	Yes	**Unsure**	**No**
1. Do you use these strategies in concordance reading?			
*Read the concordance lines word by word.	54	27	19
* Ignore unnecessary information.	35	35	30
* Locate immediate contexts and read words in chunks.	62	31	7
* Read only short or comprehensible concordances.	96	4	-
* Read full sentences at the top.	50	31	19
* Find some clues to help understand texts.	31	58	11
* Find regular collocations of the keywords.	65	31	4
* Identify parts of speech of keywords in interpreting them	42	46	12
* Other strategies	-	-	-

(Note: N = 26)

Table 4.7 clearly summarizes how the students coped with the concordance information. When dealing with a large amount of corpus data, the students chose to ignore irrelevant information (54%) or to further search other words (46%). Nobody stopped using a concordancer or used other strategies.

Table 4.7: Analysis of students' strategies in dealing with a large amount of concordances

Checklist items in Part 3 of Questionnaire II	**Percentages**
5. What do you do when dealing with a large amount of concordance data?	
* Ignore irrelevant information	54
* Further search other words	46
* Stop using a concordancer	-
* Others	-

4.3.2.2 Performances in utilizing concordances for acquiring vocabulary knowledge

Regarding students' performances in utilizing concordances to learn new words, their skills in identifying various aspects of words were acquired before those in interpreting concordance texts or deducing word meaning. These skills were gradually improved and became evident from the middle stage to the end of the study. In this section, the findings on students' skills in identifying word parts, functions and collocations as well as skills in interpreting concordance texts and/or deduce word meanings are presented.

At the beginning of the experiment, students were not aware that they should make use of context observation in concordances to identify various aspects of words for facilitating their text interpretation and meaning deduction of a word. Such incompetence was due to their inadequate knowledge of word grammatical function and their unawareness of utilizing word formation knowledge to help in guessing the meaning of unknown words. Thus, they seldom paid attention to word affixes, and they were rarely aware of breaking words into parts which might help them guess the grammatical functions of words.

After being trained, they became more aware of using context observation to identify various aspects of target words as well as trying to spot context clues for meaning deduction. At the middle stage, the data from the teacher's field notes revealed that the students became more familiar with the method and made more use of concordance contexts than ever. They began to identify types and functions of some words by observing their suffixes. For example, with the hints from the teacher, they could indicate that '*define*', '*defines*', '*defining*', and '*defined*' were verbs whereas '*definition*' and '*definitions*' were nouns. As they knew the meaning of the root '*define*' in the proceeding activity, it was not difficult for them to guess the meaning of the others.

It was also found from the interview that their ability at the end of the study improved noticeably in making use of concordance contexts to quickly identify recurrent collocations of the given keywords. The interviewees could identify word parts, types and functions as in the following example.

T: When the results appear on the screen like this, (shows the illustration) can you tell how many word types of '*depend*' there are?
S1: Yes. Six. (Points to each type and count) 1-2-3-4-5-6.
T: Right. Anyway, can you identify which type is a noun and which type is a verb?
S1: Yes, this one. (Points to the keywords '*depending*' and '*depended*'.) It is a verb.
T: How do you identify it?
S1: The verbs often end with '*-ing*' and '*-ed*'.
T: Is that all?
S1: Err.. no. With '*-s*', too.
T: Then, from this column of the keywords, which one is the root verb?
S1: The first one. (Points to '*depend*'.)
T: Is it easy to observe word types in a concordance format?
S1: Yes, quite simple.
T: If you search other words, can you specify the verbs like this?
S1: I think so. Just spot the endings of the keywords – whether they end with '*–ing*' or '*–ed*'.

According to the questionnaire data, Item 2 in Table 4.8 illustrated that more than half of the students could make use of context observation to identify various aspects of words i.e. words' grammatical functions, chunks and regular collocations as well as to find corpus information to complete the tasks. However, most of them were unsure whether they could identify key context clues and deduce word meaning from contexts.

Table 4.8: Analysis of students' performances in identifying various aspects of words (1)

Items with '*yes-unsure-no*' questions in Part 3 of Questionnaire II	Percentages		
	Yes	Unsure	No
2. Can you use concordance information to do the following activities?			
* Identify parts of speech of keywords from contexts.	58	35	7
* Identify chunks of the keywords.	65	31	4
* Identify regular collocation of the keywords.	54	46	-
* Find some examples or information to complete the tasks.	54	46	-
* Identify key context clues.	46	54	-
* Deduce word meaning from contexts.	39	61	-

(Note: N = 26)

Their abilities to perform these skills varied because the results in Table 4.9 illustrates that nobody rated their performances on these skills as very quick, about 12 – 25% rated as quick, about 35-34% rated as average, about 26-46% rated as slow, and only one student (4%) rated as very slow. Based on these results, it can be concluded that about 60% of them could perform these skills moderately fast whereas the others (about 40%) were slower than their peers. It was also noted that the skills of identifying key contexts clues and deducing word meaning had the least rating on very quick. These results indicated that the students' skills in dealing with the concordance input had improved noticeably although they were not fully mastered at the end of the study, especially those of identifying key context clues and deducing word meanings. This was due to the fact that the skill of deducing word meaning took more time to be acquired after the students could properly identify various parts of words and context clues for facilitating their word-meaning deduction.

Table 4.9: Analysis of students' performances in identifying various aspects of words (2)

Scaled items in Part 3 of Questionnaire II	**Percentages**				
	5	**4**	**3**	**2**	**1**
3. How quick can you do the following activities					
* Identify parts of speech of keywords from contexts.	-	23	39	39	-
* Identify chunks of the keywords.	-	23	46	26	4
* Identify regular collocation of the keywords.	-	31	35	35	-
* Find some examples or information to complete the tasks.	-	27	39	31	4
* Identify key context clues.	-	12	54	31	4
* Deduce word meaning from contexts.	-	15	35	46	4

(Note: N = 26, 5 = very quick, 4 = quick, 3 = moderately quick, 2 = slow, and 1 = very slow)

Consistently, details of these performances from the teacher's field notes and interview suggested that their abilities in specifying word chunks and collocations improved substantially, compared to at the beginning of the study. The teacher found at the middle stage that the students could spot regular recurrent patterns of such keywords as '*classified*', '*equal*', '*addition*' etc. before inferring their typical collocations. Moreover, they could find specific information from the corpus to complete the given concordances rather quickly. When being asked how they find information to complete the gaps in the given concordances, some students replied that they observed the contexts of the gaps and used one or a few of words in context as keywords to be searched in the corpus before inferring word meanings, functions or collocations. Since the gapped concordances were frequently included with words recycled from earlier lessons, the students reported that such repetition of encountering words helped them in reading a lot of concordance lines comprehensibly. As to the question of whether they read and interpreted such concordances, they said they did and could somewhat get the overall meaning of each concordance. In addition, some students reported that, without being assigned, they were motivated to find more contexts of some words instead of reading fragments in concordances by referring to full sentences or source texts to read in passages and found that they could get the overall meaning of those passages.

This evidence is supported by the interview data that the concordance contexts were mostly utilized for spotting any recurrent patterns of the keywords. After the concordance output appearing on the computer screen, they usually looked at the keywords and then observed which words often co-occurred with the keywords. One student, for example, explained how he initially dealt with concordance texts as follows.

T: When the concordance output first appeared on the screen, which parts of the concordances do you look at?
S9: This. (Points to the column of the keywords in the illustration.)
T: And then?
S9: I observed the contexts to see which words often come before or after the keywords.
T: Why?
S9: To find regular co-occurring words or to locate word chunks.

In addition, the following interview script confirmed that the students could cope with the concordance texts well enough to infer the use of typical collocations of '*depend*' and '*refer'*.

T: From this illustration, (Gives the illustration of '*depend'* concordance output.) do you think the output was sorted by the left or right contexts?
S10: It might be sorted by the right contexts since the words '*on'* and '*upon'* were rearranged together.
T: Can you immediately notice that these keywords are often followed by '*on'* or '*upon'*.
S10: Of course. A lot of them immediately come after the keywords.
T: Let's switch the illustration. (Gives another illustration of '*reference'* concordance output.) Can you identify which patterns often co-occur with these keywords?
S10: With its right-sort, the word '*to'* always comes after the keywords.
T: What about the word '*as*'?
S10: '*As'* also often comes after '*to'*. In the case of searching for information, I think I should use an advanced search because both '*to'* and '*as'* could narrow the relevant output.
T: But in this case, I would like to know why some keywords of '*refer'* are not followed by '*to as'* and why some are?

S10: (Looks at the illustration and thinks.) Well, the word '*as*' will follow '*to*' when the word '*refer*' ends with '*-ed*' …umm.. when it functions as a past participle.
T: Do you also observe the contexts in front of the keywords?
S10: Yes.
T: What do you find then?
S10: (Thinks.) Um. The phrases '*referred to as*' often have '*is*', '*are*' or '*was*' in front of them.
T: Good. Then, what can you learn or infer from such information?
S10: (Think.)
T: When the verb to be such as '*is*' or '*are*' comes together with a past participle, what can this verb phrase function?
S10: Passive form, right?
T: Well done. Now, what can you infer from this information.
S10: Can I say '*to*' always comes after all types of '*refer*' whereas '*as*' will come after '*to*' when '*refer*' is in a passive form.

More details in teacher's field notes revealed that these interpretative and deductive skills were occasionally found at the middle stage of the study. Despite being unable to properly deduce meanings of all given words, with hints from the teacher, the students could somewhat deduce the meanings of some words such as '*automation*', '*artificial*', and '*intelligence*' using the contexts to match the words with the given definition correctly. In addition, students' logs reported that they could somewhat make some use of context observation in deducing word meaning, despite being unsure of the accuracy of the guessed meanings. Two students recorded in their logs as follows.

S8: I could interpret some concordances and tried to interpret other difficult concordances by discussion with friends. Sometimes, I could not exactly tell the meaning of some concordances but I think I could get their overall meaning.

S5: Today I could observe the contexts in concordances better and could somewhat deduce the meanings of some words such as '*artificial intelligence*'. Based on its various contexts of computer engineering, I realize that such a collocation must have a particular meaning concerning computers, rather than referring to the thinking processes.

One finding on students' dealing with concordance information was concerned with the difficulty of authentic concordance texts. This difficulty was due to students' unfamiliarity with concordances as well as their inadequate vocabulary knowledge. Students frequently complained in their logs at the beginning stages that their limitation of vocabulary knowledge inhibited them from interpreting the texts properly. One sample is as follows.

> S2: I could somewhat make use of the context observation but I still did not know many words in the context. A lot of unknown words in a context made me unable to deduce the meaning of the keywords and consequently I became discouraged. My main problem was the limitation of my vocabulary. If we don't know a lot of words in contexts, the guessing of the keywords' meanings becomes difficult or impossible.

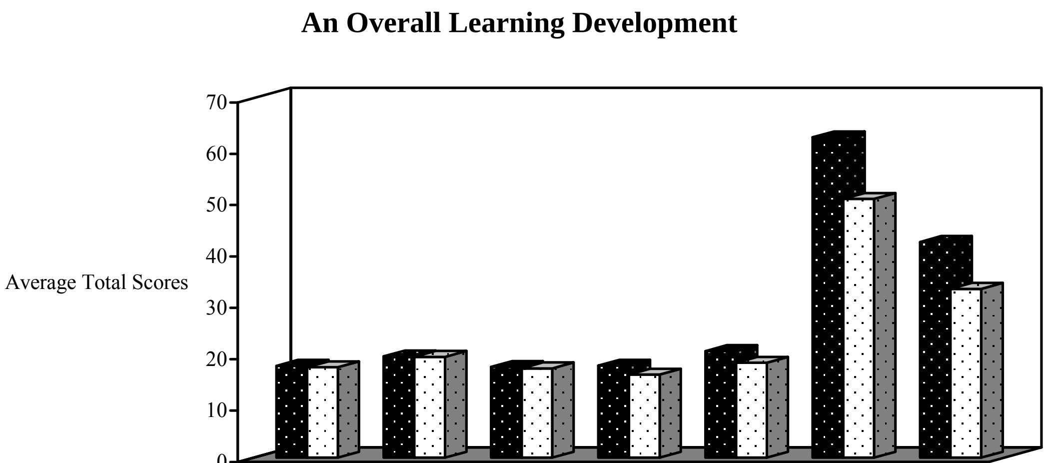
Although such a problem was frequently mentioned in students' logs at the beginning stage, it was less recorded in the later stages. The teacher assumed that the less complaint might be due to their vocabulary expansion which helped them cope with the text difficulty better. This assumption was supported by the questionnaire data which showed that 65% of the students rated the problem in dealing with concordances as average and 23% replied they had very few problems. Only three students thought that there were many problems in dealing with concordances.

To summarize the findings on students' processes in dealing with concordance information, it was consistently found from all relevant data that the students were gradually able to deal with concordance information in order to learn vocabulary by identifying various parts of words for facilitating their text interpretation and deduction of word meaning. These performances in text interpretation and deduction of word meaning were improved noticeably, compared to those at the beginning of the study. However, students' ratings of their performance as moderate signified that these performances were not inadequate for properly interpreting texts and deducing word meaning, and longer training was suggested in the open-ended questionnaire as necessary for them before being able to use the method independently. One problem concerning the difficulty of texts was found from dealing with the concordance information. However, it was not a main obstacle since the students could cope with them better at the later stage after their vocabulary size gradually expanded. Therefore, the problem in dealing with the method was rated as moderate by the students.

4.3.3 Overall learning development

An overall learning development was tracked to overview the trend of their learning gain in different stages from the beginning through to the end of the study. This finding was used to supplement or confirm other findings on the learning process in order to assess how learning gains from such processes were developed as well as to indicate at which stage the differences between the experimental group and the comparison group occurred. Learning development was revealed by comparing the data from students' average total scores of the experimental group and the comparison group in all measures of vocabulary knowledge as illustrated in Figure 4.3.

Figure 4.3: Average total scores on all measures of vocabulary knowledge



	Pretest	Review Task 1	Review Task 2	Review Task 3	Review Task 4	Posttest	Delayed
Experimental Group	17.88	19.73	17.65	17.92	20.73	62.35	42
Comparison Group	17.58	19.62	17.38	16.15	18.46	50.35	32.85
Mean difference	0.30	0.11	0.27	1.77	2.27	12.00	9.15
Std. error	1.267	0.897	0.838	0.586	.658	1.50	2.152

(Note: Total scores in the pretest, the immediate posttest and the delayed test = 101 scores
Total scores in each review tasks = 30 scores)

It was found that at the beginning of the study both groups similarly obtained very low scores at about 17 with the mean difference of 0.30. In the subsequent measures, however, the mean differences between scores were constantly greater by 0.11, 0.27, 1.77, and 2.27 in Review Tasks 1 to 4 respectively until reaching the peak at 12.00 in the immediate posttest before dropping to 9.15 in the delayed test. Figure 4.3 clearly shows that the differences between groups in both posttests are distinct with the higher scores belonging to the experimental group. These differences were tested for significant differences by conducting the MANOVA with the results illustrated in Table 4.10.

Table 4.10: The results of tests of between-subjects effects in all measures

Source	Dependent Variable	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Methods or Groups	Pretest	1.231	1	1.231	0.059	.809	.001
	Review Task 1	0.173	1	0.173	0.017	.898	.000
	Review Task 2	0.942	1	0.942	0.103	.749	.002
	Review Task 3	40.692	1	40.692	9.114	.004*	.154
	Review Task 4	66.942	1	66.942	11.887	.001*	.192
	Immediate Posttest	1872.00	1	1872.00	64.032	.000*	.562
	Delayed Posttest	1089.308	1	1089.308	18.099	.000*	.266
Error	Pretest	1043.000	50	20.860			
	Review Task 1	523.269	50	10.456			
	Review Task 2	456.038	50	9.121			
	Review Task 3	223.231	50	4.465			
	Review Task 4	281.577	50	5.632			
	Immediate Posttest	1461.769	50	29.235			
	Delayed Posttest	3009.385	50	60.188			

*$p < 0.05$

At the beginning of the study, it was found that there were no significant differences between both groups in the pretest, F (1, 50) = 0.059, $p > 0.05$, $\eta_p^2 = 0.001$; Review Task 1, F (1, 50) = 0.017, $p > 0.05$, $\eta_p^2 = 0.00$; and Review Task 2, F (1, 50) = 0.103, $p > 0.05$, $\eta_p^2 = 0.002$. However, significant differences were found in the subsequent four measures with large effect sizes: Review Task 3, F (1, 50) = 9.114, $p < 0.05$, $\eta_p^2 = 0.154$ / $d = 0.8$, percentile standing = 79, and % of non-overlap = 47.4%.; Review Task 4, F (1, 50) = 11.887, $p < 0.05$, $\eta_p^2 = 0.192$ / $d = 1.0$, percentile standing = 84, and % of non-overlap = 55.4%; the immediate posttest, F (1, 50) = 64.032, $p < 0.05$, $\eta_p^2 = 0.562$ / $d = 2.0$, percentile standing = 97.7, and % of non-overlap = 81.1%.; and the delayed posttest, F (1, 50) = 18.099, $p < 0.05$, $\eta_p^2 = 0.266$ / $d = 1.2$, percentile standing = 88, and % of non-overlap = 92.2%.

4.4. Learners' Attitudes

Apart from learning effects and processes, learners' attitudes towards the application of the concordance-based method were also explored in the study. Learners' attitudes were concerned with learners' opinions towards the application of the concordance-based method in terms of its usefulness, level of difficulty and students' level of preferences for the method. These attitudes were assessed by the data from students' logs, questionnaire and interview. In general, findings from the questionnaire revealed that students' attitudes towards the application of the concordance-based method were positive. According to Table 4.11, all means concerning students' attitudes were found at above the middle point of 3 in the five-point rating scales.

Table 4.11: Analysis of learners' attitudes

Part	Scaled items in Questionnaire II	Percentages					Means
		5	4	3	2	1	
2	7. Confidence in using the concordancer	-	46	50	4	-	3.42
	8. Preference in using the concordancer	8	46	42	4	-	3.58
3	6. Usefulness of a concordance format in identifying word chunks	-	65	35	-	-	3.65
	7. Usefulness of a concordance format in identifying collocations	-	50	50	-	-	3.50
4	1. Usefulness of the concordance-based method for studying English	-	50	50	-	-	3.50
	2. Ease or difficulty in using the method for studying English	-	31	65	4	-	3.27
	3. Preference in using the concordance-based method	4	46	50	-	-	3.54

(Note: N = 26, 5 = very much, 4 = much, 3 = moderate, 2 = little, and 1 = very little)

More findings on students' opinions in terms of the usefulness of the concordance-based method, ease or difficulty of its application, and problems and suggestions are presented respectively as follows.

4.4.1 Opinions on the usefulness of the method

Students' opinions were generally given on the usefulness of the concordance-based method for studying English. According to Table 4.11, it was found from the questionnaire that all students considered the method as being useful for studying English: half of them rated it as '*much'* useful whereas the other half rated it as '*moderate*'. Moreover, its usefulness for identifying word chunks and collocations were also rated: more than half (50-65%) of them regarded the method as '*much'* useful whereas the other rated it *'moderately'*.

Findings from the students' logs and interview provided more details on the usefulness of the method for studying English. According to students' logs, students considered that the method facilitated vocabulary learning in finding linguistic information, observing words in contexts, identifying various aspects of words, drawing their active involvement, enhancing memorization, and self-studying. The following extracts reflect these opinions.

> S7: A concordancer helps me to quickly figure out the typical collocations of particular words and then study the specific use of these collocations.
>
> S4: The method makes it convenient to find information on the keywords as well as to observe the surrounding contexts. I enjoyed searching the information from the corpus and I could learn a lot of vocabulary. Studying with this method helps me to memorize words well and it also encourages me to learn more from the corpus.

In addition, one student thought the method could be useful for self-study. According to him:

> S5: The method was very interesting when I knew how to use it. I think it can be used for self-study at home.

Findings from the interview also confirmed this evidence. The interviewees gave reasons to support the fact that the method increased their observation skills and utilization of word contexts and this enhanced their memorization of the studied words. One sample is in the following interview transcript.

> T: From these illustrations, now we can learn that '*depend'* is often followed by '*on'* whereas '*refer'* is often followed by '*to'*. Does this make you closely observe word collocations? I mean, when you find these words somewhere else such as in textbooks or advertisements, do you try to verify whether 'on' will come after '*depend'* or '*to'* will come after '*refer'*?
> S6: Yes. I make more observation and pay more attention to such collocations in order to test whether these words will co-occur or not. If I find these collocations very often, I should recognize them.
> T: So you think it helps you memorize words, right?
> S6: That's right.

T: Before studying with this method, have you ever made used of context observation like this?
S6: No, never. I had never used a computer to study like this, either. I just studied from paper-based textbook.

In comparing the usefulness of the concordance-based method with the other teaching method, the findings from students' logs and interview were consistent in revealing that the students considered the method better than the others as reflected in two students' logs as follows.

S3: The method encouraged students to learn more actively than the traditional paper-based one in which some students may not fully attempt to do so.

S2: The concordance format is very helpful for clearly distinguishing between the use of two collocations such as '*different from*' and '*similar to*'. Previously, I used to study these collocations by memorizing the patterns given by the teacher. However, the concordance-based method can verify these typical uses so very well that I get insight, not by being told. Therefore, I am impressed with its usefulness and I get much insight by such learning.

According to the interview, when being asked to compare the method with other normal paper-based ones, the students also indicated more advantages of the concordance-based method. The interviewees mentioned that the method could draw their attention to word frequency whereas normal reading could not. Knowing frequency information encouraged them to learn more since they felt assured that the words being studied would likely be met often in their further reading. Apart from motivating them to learn, the method could also facilitate word memorization. The following interview transcript clearly reflects these details.

T: Let's compare learning through reading in concordances with those in normal paper-based reading. What do you think?
S7: Normal reading does not provide frequency information of particular words or collocations. Therefore, I have never paid much attention to how often such words or collocations are used.
T: Right.
S7: After reading, we may not pay attention to particular words found in reading since there was no guarantee that those words may or may not be found again. With the concordance-based method, I see a lot of recurrent patterns. This draws my attention to the frequency

information of words and encourages me to learn more about those words. I think the more the frequency of words we find in the corpus, the more likely we will find them in other texts. Moreover, when we re-encounter these words in any reading, we can better remember them.

Another student compared the concordance-based method with the method he had been exposed to previously.

T: Supposing that we do not use this method but I give you a wordlist for memorizing the meaning of words. Which method would make you learn words better? And which one do you prefer?

S8: I prefer studying with the concordancing method. With the memorizing method, we just look at words and try to memorize their meanings. With the concordance-based method, we don't have to memorize words but we learn by dealing with them. We learn from the corpus information and we see a lot of authentic examples, not by being told. Frequent dealing with particular words makes me learn those words and remember them without trying to memorize them.

T: So you think the method is useful, right?

S8: Certainly. It is very useful and user-friendly. I can learn a lot of collocations. Formerly, I was taught that 'different' would co-occur with 'from' whereas 'similar' would co-occur with 'to'. I just learnt by memorizing the patterns. Now, the concordance-based method gives me ample evidence to get insight into these collocations frequently used.

T: Does this motivate you to learn?

S4: Yes. The method makes it possible for me to verify what we have learnt in classes. Such verification seems to make me feel as if I have discovered new knowledge by myself, not by being told.

Apart from increasing word memorization, the students mentioned that the method increased their amount of reading and they thought their reading proficiency was much improved.

T: Do you think the method increased the amount of your reading?

S9: Certainly. I read much more than ever now. While reading, I try to observe as many aspects of words as possible. When I found the collocations we studied in classes, I am encouraged to practise interpreting them and I am glad to find that I can really interpret them better than I have ever done.

4.4.2. Opinions on level of difficulty of the method

The results from the questionnaire illustrated in Table 4.11 revealed that the concordance-based method was considered at a moderate level of ease or difficulty. The majority (65%) rated it at an average level of difficulty whereas 31% of them thought the method was easy and only one student (4%) thought it was difficult. This evidence was supported by relevant data in students' logs and interview. The students thought that dealing with a concordancer was very easy but dealing with the corpus information was rather difficult. On the one hand, students' computer concordancing skills were found to be at a good level, as discussed in 4.3.2.2. Therefore, most students mentioned that it was very easy for them to operate the concordancer for specific purposes and the method was very convenient for use for searching words and observing contexts.

On the other hand, most students agreed that the difficulty was with the concordance information as well as the utilization of the results from context observations. Although it was evident that the students' language concordancing skills were much improved, these skills were still inadequate and needed to be developed further before they could deal with the method more efficiently. The following transcript was one example of the students' opinion on the ease or difficulty of using the method.

> T: Do you think using this method is easy or difficult?
> S9: Compared to other computer programs, I think the concordancing program is not difficult to use since the instructions were not many and not complicated. The output format facilitates the observation.
> T: So, you think it is easy, right?
> S9: Umm… It's neither easy nor difficult. Although operating the computer concordancer was very easy, dealing with corpus information was rather difficult. Sometimes the concordance lines were so long that they look discouraging. My limited vocabulary inhibited me from properly interpreting concordance texts.
> T: Then, how do you deal with this problem?
> S9: I just interpret only the chunks in focus and guess for getting the overall meaning. By doing this, I can somewhat cope with such information. It is difficult but challenging.

It was also found from students' logs near the end of the study that the method seemed to become easier, compared to its use at the beginning.

> S2: The lesson today is most likely easier when compared to the first lesson since I can integrate all the knowledge and skills learnt in the earlier lessons for use in this last lesson.

S5: I think the lesson today seems simpler since I am more familiar with the method.

S9: Today I can operate the concordancer to access the corpus without waiting for the teacher's instructions and I can do it more quickly than ever. I feel the method seemed easier for me to find word information.

4.4.3 Preference for the application of the method

The results illustrated in Table 4.11 in 4.4.1 show that the students liked dealing with the concordance-based method to a great extent. The words '*like*', '*interesting*', and '*challenging*' were often used in their comments on the method and these words were continually found in the students' logs from the beginning through to the end of the study. For example:

S1: I like studying with concordances since it helps me to observe word functions more clearly with more understanding.

S6: I like searching the corpus information to infer word meanings. I used a simple search more often than an advanced search. I do not think I have problems now since I can adapt myself to the method."

Similarly, all interviewees also mentioned their preferences in dealing with the method, but to different degrees. Two students reported that although they were very discouraged at the beginning stage, they started to enjoy dealing with the method when they were more familiar and able to cope with the method better. One of these two students wrote about this in the questionnaire whereas the other mentioned it in the interview as follows.

S10: In the earlier lessons, I disliked the concordancer since I did not understand how to use it. However, after dealing with it in succeeding lessons, I thought the program was easy to use and started to enjoy using it.

S11: I was, at first, very discouraged since I thought I could not study with this method. However, after I seriously tried to deal with it, I changed my mind and liked using it.
T: Yes, I saw that you enjoyed the activities and could find the information very quickly. Do you think you can use it independently?
S11: Yes, I'm sure I can use it by myself.

The students were also pleased with the content relating to the themes concerning engineering fields. They thought that the vocabulary in focus was very interesting and could be really applied in their academic situations because such language inputs were closely related to their fields of study. Three students commented as follows.

S11: I like this lesson since the vocabulary is concerned with technical drawing. The words studied today are very interesting since they could be applied to my engineering study.

S8: The words studied today are words often found in my engineering study so I think they are important and interesting."

Interestingly, despite being slower than his friends, one student also expressed his motivation as follows.

S3: Today, I tried to do the activities by myself rather than depending on my friends. Although I am quite slower than them, I found that I could observe the concordance contexts and deduce the meaning of some words. When I started to fulfill some points of the activities, I felt challenged. Now, I realize that the use of the concordance-base method is not too difficult for me to use, but it is not easy, either.

Regarding their confidence in dealing with the method, it was found in the questionnaire results in Table 4.11 that nearly all of them were moderately confident. The interview data also supported this evidence. Finally, when being asked both in the questionnaire and interview whether they would continue to use the concordance-based method for their self-study, most students (96 %) responded positively. They stated that the method was very useful for studying various aspects of words since it facilitated searching and observing words in various contexts with plenty of language examples.

4.4.4. Comments and suggestions

The problem frequently mentioned was that of crammed lessons which allowed little time for practice of each activity. The students suggested reducing the content in each lesson. However, they were aware that all activities were interesting and useful for them so they thought that it was necessary to have longer training with the concordance-based method on vocabulary learning before they could cope with it more independently and with more confidence.

Another problem mentioned was their inability to properly interpret the concordance texts. Although all students thought that their vocabulary knowledge as well as reading skills was much improved, some of them still worried that their language proficiency was inadequate for dealing with the concordance information. These students said that their inadequate proficiency inhibited them from using the method effectively. One student suggested that the weekly wordlists should have been given for them to look up word meaning in advance in order to reduce unknown words found in the class activities. Accordingly, during class activities, they could have more time studying other aspects of the target words by dealing with the concordance-based method.

Apart from these two problems, a few students suggested making the lessons more interesting. They proposed more variety of input presentation by including more figures or illustrations in the handouts such as in the lessons dealing with advertisements.

4.5. Summary

In this chapter, the results of the study were presented in three main areas: learning effects, learning processes and learners' attitudes. Regarding learning effects, the average scores of the experimental group were found to be significantly higher than those of the comparison group in all measures with higher retention rates. In addition, the magnitudes of these differences on the measures of transferable knowledge were greater than those of definitional knowledge both in the posttest and the delayed test.

With regard to learning processes, although the concordance-based method was completely new to the students, they quickly became familiar with the computer concordancer and learned to operate it very well. However, it took a longer time for them to acquire the ability to deal properly with concordance information, especially at the beginning stage. Their skills in interpreting concordance texts and deducing word meaning gradually improved at the subsequent stages of the course. Although the students did not master some necessary skills, the findings on learning development showed their potential. Based on the ongoing assessment, the difference between both groups became apparent in the middle stage of the study. As can be seen, the average scores of the experimental group became significantly higher than those of the comparison group on all the subsequent measures. Despite having a different level of confidence, the students mentioned that they would be able to utilize the method properly for their language study if the training was conducted for a longer period of time. More support and more time for practice were still needed before they would become skillful and confident enough to utilize the method independently after finishing the EAP courses.

In terms of the students' attitudes, it was found that their attitudes were very positive towards the method. The students considered the method very useful for studying language and its difficulty level was rated as '*average*'. Although they faced some difficulties, the students regarded such difficulties as challenging and interesting, rather than completely discouraging. Despite being only moderately confident, the students liked dealing with the method a lot. Recognizing its usefulness, all students mentioned that they would continue to utilize the method for their own self-study.

CHAPTER V
DISCUSSION AND CONCLUSIONS

5.1. Introduction

In this chapter, a summary of the study is firstly provided. Then, the findings presented in the previous lesson are discussed according to the five research questions. The first three questions are concerned with the comparisons of the learning effects of the concordance-based method and those of the conventional teaching methods. The other two questions explore learning processes and learners' attitudes in dealing with the method. Accordingly, the findings on the effects of the concordance-based method on vocabulary gains, learning processes and learners' attitudes are discussed respectively. After that, the discussions are on the implications of the study, suggestions on the application of the method and recommendations for further study.

5.2 Summary of the study

The primary goal of the study is to investigate the effects of the concordance-based method on vocabulary learning in three areas: learning effects, learning processes and learners' attitudes. In particular, the learning effects of the concordance-based method are compared with those of the conventional teaching method in three dimensions: definitional knowledge, transferable knowledge and retention rates. In addition, learning processes and learners' attitudes in dealing with the concordance-based method are explored. The present study is aimed at providing insights into studies on vocabulary learning and instruction as well as providing suggestions on how to increase students' vocabulary size so that they can efficiently cope with academic reading.

The conceptual framework of the study is based on pedagogical principles that words can be learnt explicitly, implicitly and through strategy learning. Based on the concept of an incremental nature of vocabulary acquisition, lessons are designed in such a way that target words are presented in multiple contexts with repeated encounters so that many aspects of particular words can be learnt accumulatively. This is to enhance both the quantity and quality of word knowledge. Regarding teaching/learning methods, the DDL approach is partially adopted to allow for students' self discovery. By studying target words in the concordances, students are expected to come up with rules of word co-occurrences as well as lexical meanings.

This comparative study was designed in the form of '*a matching-only pretest-posttest comparison*'. It was conducted with two intact groups of engineering students at an undergraduate level. One group was randomly assigned to be the experimental group using the concordance-based method whereas the comparison group studied with the conventional teaching method. In both groups, all learning conditions were the same, except for the teaching methods used. With the concordance-based method, the students were trained to explore the corpus information for vocabulary learning with the support and guidance from the teachers and classroom materials. On the other hand, students in the comparison group were taught to learn vocabulary through the contexts of short reading passages including reading and vocabulary exercises.

Classroom materials were based on the Engineering Corpus which was compiled from academic texts in engineering, and target words were selected on the criteria that they were words in the established wordlists of the GSL and the AWL, which were high frequency words in the corpus. These target words were used to design all classroom materials, tasks and tests. The lesson plans and class handouts were designed in two versions: one for the experimental group and the other for the comparison group. Four review tasks were developed for ongoing assessments whereas the pretest, the immediate posttest and the delayed posttest were designed for assessing the overall learning effects on definitional knowledge, transferable knowledge and retention rates. The other instruments were teacher's field notes and students' logs to be collected after each concordance-based lesson whereas the questionnaire and the interview were used at the end of the study to investigate students' learning processes and attitudes towards the concordance-based method.

As for data collection, a questionnaire and a pretest were administered at the beginning of the study. During the experiment, teacher's field notes and students' logs were recorded after every concordance-based lesson. The first two review tasks were used as the midterm exam whereas the other two tasks were administered separately after every three lessons. At the end of the study, an immediate posttest was administered with both groups and another set of questionnaires and the interviews were administered only with the experimental group. Finally, both groups took a delayed posttest about one month after the study.

The main findings from the study can be summarized in three areas: learning effects, learning processes and learners' attitudes. Regarding learning effects, it was found that the students' average scores in the experimental group were significantly higher than those in the comparison group in all measures of definitional knowledge, transferable knowledge and retention rates. In addition, the effect sizes of such differences were found greater on the measures of transferable knowledge than those of definitional knowledge, suggesting the better quality of lexical knowledge gained from the concordance-based method. As far as the students' learning process is concerned, it was found that students could acquire the skills in operating the concordancer quickly whereas it took a longer time for them to master the skills in identifying various aspects of words, interpreting concordance texts and deducing word meaning from contexts. However, findings at the end of the study revealed that these skills improved satisfactorily: the improvement in identifying skills was found earlier than that in interpretative and deductive skills. At the end of the study, learners expressed positive attitudes towards the concordance-based method. The students found the method challenging, interesting and useful for studying vocabulary. They liked dealing with the method and stated that they would continue to practise utilizing the method for their self-study.

5.3 Discussions on the Findings

5.3.1 Effects of the concordance-based method on vocabulary gains

Vocabulary gains are the emphases of the first three research questions on investigating the learning effects of the concordance-based method in comparison with those of the conventional teaching method. With regard to these questions, it is hypothesized that significant differences exist in the effects of using these two teaching methods in maximizing learning gains in definitional and transferable knowledge as well as retention rates of both knowledge types.

It was found from the study that the concordance-based method was more effective than the conventional teaching method in maximizing students' vocabulary gains as well as their retention rates. As is evidenced, the average scores of the experimental group were significantly higher than those of the comparison group on all measures of students' definitional knowledge, transferable knowledge and retention rates. Apart from significant differences, the greater effect sizes were found on all measures of transferable knowledge rather than those of the definitional knowledge. In fact, the effect sizes on the measures of transferable knowledge were found at the maximum points although it is much more difficult for this type of knowledge to be acquired. For knowledge to be transferable, a depth of knowledge is necessary for ensuring the quality of word knowledge. In other words, transferable knowledge needs more knowledge than one aspect of each word whereas definitional knowledge requires only the memorization of word meaning (Qian, 1999). This also explains why definitional knowledge in both groups was found to be greater than transferable knowledge. In addition, the findings on the maximum effect sizes in knowledge transfer indicate that the lexical knowledge gained by the concordance-based method is more consolidated, resulting in students' significant gains on both knowledge types as well as retentions of these knowledge types.

These findings are consistent with those in Cobb's studies (1999a and b) where differences in the effects of definitional knowledge were little but students dealing with hands-on concordances were more able to transfer their word knowledge to novel texts than students learning vocabulary from a wordlist and a dictionary. In Cobb's (1999b) study, students learning vocabulary through a concordancing program had strong gains both in definitional and transferable knowledge in the short and long term. In contrast, students learning from a wordlist and a dictionary had strong gains only in definitional knowledge but this knowledge was not well retained. Cobb (1999a, p.30) viewed the strong gains of definitional and transferable knowledge in the experimental group as having taken place because hands-on concordancing facilitated word learning in multiple contexts, which was the main precondition for producing transferable knowledge (Mezynski, 1983, and Stahl and Fairbanks, 1986; cited in Cobb, 1999a). Cobb concluded that interpreting new words in various contexts made students think of new words in a new way which made their knowledge more transferable.

His conclusion is congruent with suggestions in Cobb and Horst (2001), Nation (2001) and Nagy (1997) that learning words in rich contexts with a number of word encounters could lead to word acquisition. According to these suggestions, words are best learnt through meaningful encounters in several natural contexts either with or without being given word definitions. One reason is that many words have more than one meaning and their actual meanings need to be determined by the surrounding contexts. Apart from having various meanings, words also possess more than one aspect such as grammatical functions and collocations, and these aspects are unlikely to be exemplified and learnt in only one word encounter. Therefore, the effectiveness of the teaching method can be accounted for by the use of rich contexts and the increasing number of word encounters, resulting in productive and transferable knowledge.

Accordingly, in the present study, students learning vocabulary through concordance input have significant differences in learning gains from students' learning words through paper-based teaching. With the concordance-based method, the students have an access to large linguistic resources in a variety of contexts, providing them more chances to find more linguistic examples and re-encounter particular words in different contexts. Especially, in the present study, the selection of words according to their high frequency in the corpus increases frequency of word re-encounters in the concordance lessons. In addition, the concordance format enhances word salience, resulting in the high possibility for words to be noticed and closely observed by the students. According to Gavioli (1997), concordances highlight the aspects of language use which show up as recurrent patterns or repetition in the corpus. These advantages were also evidenced in the present study. The students reported in their logs and interviews that the concordance inputs made particular collocations so salient and frequent that they recognized such recurrent patterns and became aware of their frequent use. This recognition seldom occurred in their normal reading in paper-based texts. As a result, re-encountering new words salient in contexts seems to have significant rewards in word retention and long-term memory since plenty of word encounters illustrated various aspects of each word so frequently that each of them becomes recognized, accumulatively learnt and consolidated (Sokmen, 1997; and Nagy, 1997). Learning with the concordance-based method combines the benefits of learning vocabulary through multiple contexts in concordances with multiple word encounters, as measured by its strong gains and retentions of both definitional and transferable knowledge in the experimental group of the present study.

In contrast, with the conventional teaching method, the presentation of linguistic items and examples are controlled and pre-conditioned solely by the teacher, using traditional class handouts as a main linguistic resource. Although paper-based reading texts also plans for words to be learnt in various contexts with a number of word recycles, the availability of linguistic items, word contexts and recycles are, in practice, rather limited in most traditional types of texts in the class handouts. Compared to learning vocabulary through hands-on concordancing, various aspects of each word were less exemplified and less encountered through normal reading texts, resulting in less accumulative acquisition. In addition, although keywords in the conventional handouts were also highlighted, they might not be as salient and recognized as those in a concordance format. Several studies found that new words went by typically unnoticed when being encountered in normal continuous reading in paper-based texts (Cobb, 1999c). With the limited availability of word contexts, encounters and salience, despite having high learning gains, lexical knowledge resulting from the conventional teaching method is significantly less transferable and retained than that of the concordance-based method.

Apart from providing richer contexts, more word encounters and more word salience, the concordance-based method can encourage more active and student-centered learning. With the conventional teaching method, learning is passive since it is largely controlled by the teacher in pre-conditioning language inputs and learning activities and the students only reflect and memorize the obtained information to complete the given tasks. According to Chen (2004), a learning process in which knowledge is provided by the teacher is usually regarded as a '*passive way of learning*'. In contrast, with the concordance-based method, the students have more control over their own learning, thus making them more actively involved in learning. While dealing with corpus information, they have more freedom in choosing concordancing techniques to accomplish the given tasks. Accordingly, they have more chances to practise observing more word contexts, identifying word parts or collocations, interpreting concordance texts, and inferring from the obtained data. When learners are involved in tasks of exploring, choosing and determining the language from various resources that the computer has found, the classroom becomes student-centered and learners have active control over their own learning (Chen, 2004; and Nation, 2001). In Hadley's (2001) study, learners were consistently found to be active when they engaged in a '*content decision making*' learning situation while exploring and noticing the target language in the corpus. It is evidenced in students' logs and interviews in the present study that students dealt with a lot of English texts and more of these texts than they had ever used before when dealing with the concordances. This consequently encourages them to use skills in observing word contexts to get the word meanings. Their active interaction with language makes the lessons more meaningful, resulting in high vocabulary gains. As Cobb (1999a, p.15) stated, knowledge encoded from data by learners themselves will be more flexible, transferable and useful than knowledge encoded for them by experts and transmitted to them by an instructor or other delivery agents.

To summarize, significant differences in vocabulary gains and retention are considered to be as a result of the potential of the concordance-based method in facilitating vocabulary learning in multiple contexts with a unique display of word salience and plenty of word encounters as well as in encouraging learners' active involvement. These factors enhance the accumulation of so that knowledge gained from the concordance-based method is consolidated more sufficiently than that from the conventional teaching method, resulting in its greater effects on transferable knowledge and retention.

5.3.2 Effects of the concordance-based method on learning processes

Research Question 4 is aimed at exploring students' learning processes in dealing with the concordance-based input at different stages of the study. At the beginning stage, the students are trained to deal with a computer concordancer before they start using it in studying new lexical knowledge. As the findings suggest, the students become quickly familiar with the computer concordancing program and can operate the concordancer very well although the method is completely new to them. However, it takes a while for them to be able to deal with concordance information effectively. This is due to their unfamiliarity of the concordance format, the vast amount of the corpus data, and their limitation of vocabulary size to cope with those authentic texts. This evidence is consistent with that in Hadley's (2002 and 2001) studies in which the students faced difficulties with the concordance material when they initially dealt with data-driven learning. However, Hadley found a pleasant improvement in the writing skills and test scores of his students at the end of the study. This supports Gavioli's (2001) suggestion that the processes of observation and generalization can pose many difficulties to learners because concordances do not provide support for a particular analysis; and EFL learners cannot rely on their intuition to guide and back up their observations and to suggest and reinforce explanatory generalizations. Therefore, it seems common to find such difficulties at the beginning of dealing with the concordance-based method before its productive outcome takes place because of the provision of learner training and teacher's support.

Despite these difficulties, in the present study, the students' skills in dealing with concordances gradually improved at the subsequent stages. It is found that their skills in utilizing context observation to identify word parts or chunks are acquired more quickly than the skills in utilizing such concordance information to deduce word meaning or interpret texts. This is not surprising since deducing and interpreting data involves students' existing knowledge (Hossain and Saddik, 2004), which, in this case, is very limited at the beginning stage. In addition, Gavioli (2001, p.129) points out that the methods of analyses aimed at identifying recurrences and inferring patterns in particular contexts may be problematic for many learners since raw concordance data are not filtered pedagogically. However, the students need time to acquire the appropriate methods of such language analyses as well as to appreciate their usefulness in vocabulary learning before they can do it properly and independently.

Accordingly, before the end of the experiment, the students appeared to be more capable of utilizing the data to interpret the concordance texts. This is seen to be partly because they are more familiar with dealing with the concordance information and acquire the trained strategies to cope with a lot of corpus information by screening out irrelevant information and/or interpreting only from comprehensible data in order to get the overall rather than specific meaning. Apart from acquiring such strategies, the students' improvement is partly due to the expansion of their vocabulary size after studying more words in the earlier lessons. As the target words are words from the GSL and AWL, regarded as lexical thresholds for academic reading (Nation, 2001; Cobb and Horst, 2001), the expansion of such lexical knowledge increases students' capability to cope with reading texts in concordances.

The findings based on the ongoing assessment from the four review tasks reveal the difference in learning development between groups at the middle stage of the study. After the midterm examination, the average scores of the experimental group were gradually and significantly higher than those of the comparison group on all the measures. This suggested positive learning development in the experimental group. Moreover, all the interviewees were confident that with extended training, they would be able to utilize the method properly for their language study. They reported they had learnt these skills and recognized the usefulness of the method. However, support and guidelines would be needed either from the teacher or the handouts for these students to become more skillful and confident in utilizing the method independently.

All these findings suggest that the concordance-based method not only enhances learning but also promotes learning independence. The concordancing skills would enable students to practise and explore new knowledge by themselves, even after finishing all ESP courses. It is evident that although the process of the concordance-based training takes time, it is a prerequisite for independent learning to take place.

5.3.3 Learners' attitudes towards the concordance-based method

The last research question surveyed the students' attitude towards the application of the concordance-based method. It was found that the students had positive attitudes towards the method as has been frequently found in most classroom-based research concerning classroom concordancing (Chan and Liou, 2005; Kaur and Hegelheimer, 2005; Hadley, 2002 and 2001; Sirphicharn, 2002; Cobb and Horst, 2001; Cobb, 1999a and b; and Cobb, 1997a and b). The students were aware that the concordance-based method was very useful and challenging though they reported some difficulties in dealing with the method. Many students indicated that they would continue to practise utilizing the method for self-study. The students' positive attitudes might be attributed to the potential of the concordance-based method in raising students' awareness. The authenticity of corpus texts and frequency information of particular items make students aware that the target words are really useful as they are used frequently in the corpus, which is compiled from authentic reading texts. This may lead to the increase in their motivation and efforts to learn those words. Although it is hard for students with limited proficiency to deal with a lot of authentic texts, they realize that these vocabulary items are necessary for successful academic reading. Therefore, they find such difficulty challenging.

However, it should be pointed out that learning motivation cannot be fostered without the teacher's intervention, as exposure to a vast number of authentic texts may cause confusion and discouragement (Hadley, 2002 and 2001; and Aston, 2002 and 1997). A student will be motivated only if he feels a sense of achievement in learning (Larsen-Freeman, 1991). If he sees no chance of development, he will soon lose interest in studying. Therefore, it is important for the teacher, especially at the beginning stage, to select and organize the texts in such a way that they are manageable for the students. The paper-based concordancing activities will serve this purpose as suggested in Aston (2002). With these activities, the amount of language inputs could be controlled and the inputs which might pose problems to the students could be screened out. In many cases, these authentic texts might have to be slightly modified and only short concordances with simple language structures will be presented for the students to practise dealing with the corpus information.

Moreover, the high motivation of students studying with the concordance-based method may be partly due to their preference for the use of computers and experiential learning. Generally, engineering students like dealing with technological equipment. This is also true with the students in the experimental group. Their preference tends to encourage them to be actively involved in hands-on activities. In addition, working with computers to explore the corpus information makes them feel more independent since they can learn by doing things themselves. Therefore, this experiential learning is likely to make them feel motivated and engaged in the activities. According to Fox (1998), learning from corpora by discovering linguistic knowledge oneself is motivating because most people enjoy finding things out for themselves, and the majority believe that learning is enhanced by doing so.

5.3.4 Conclusions of the Findings

Based on these findings, the concordance-based method is considered more effective than the conventional teaching method in maximizing students' definitional and transferable knowledge as well as the vocabulary retention of these knowledge types. In addition, the greater effect size in transferable knowledge than in definitional knowledge indicated that lexical knowledge gained from the concordance-based method increased both quantitatively and qualitatively. The outstanding performances in the concordance-based group are attributed to the potentials of the method in facilitating vocabulary learning in multiple concordance contexts with plenty of word encounters as well as in encouraging students' active involvement in vocabulary learning. On the one hand, language presented in concordances provides richer contexts for word study and allows for a larger number of word encounters. The concordance format makes it easier to learn words in multiple contexts or observe word behaviors with a greater number of encounters. This gives students more chance to learn various aspects of words accumulatively with sufficient word recycle. On the other hand, the concordance-based method is more learner-centered. The students have more control over their own learning and, consequently, are actively engaged in class activities.

Regarding learning processes, with the concordance-based method, students' language performance improved remarkably. Although the students could not adequately master all the necessary skills at the end of the study, their learning development may be sustained given longer training. Findings also suggest that learner training is necessary in applying the concordance-based method. Although the process of training might take time, it is beneficial as it promises to enhance learning independence. Equipped with concordancing skills, the students can explore new knowledge by themselves even after finishing the EAP courses. In addition, the concordance-based method can raise students' awareness of the importance of word study. This awareness can bring insights into word use, which will in turn motivate students to utilize the corpus information for their self-study.

In conclusion, the concordance-based method proves fruitful in expanding students' vocabulary size for academic reading. It is more effective than the conventional teaching method in enhancing the quality of vocabulary knowledge, resulting in the students' ability to transfer knowledge of word meaning to new contexts as well as to retain such lexical knowledge. However, due to the small sample size in the study and its implementation in language laboratory, these findings may not be generalizable to all academic settings. Nevertheless, findings can still provide useful insights into pedagogical approaches in other similar settings. The framework of the study and the application of the concordance-based method may be adapted in many EFL academic situations with different levels of students' proficiency.

5.4 Implications for vocabulary instruction and vocabulary learning

The present study tends to suggest that the concordance-based method can be used well in conjunction with many other conventional teaching approaches. In this study, the benefits of three main approaches: explicit, implicit and strategy learning are integrated into the implementation of the present study. Words were explicitly or intentionally taught through hands-on concordancing including strategies to extract word meaning from contexts whereas implicit or incidental learning was made possible through the extensive reading from the corpus information. Regarding explicit learning, the target wordlist was established as a clear goal for students to accomplish. Various techniques were used to teach these target words via three learning processes which include '*noticing*', '*retrieval*' and '*creative (generative) use*' (Nation, 2000). To enhance students' '*noticing*', their attention was initially drawn to the target words mostly presented as keywords in the concordance lines and then to their contexts. After that, for '*retriev*ing knowledge', students were assigned to do some tasks such as replacing the missing keywords in the given concordances. In addition to explicit learning, students were extensively trained in strategy learning. The students did not only learn word meaning and functions but they also learnt how to use this knowledge to extract or guess the meaning of the word or the reading texts. While dealing with the vast amount of the corpus data, incidental learning probably took place at any of the stages.

The present study is an attempt to integrate the concordance-based method with other familiar methods of language learning. The balance of the combined methods depends on the goal of instruction. In some cases, the concordance-based method might be fully used for language study such as in the present study. However, in other cases, it might be used as a supplementary tool to other teaching methods. The purpose of using the method should, therefore, be clearly determined. Since the concordance-based method deals only with plain texts, one of its disadvantages is a lack of variety in language presentation. Integrating it with other methods might be helpful for making the lessons more interesting. In the study, some figures or illustrations were used in the handouts to stimulate the students to learn. Data from the interview showed that students liked learning with those figures and illustrations, and some suggested having more illustrations such as technical drawing, and processes in engineering work etc. One interviewee suggested using advertisements when studying '*Engineering Products*'. Based on this evidence, the integration of methods seems to be one of the best options since the maximum benefits could be obtained. As is obvious from the study, the concordance-based method has the potential to be used in conjunction with various current teaching methods in promoting the explicit learning, incidental learning and strategy learning of vocabulary.

Results from the study indicate that vocabulary is best taught through reading. With this approach, words can be learnt in multiple contexts relevant to students' interests. At the same time, vocabulary and reading strategies can be explicitly taught. In addition, incidental learning is also possible with the amount of information in the corpus. With low proficiency students, '*narrow reading*' (cf. Schmitt, 2000), reading a lot of texts on the same topic, is suitable as seen from the significant gains of the students in the experimental group. In addition, the application of the concordance-based method entails systematic word and content selection as well as lesson designs if students' high motivation and positive attitudes are to be anticipated. Words selected for study should rank high on the frequency list of academic reading so that students see their relevance. Word recycles are important to consolidate what has been learnt. Meeting words in multiple contexts several times provides chances for various aspects of particular words to be learnt and consolidated not only in terms of lexical meanings but also word co-occurrences (Cobb and Horst, 2001; and Nagy, 1997). Finally, with the concordance-based method, instruction should move from teacher control to learner independence in order for them to be responsible for their own learning.

5.5 Suggestions on the application of the concordance-based method

Suggestions are given on the application of the concordance-based method. They are discussed in terms of the needs for the concordance-based training, degrees of planning the concordance-based lessons, content selection and corpus compilation, and design of concordance-based lessons.

5.5.1 Need for the concordance-based training

It is obvious that learner training is indispensable if the concordance-based is to be used. As a number of skills is involved in this method, enhancing learner independence does not mean just providing the facilities and then leaving the students to explore new knowledge in the corpus by themselves. Simply giving students direct access to the data from a corpus is not enough to make them capable of gaining new knowledge independently. In contrast, such a practice is likely to leave them too much alone, overwhelmed with information and resources (Gavioli, 1997). Therefore, the sole use of a corpus and a concordancer cannot promote positive learning effects and independence. The students need to be motivated to do their own learning as well as to be trained on some skills to exploit these facilities.

In the process of training, a gradual introduction to concordance work and extensive guidance is recommended. For proper training, the process should be implemented step by step in order to gradually expose the students to the concordance-based method as well as to increase their responsibility for their own learning. During the process, learners need to be trained how to exploit corpora. At the same time, materials or handouts with adequate sample tasks and exercises must be provided to help learners develop their analytic and interpretative skills. As found in the study, different skills took different times to be acquired. The computer concordancing skills, for example, could be mastered quickly but the analytic and interpretative skills took a longer time. Therefore, training on various concordancing skills should be carefully planned to allow sufficient practice on each skill; otherwise, learning may not take place. Currently, in ELT more attention has been paid to how to train learners to be responsible for their own learning and more pedagogical activities have required learners’ involvement in order for them to make their own discoveries (Tomlinson, 2002). Accordingly, training students to utilize the concordance-based method should be a good practice which fits nicely with the current trends in EFL teaching.

5.5.2 Degrees of planning the concordance-based lessons

The concordance-based lessons used in the present study were fully planned since the students possessed limited existing knowledge. As the link between students' old and new knowledge should be established, the process of training would help in guiding how new knowledge can be explored and later acquired through the concordance-based method. However, the fully planned lessons had some limitations as the concrete framework of the planned lessons might limit the potential utilization of the concordance-based method. In other words, it might limit the students' creativity and ability to explore and discover new knowledge themselves. In the study, all language concepts and rules were provided or guided by the teacher whereas the students were assigned to find evidence from the corpus to support those concepts and rules, gearing more towards deductive learning. The students' resulting performance was, therefore, conditioned by the manipulation on the part of the teacher, not by their ability to formulate or infer from the information available. As McDonough (1995, cited in Stevens, 1995) points out, providing a rule first might impose rule formation rather than encouraging students to make one up in their own terms.

However, according to the so-called data-driven learning (DDL) approach, inductive learning is more valued. In this approach, both the teacher and students do not necessarily know what linguistic items or patterns will be found in the corpus. Without rule teaching, learners could explore available data from corpora to generalize or induce new rules and patterns. The naturally occurring language in the corpus makes it possible for the users to explore and discover new knowledge for themselves without limit. Learners are like *researchers* in that they form hypotheses and test them against the authentic data provided by the corpus. Only by doing so, can discovery learning take place. However, it is obvious that such formulation of productive queries is particularly difficult for language learners, especially low proficiency students. Before they can be exposed to subtle patterns in the language to do the query independently, such patterns have to be pre-considered by the teacher. They need assistance until they become familiar with the concordancing techniques. Only when they are ready, should they have to be trained to formulate and test their own hypotheses by inferring or inducing something from the available corpus data, and they should be provided opportunities to learn how to discover new knowledge themselves.

Findings suggest that the degree of planning is one important factor for consideration before the method is implemented. Such considerations include students' proficiency levels and their readiness to take responsibility for their own learning. On the one end of the learning continuum, full planning might be necessary for low proficiency students, especially at the beginning stage. However, if pre-conditioning is used for too long, it might over-protect the students and limit their creativity to learn by themselves. It is, therefore, suggested that the students should have increasing opportunities to learn through self-discovery at later stages and more use of the corpus information in formulating rules or deducing meaning.

5.5.3 Content selection and corpus compilation

With the concordance-based method, the corpus is a unique and reliable linguistic resource. The corpus data best serve pedagogical needs for providing authentic and representative language as well as for guiding learners to explore and exploit a corpus for particular learning purposes. Therefore, a corpus is certainly another important factor to be considered since the quality of language inputs in the classroom entirely depends on the content in the corpus. Under situations where learning objectives are clear, compiling one specific corpus is justified in order to obtain linguistic information as used in the target situations. In compiling a corpus, at least two main factors should be considers: a corpus size and text selection. Although a bigger corpus may ensure the representativeness of particular language areas, the corpus for pedagogical purposes is not necessarily big. The judgment mostly depends on the purposes and availability of resources and time. A small corpus may suffice as long as it can provide sufficient examples of the language in focus. Regarding text selection, texts to be included in the corpus must be texts with content relating to the students' specialized fields. In addition, text types and content should be taken into consideration. If the texts are general and not specially selected for any particular groups, the corpus data may not serve the specific needs of students and the content is unlikely to be motivating. As evidenced in this study, even engineering students from different branches such as mechanics and electrical power seem to appreciate reading different texts. According to Jordan (2000), students prefer to devote time to study texts and topics related to their particular disciplines.

In compiling a corpus for advanced students, the types and topics of texts should be balanced in order to cover as many areas as possible in the particular fields of study. With low proficiency students, however, some pre-conditioning is suggested to facilitate their learning. To accelerate their authentic reading, for example, the underlying principles of the '*narrow reading*' method can be applied. According to Schmitt (2001), this method is concerned with reading numerous authentic texts, but all on the same topic in order that much of the topic-specific vocabulary will be repeated throughout the course of reading. Schmitt suggests that the method of '*narrow reading*' can accelerate access to authentic materials. To integrate this idea into the concordance-based method, texts selected for corpus compilation should be confined only to a few text types and topics, thus making the corpus data condensed with language in particular areas so that students will distinguish them while exploring the corpus data. Moreover, students will have more chance to reencounter target words recycled in the concordance lines.

5.5.4 Design of concordance-based lessons

The corpus alone may not be able to create good learning effects if the link among language in the corpus, language studied in classes and language in their real academic situations is not established. This connection would help motivate students to learn. In the present study, the content was categorized according to particular themes such as '*technical drawing*' and '*computers in engineering*'. Such organization helped to facilitate their mind mapping process, linking their existing knowledge with what is to be learnt. As was frequently found from their logs, the students expressed their admiration for the content and their motivation to learn it. They found the content in each lesson very interesting and useful. Their motivation seemed to be due to the fact that they could find a clear connection between language taught in classes and that in their engineering field.

5.6 Recommendations for further study

The present study has shown with empirical evidence the potential of the concordance-based method in increasing students' lexical knowledge for academic reading. In the study, although gains in lexical knowledge were assessed according to definitional knowledge, transferable knowledge and retention rate, gains in reading comprehension were not measured. Future research should investigate whether the concordance-based method would also help increase reading proficiency. Also, as this method has the potential to promote independent learning, it would be interesting to conduct a study investigating how long it will take students to be properly prepared for exploring new knowledge from the corpus themselves, that is how much training would be needed before the students can take responsibility for their own learning. Such a study would give insights into the principles of learner autonomy. In addition, since this study was conducted with a small number of samples who were Thai engineering students at an undergraduate level, further investigations with larger samples might be needed so that the findings may be generalized to populations other than Thai engineering students at an undergraduate level. Moreover, studies which compare the learning effects of high and low proficiency students may be beneficial. Finally, as the design and preparation of the concordance-based method are an important factor contributing to its success, future research may aim at designing and developing classroom materials that will bring about optimal benefits.

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APPENDICES

Appendix A

Vocabulary Level Tests

……………………………………………………………………………………………..

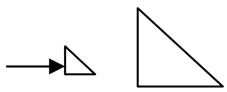
I. 1000 Word Level Test A

[Source: Nation's (1990) Receptive Vocabulary Test published in Nation, I.S.P. (2001) *Learning Vocabulary in Another Language*, pp.412-3. UK: Cambridge University Press.]

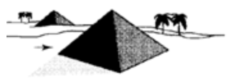
Instructions: There are 39 questions. Tick (✓) "T" if a sentence is true. Tick (✓) "N" if a sentence is not true. Tick (✓) "X" if you do not understand the sentence.

For example: We cut time into minutes, hours, and days.
.. ✓.. T (This is **True.**)
….. N (This is **Not true**.)
….. X (I do **Not understand** the question.)

1. This one is little.
….. T
….. N
….. X



2. You can find these everywhere.
….. T
….. N
….. X



3. Some children call their mother Mama.
….. T
….. N
….. X

4. *Show me the way to do it* means 'show me how to do it.'
….. T
….. N
….. X

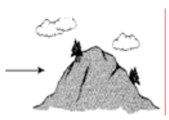
5. This country is part of the world.
….. T
….. N
….. X

6. This can keep people away from your house.
….. T
….. N
….. X

7. When something falls, it goes up.
….. T
….. N
….. X

8. Most children go to school at night.
….. T
….. N
….. X

9. It is easy for children to remain still.
….. T
….. N
….. X
10. One person can carry this.

….. T
….. N
….. X
11. A scene is a part of a play.
….. T
….. N
….. X
12. People often think of their home, when they are away from it.
….. T
….. N
….. X
13. There is a mountain in every city.
….. T
….. N
….. X
14. Every month has the same number of days.
….. T
….. N
….. X
15. A chief is the youngest person in a group.
….. T
….. N
….. X
16. Black is a colour.
….. T
….. N
….. X
17. You can use a pen to make marks on paper.
….. T
….. N
….. X
18. A family always has at least two people.
….. T
….. N
….. X
19. You can go by road from London to New York.
….. T
….. N
….. X
20. Silver costs a lot of money.
….. T
….. N
….. X
21. This is a hill.

….. T
….. N
….. X

22. This young person is a girl.

….. T
….. N
….. X

23. We can be sure that one day we will die.
….. T
….. N
….. X

24. A society is made of people living together.
….. T
….. N
….. X

25. An example can help you understand.
….. T
….. N
….. X

26. Some books have pictures in them.
….. T
….. N
….. X

27. When some people attack other people, they try to hurt them.
….. T
….. N
….. X

28. When something is ancient, it is very big.
….. T
….. N
….. X

29. Big ships can sail up a stream.
….. T
….. N
….. X

30. It is good to keep a promise.
….. T
….. N
….. X

31. People often dream when they are sleeping.
….. T
….. N
….. X

32. This is a date – 10 o'clock.
….. T
….. N
….. X

33. When something is impossible, it is easy to do it.
….. T
….. N
….. X

34. Milk is blue.
….. T
….. N
….. X

35. A square has five sides.

….. T
….. N
….. X

36. Boats are made to travel on land.

….. T
….. N
….. X

37. Cars cannot pass each other on a wide road.

….. T
….. N
….. X

38. When you look at something closely, you can see the details.

….. T
….. N
….. X

39. This part is a handle.

….. T
….. N
….. X

II. 2000 Word Level Test A

[Source: Schmitt, Schmitt, and Clapham's (1999) Receptive Vocabulary Test published in Schmitt, N. (2000) *Vocabulary in Language Teaching*, pp.192-4. USA: Cambridge University Press.]

Instructions: Choose the right word to go with each meaning. Write the option of that word in front of its meaning.

For example:

……f…… part of a house	a. business	d. pencil
……c…… animal with four legs	b. clock	e. shoe
……d…… something used for writing	c. horse	f. wall

1. …………	game	a. birth	d. row
2. …………	winning	b. dust	e. sport
3. …………	being born	c. operation	f. victory
4. …………	heat	a. choice	d. salary
5. …………	meat	b. crop	e. secret
6. …………	money paid regularly for doing job	c. flesh	f. temperature
7. …………	teaching and learning	a. cap	d. parent
8. …………	number to measure with	b. education	e. scale
9. …………	going to a far place	c. journey	f. trick
10. …………	gold and silver	a. attack	d. pen
11. …………	pleasing quality	b. charm	e. shadow
12. …………	not having something	c. lack	f. treasure
13. …………	part of milk	a. cream	d. pupil
14. …………	a lot of money	b. factory	e. sacrifice
15. …………	person who is studying	c. nail	f. wealth
16. …………	go up	a. adopt	d. pour
17. …………	look at closely	b. climb	e. satisfy
18. …………	be on every side	c. examine	f. surround
19. …………	join together	a. bake	d. limit
20. …………	walk without purpose	b. connect	e. recognize
21. …………	keep within a certain size	c. inquire	f. wander
22. …………	break open	a. burst	d. fold
23. …………	make better	b. concern	e. improve
24. …………	take something to someone	c. deliver	f. urge
25. …………	first	a. original	d. slow
26. …………	not public	b. private	e. sorry
27. …………	all added together	c. royal	f. total
28. …………	commonly done	a. brave	d. hungry
29. …………	wanting food	b. electric	e. local
30. …………	having no fear	c. firm	f. usual

III. Academic Word Level Test A

[Source: Schmitt, Schmitt, and Clapham's (1999) Receptive Vocabulary Test published in Schmitt, N. (2000) *Vocabulary in Language Teaching*, pp.199-200. USA: Cambridge University Press.]

Instructions: Choose the right word to go with each meaning. Write the option of that word in front of its meaning.

For example:

……f…… part of a house	a. business	d. pencil
……c…… animal with four legs	b. clock	e. shoe
……d…… something used for writing	c. horse	f. wall

………………………………………………………………………………………..

1. …… work	a. benefit	d. principle
2. …… part of 100	b. labor	e. source
3. …… general idea used to guide one's actions	c. percent	f. survey

………………………………………………………………………………………..

4. …… money for a special purpose	a. element	d. philosophy
5. …… skilled way of doing something	b. fund	e. proportion
6. …… study of the meaning of life	c. layer	f. technique

………………………………………………………………………………………..

7. …… total	a. consent	d. parameter
8. …… agreement or permission	b. enforcement	e. sum
9. …… trying to find information about something	c. investigation	f. trend

………………………………………………………………………………………..

10. …… 10 years	a. decade	d. incidence
11. …… subject of a discussion	b. fee	e. perspective
12. …… money paid for services	c. file	f. topic

………………………………………………………………………………………..

13. …… action against the law	a. colleague	d. inclination
14. …… wearing away gradually	b. erosion	e. panel
15. …… shape or size of something	c. format	f. violation

………………………………………………………………………………………..

16. …… change	a. achieve	d. link
17. …… connect together	b. conceive	e. modify
18. …… finish successfully	c. grant	f. offset

………………………………………………………………………………………..

19. …… keep out	a. convert	d. facilitate
20. …… stay alive	b. design	e. indicate
21. …… change from one thing into another	c. exclude	f. survive

………………………………………………………………………………………..

22. …… control something skillfully	a. anticipate	d. denote
23. …… expect something will happen	b. compile	e. manipulate
24. …… produce books and newspapers	c. convince	f. publish

………………………………………………………………………………………..

25. …… most important	a. equivalent	d. primary
26. …… concerning sight	b. financial	e. random
27. …… concerning money	c. forthcoming	f. visual

………………………………………………………………………………………..

28. …… last or most important	a. alternative	d. ethnic
29. …… something different that can be chosen	b. ambiguous	e. mutual
30. …… concerning people from a certain nation	c. empirical	f. ultimate

………………………………………………………………………………………..

Appendix B

Questionnaire I

……………………………………………………………………………………………..

Descriptions

The information derived from this questionnaire is useful for improving the lessons in order to make them appropriate for the learners as much as possible. It is not concerned with the evaluation of your studying performance in this semester. Therefore, please give honest answers to all the questions.

The questionnaire consists of 5 parts as follows.

• Part I: General Information	• Part IV: Computer Skills
• Part II: English Previous Study	• Part V: Comments and Suggestions
• Part III: Reading Background	

คำอธิบาย

ข้อมูลที่ได้รับจากแบบสอบถามนี้จะเป็นประโยชน์ในการจัดปรับบทเรียนให้เหมาะสมกับผู้เรียนมากที่สุด ไม่มีผลกระทบต่อการประเมินผลการเรียนของคุณในภาคเรียนนี้แต่ประการใด กรุณาตอบคำถามให้ครบทุกข้อตามความเป็นจริง

แบบสอบถามแบ่งเป็น 5 ส่วนดังนี้

• ตอนที่ 1: รายละเอียดทั่วไป	• ตอนที่ 4: ทักษะทางคอมพิวเตอร์
• ตอนที่ 2: พื้นฐานภาษาอังกฤษ	• ตอนที่ 5: ความเห็นและคำแนะนำ
• ตอนที่ 3: พื้นฐานในการอ่าน	

Instruction: Please give the information by ticking (✓) in appropriate boxes or columns and giving short answers where needed.

(การตอบแบบสอบถาม: กรุณาให้รายละเอียดโดยกรอกข้อมูลที่เกี่ยวข้องและใส่เครื่องหมาย ✓ ลงในกรอบหรือในตาราง ตามความเหมาะสม)

Part I: General Information

1. Name (ชื่อ-นามสกุล) ……………………………………………… Age (อายุ) …….………

2. Faculty (คณะ)……………………………… Field of study (สาขาวิชา) …………………….

3. Previous school / institution (โรงเรียน / สถาบันศึกษาเดิม)

………………………………………………

4. GPA of the last semester (เกรดเฉลี่ยในเทอมสุดท้าย)

☐ Less than (น้อยกว่า) 2 ☐ 2.00 – 2.49 ☐ 2.50 – 2.99

☐ 3.00 – 3.49 ☐ More than (มากกว่า) 3.50

Part II: English Previous Study

1. When did you start learning English? (คุณเริ่มเรียนภาษาอังกฤษเมื่อใด)

   ☐ Kindergarten (อนุบาล)

   ☐ Primary school (ประถมศึกษา)

   ☐ Secondary school (มัธยมศึกษา)

2. How long have you been learning English? (คุณเรียนภาษาอังกฤษมานานเท่าใด)

   ☐ 1-3 years
   ☐ 4-6 years
   ☐ 7-9 years
   ☐ 10-12 years
   ☐ More than 12 years

3. Have you ever stopped studying English in any academic semesters / years?
   (คุณเคยหยุดเรียนภาษาอังกฤษในบางภาคเรียนหรือปีการศึกษาบ้างหรือไม่)

   ☐ Yes (เคย) Why? (เพราะเหตุใด) ……….………………………

   How long? (นานเท่าใด) ………………..………………

   ☐ No (ไม่เคย)

4. Have you ever had any English-native teacher? (คุณเคยเรียนกับครูต่างชาติที่เป็นเจ้าของภาษาหรือไม่)

   ☐ Yes (เคย) How long? (นานเท่าใด) ………………..…………

   ☐ No (ไม่เคย)

5. What grades did you earn from the last two English courses? Tick two items if they are different. (คุณได้เกรดอะไรในวิชาภาษาอังกฤษสองภาคเรียนสุดท้าย ถ้าเกรดไม่เหมือนกันให้เลือกสองข้อ)

   ☐ A ☐ B ☐ C ☐ D ☐ F

6. Do you like studying English? (คุณชอบเรียนภาษาอังกฤษหรือไม่)

   ☐ Very much (ชอบมากๆ)

   ☐ Much (ชอบมาก)

   ☐ Averagely (ปานกลาง)

   ☐ Not much (ไม่ค่อยชอบ)

   ☐ Not at all (ไม่ชอบเลย)

7. Why do you learn English? Choose 1-2 items closing to your purpose mostly.
   (ทำไมคุณจึงเรียนภาษาอังกฤษ เลือกที่ตรงกับคุณมากที่สุด 1-2 ข้อ)

   ☐ Because it is a compulsory course. (เพราะเป็นวิชาบังคับ)

   ☐ Because it is fashionable. (เพราะเป็นสิ่งที่ทันสมัย)

   ☐ Because I like studying language. (เพราะชอบเรียนภาษา)

   ☐ Because it helps me to get a good and well-paid job. (เพราะช่วยให้ได้งานดีและมีเงินเดือนดี)

   ☐ Because it helps me to prepare myself for studying in higher education. (เพราะช่วยในการศึกษาต่อ)

   ☐ Because it helps me to get information. (เพราะช่วยในการค้นคว้าข้อมูล)

   ☐ Because it helps me to get pleasure. (เพราะช่วยให้ความเพลิดเพลิน)

☐ Because it is widely spoken in the world today.
(เพราะเป็นภาษาที่พูดกันแพร่หลายทั่วโลกในปัจจุบันนี้)
☐ Because it helps me to be able to communicate with foreigners.
(เพราะช่วยให้ได้สื่อสารกับชาวต่างประเทศ)
☐ No particular reason. (ไม่มีเหตุผลโดยเฉพาะ)
☐ Other reasons. (Please specify.)
(เหตุผลอื่นๆ กรุณาระบุ) …………………………………………..

8. How often do you do the following activities in previous English courses? Tick (✓) in the appropriate boxes, according to these numbers. (คุณทำกิจกรรมเหล่านี้บ่อยมากน้อยเพียงใดในการเรียนวิชาภาษาอังกฤษที่ผ่านมา ใส่เครื่องหมาย ✓ ลงในช่องที่เหมาะสมตามหมายเลขดังนี้)

- 5 = Always (เสมอ)
- 4 = Often (บ่อยๆ)
- 3 = Sometimes (บางครั้ง)
- 2 = Rarely (นานๆ ครั้ง)
- 1 = Never (ไม่เคย)

Activities	5	4	3	2	1
• Regularly attend English class. (เข้าเรียนวิชาภาษาอังกฤษสม่ำเสมอ)					
• Actively participate in class activities. (ตั้งใจร่วมกิจกรรมระหว่างเรียนเต็มที่)					
• Be absent from class. (ขาดเรียน)					
• Be late from class. (เข้าเรียนสาย)					
• Complete the assignment in time. (ทำงานที่มอบหมายครบและทันตามกำหนด)					
• Have extra English classes. (เรียนพิเศษภาษาอังกฤษ)					
• Practise English on your own. (ฝึกภาษาอังกฤษด้วยตนเอง)					
• Practise listening from cassette tapes. (ฝึกฟังภาษาอังกฤษจากเทป)					
• Practise pronunciation after cassette tapes. (ฝึกออกเสียงตามเทป)					
• Practise speaking English with any foreigner you met. (ฝึกพูดภาษาอังกฤษกับชาวต่างชาติที่พบ)					
• Go to language self-access center after classes. (เข้าศูนย์เรียนรู้ภาษาด้วยตนเองนอกเวลาเรียน)					
• Watch English movies or listen to news / songs in English. (ดูภาพยนต์หรือฟังข่าว/เพลงเป็นภาษาอังกฤษ)					
• Write e-mails or chat via the Internet in English. (เขียนอีเมล์ หรือพูดคุยผ่านอินเตอร์เน็ตเป็นภาษาอังกฤษ)					

9. Do you think how good your English language skills are? Tick (✓) in the appropriate boxes, according to these numbers. (คุณคิดว่าทักษะภาษาอังกฤษของคุณดีมากน้อยเพียงใด กรุณาใส่เครื่องหมาย ✓ ลงในช่องที่เหมาะสมตามหมายเลขดังนี้)

- 5 = Very good (ดีมาก)
- 4 = Good (ดี)
- 3 = Average (ปานกลาง)
- 2 = Poor (อ่อน)
- 1 = Very poor (อ่อนมาก)

Skills (ทักษะ)	5	4	3	2	1
• Speaking skill (ทักษะการพูด)					
• Listening skill (ทักษะการฟัง)					
• Reading skill (ทักษะการอ่าน)					
• Writing skill (ทักษะการเขียน)					

Part III: Reading Background

1. Do you like reading? (คุณชอบการอ่านหรือไม่)

☐ Yes (ชอบ) Why?(เพราะเหตุใด) ………………………………………….

☐ No (ไม่ชอบ) Why? (เพราะเหตุใด) ………………………………………….

2. How often do you read any texts in Thai? (คุณอ่านข้อความหรือหนังสือที่เป็นภาษาไทยบ่อยมากน้อยเพียงไร)

☐ Always (เสมอ)

☐ Often (บ่อย)

☐ Sometimes (บางครั้ง)

☐ Rarely (นานๆครั้ง)

☐ Never (ไม่เคยอ่าน)

3. What types of texts do you usually read? Tick (✓) all types of texts you read. (ข้อความประเภทใดที่คุณอ่านเป็นประจำ ใส่เครื่องหมาย ✓ หน้าข้อความทุกประเภทที่คุณอ่าน)

☐ Textbooks (ตำราเรียน) ☐ Fictions (นวนิยาย)

☐ Cartoons (การ์ตูน) ☐ Newspapers (หนังสือพิมพ์)

☐ Comics (ขำขัน/เบาสมอง) ☐ Advertisements (โฆษณา)

☐ Magazines (นิตยสาร) ☐ Journals (วารสารเชิงวิชาการ)

☐ Others, please specify (อื่นๆ โปรดระบุ) ……………………………………………

☐ None (ไม่เคยอ่าน)

4. How often do you read texts in English? (คุณอ่านข้อความภาษาอังกฤษบ่อยมากน้อยเพียงไร)

   ☐ Always (เสมอ)

   ☐ Often (บ่อย)

   ☐ Sometimes (บางครั้ง)

   ☐ Rarely (นานๆครั้ง)

   ☐ Never (ไม่เคย)

5. Have you ever read any piece of texts in English longer than a page at a time?
   (คุณเคยอ่านข้อความเป็นภาษาอังกฤษยาวเกินหนึ่งหน้ากระดาษในครั้งเดียวหรือไม่)

   ☐ Yes (เคย) What types of texts? (ข้อความแบบใด) ………………….

   ☐ No (ไม่เคย)

6. How long of English texts have you ever read? (คุณเคยอ่านข้อความที่เป็นภาษาอังกฤษในระดับความยาวเท่าใด)

   ☐ Words (อ่านในระดับคำ)

   ☐ Sentences (อ่านในระดับประโยค)

   ☐ Paragraphs (อ่านในระดับย่อหน้า)

   ☐ Pages (อ่านในระดับหน้ากระดาษ)

   ☐ Chapters (อ่านในระดับบท)

   ☐ Books (อ่านเป็นเล่ม)

   ☐ Others, please specify (อื่นๆ โปรดระบุ) …………………………………………

7. In engineering courses, have you ever been assigned to read any texts in English?
   (ในวิชาทางวิศวกรรม คุณเคยได้รับมอบหมายให้อ่านตำราหรือบทความเป็นภาษาอังกฤษหรือไม่)

   ☐ Yes (เคย) In what subjects? (ในวิชาใด) ………………………………

   How often? (บ่อยมากน้อยเพียงใด) …………………..……

   How long? (ความยาวเท่าใด) ………………….……….

   ☐ No (ไม่เคย)

8. Do you have any difficulties in reading texts in English? (คุณมีปัญหาในการอ่านข้อความเป็นภาษาอังกฤษหรือไม่)

   ☐ Very much (มีปัญหา เยอะมาก)

   ☐ Much (มีปัญหามาก)

   ☐ Some (มีปัญหาบ้าง)

   ☐ A little (มีปัญหาน้อย)

   ☐ Very little (มีปัญหาน้อยมาก)

9. Do you think which of the following item is the most difficulty for your reading? (คุณคิดว่าหัวข้อใดต่อไปนี้ ที่เป็นปัญหามากที่สุดในการอ่านของคุณ)

☐ Vocabulary (คำศัพท์)

☐ Grammar (ไวยากรณ์)

☐ Organization (การเรียบเรียงข้อความ)

☐ Writing style (สไตล์ในการเขียน)

☐ Others, please specify (อื่นๆ โปรดระบุ) ……………………………………………

10. Do you use any reading strategies to solve the reading problems? (คุณเคยใช้เทคนิคการอ่านเพื่อช่วยแก้ปัญหาบ้างหรือไม่)

☐ Yes (เคย) What are they? (เทคนิคแบบใด) …………………

☐ No (ไม่เคย)

Part IV: Computer Skills

1. Do you like using a computer? (คุณชอบใช้คอมพิวเตอร์หรือไม่)

☐ Yes (ชอบ)

☐ No (ไม่ชอบ)

2. How often do you access a computer? (คุณใช้คอมพิวเตอร์บ่อยมากน้อยเพียงใด)

☐ Very often (บ่อยมาก)

☐ Often (บ่อย)

☐ Sometimes (บางครั้ง)

☐ Rarely (นานๆครั้ง)

☐ Never (ไม่เคยใช้)

3. Do you have your own computer? (คุณมีคอมพิวเตอร์ของตนเองหรือไม่)

☐ Yes (มี)

☐ No (ไม่มี)

4. Where do you usually access the computer? Tick (✓) all places where you access the computer. (คุณมักใช้คอมพิวเตอร์ที่ใด ใส่เครื่องหมาย ✓ ให้ตรงกับทุกสถานที่ที่คุณใช้คอมพิวเตอร์)

☐ At home (ที่บ้าน)

☐ At the university (ที่มหาวิทยาลัย)

☐ Computer shop (ร้านคอมพิวเตอร์)

☐ Others. Please specify. (อื่นๆ โปรดระบุ)…………….

5. How good is your basic computer skill? (ทักษะพื้นฐานในการใช้คอมพิวเตอร์ของคุณอยู่ในระดับใด)

☐ Very good (ดีมาก)

☐ Good (ดี)

☐ Average (ปานกลาง)

☐ Poor (ไม่ดี)

☐ Very poor (แย่มากๆ)

6. What kinds of computer programs can you use? Tick (✓) all programs you can use. (โปรแกรมคอมพิวเตอร์แบบใดที่คุณใช้เป็น กรุณาใส่เครื่องหมาย ✓ ให้ตรงกับทุกโปรแกรมที่คุณใช้)

☐ Game	☐ Word Processing
☐ Email (Hotmail, Yahoo etc.)	☐ Excel
☐ Chat (MSN)	☐ Power Point
☐ Pirch	☐ CAD program
☐ Internet Explorer	☐ Dreamweaver
☐ Search Engine (Yahoo, Google)	

☐ Others, please specify (อื่นๆ โปรดระบุ) ………………………………………

7. What types of activities do you usually do with the computer? Tick (✓) all activities you do with the computer? (คุณใช้คอมพิวเตอร์ทำอะไรบ้าง กรุณาใส่เครื่องหมาย ✓ ให้ตรงกับทุกกิจกรรมที่คุณใช้งานคอมพิวเตอร์)

☐ Typing (พิมพ์งาน)

☐ Using the technical programs. (ใช้โปรแกรมทางช่างเทคนิค)

☐ Using self-study programs. (ใช้โปรแกรมเรียนรู้ด้วยตนเอง)

☐ Playing games. (เล่นเกม)

☐ Accessing the Internet for e-mailing and online chatting etc. (ใช้อินเตอร์เน็ตเพื่ออีเมล์และสนทนาออนไลน์ ฯลฯ)

☐ Accessing the Internet for finding information. (ใช้อินเตอร์เน็ตเพื่อค้นคว้าข้อมูล)

☐ Others. Please, specify. (อื่นๆ โปรดระบุ) …………………………………

8. Have you ever used a computer for studying any subjects? (คุณเคยเรียนหรือค้นคว้าวิชาต่างๆ ผ่านคอมพิวเตอร์หรือไม่)

☐ Yes (เคย) What subject? (วิชาใด) ………………………………………………..

☐ No (ไม่เคย)

9. What kinds of computer learning materials have you ever used? Tick (✓) all kinds of materials you have used. (ใช้สื่อการเรียนคอมพิวเตอร์แบบใด กรุณาใส่เครื่องหมาย ✓ให้ตรงกับทุกประเภทของสื่อการเรียนที่คุณเคยใช้)

☐ CD-ROM (ซีดีรอม)

☐ Internet (อินเตอร์เน็ต)

☐ E-mail (อีเมล์)

☐ Others, please specify (อื่นๆ โปรดระบุ) ………………………………………

10. Have you ever used a computer for studying English? (คุณเคยเรียนภาษาอังกฤษผ่านคอมพิวเตอร์ บ้างหรือไม่)

☐ Yes (เคย) Where: inside or outside classroom? (ที่ไหน ในหรือนอกชั้นเรียน) …………

☐ No (ไม่เคย)

11. What kinds of computer learning materials have you ever used in studying English? Tick (✓) all kinds of materials you have used. (คุณเคยใช้สื่อการเรียนคอมพิวเตอร์แบบใดในการเรียนภาษาอังกฤษ กรุณาใส่เครื่องหมาย ✓ให้ตรงกับทุกประเภทของสื่อการเรียนที่คุณเคยใช้)

☐ CD-ROM (ซีดีรอม)

☐ Internet (อินเตอร์เน็ต)

☐ E-mail (อีเมล์)

☐ Others, please specify (อื่นๆ โปรดระบุ) ………………………………………

12. Have you ever heard anything about a corpus or a concordancer? (คุณเคยได้ยินเกี่ยวกับ corpus หรือ concordancer หรือไม่)

☐ Yes (เคย) What is it? Please specify. ……………………………………….

☐ No (ไม่เคย)

Part V: Comments and Suggestions

Please give your opinions, comments or suggestions concerning English study or studying English through a computer.
(กรุณาให้ความคิดเห็นหรือคำแนะนำเกี่ยวกับการเรียนภาษาอังกฤษ หรือการเรียนภาษาอังกฤษผ่านคอมพิวเตอร์)
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Thank you for your cooperation.

Appendix C

Pilot Study

……………………………………………………………………………………………..

Before the main study was conducted, a pilot study was implemented with the aim to try out classroom materials with students similar to the samples of the main study. Since the concordance-based method was completely new in this situation, the classroom materials and activities were tried out so that problems concerning the use of them could be identified and tackled before the implementation of the main study. The results from the pilot study were used for providing a practical framework as well as a set of guidelines for conducting the main study.

1. Samples of the pilot study

The experimental group in the pilot study consisted of 21 students in Electrical Power Engineering whereas the comparison group consisted of 35 students in Mechanical Engineering. All students were males with average ages of about 20-21. They studied in the third year of the engineering programs. As there were much fewer students in the experimental group, all 21 students could be conveniently matched in pairs with the comparison group on nearly the same scores. There were only six pairs whose difference was not more or less than one mark. Therefore, the mean scores between both groups were not significantly different, mean difference = 0.05, t = 0.46, and p = 0.964.

2. The corpus and word selection

At the initial stage, a small corpus of around 100,000 running words was compiled from academic texts relating to engineering fields. In compiling the corpus, various text types were included such as handouts, textbooks, articles, news, manuals and advertisements. Some texts were from sources recommended by engineering instructors in the questionnaire (see Appendix C). The selected texts were mostly from web-based resources such as online magazines and journals, with text topics mostly concerned with news or advancement in Technology. The proportion of text types and topics were not balanced and the selected texts were not classified while being saved into the corpus.

After the corpus was compiled, a word frequency list was created and checked across West's (1953) General Service List of English Words (GSL) and Coxhead's (2000) Academic Word List (AWL). Both lists were set as '*reference lists*' (see Appendix D). The reference lists were regarded as a lexical threshold for academic reading. In the pilot study, words were selected if they were words in the GSL or the AWL with occurrences in the corpus of not less than 8 times. The lexical words at the top ranks were mainly focused and selected whereas most function words were deleted from the lists, except for words which are often used as discourse markers in reading such as '*despite*', '*however*', '*therefore*', and '*moreover*' etc. Words predicted as students' known words were also omitted whereas words predicted as unknown and useful ones were selected. The resulting wordlist formed a '*target wordlist*' used as a basis for designing the test to assess learning effects of the whole study. The target wordlist consisted of 840 words in total and it was divided into 12 weekly wordlists i.e., 70 words for each. Before the target words were distributed to weekly wordlists, they were grouped in terms of their functions and uses such as parts of speech, polysemies and discourse markers. Each weekly wordlist was a basis for designing weekly lessons and related materials.

3. Classroom materials

The lessons were planned based on the RMUTL course description for Technical English Reading. As mentioned earlier, the focus of the course was reading articles, journals and textbooks related to students' specialized fields for information, and interpretation or inference. Accordingly, the lesson plan was intended to teach strategies and skills to interpret local meaning of texts in sample sentences/concordances and reading passages. The target words were presented in language input, activities and exercises. The whole lesson plan was divided into four main parts: guessing word meanings from words' grammatical functions, word parts and context clues as well as reading comprehension. Then, these four parts were divided into 12 lessons. Each lesson focused on a given weekly wordlist. Table 1 illustrates the outline of the whole lesson plan.

Table 1: Outline of the lesson plan for the pilot study

Week	Lessons		Review Tasks
1	Introduction & Vocabulary Level Test		
2	Questionnaire I & Pretest		
3	Part I: Guessing word meaning from words' grammatical functions	Unit 1: Parts of Speech	
4		Unit 2: Sentence Structures	Review Task 1
5	Part II: Guessing word meaning from word parts	Unit 3: Compound Words	
6		Unit 4: Prefixes I	Review Task 2
7		Unit 5: Prefixes II	
8		Unit 6: Suffixes	Review Task 3
9	Mid-term Exam		
10	Part III: Guessing word meaning from context clues	Unit 7: Definition / Classification Clues	
11		Unit 8: Connector / Discourse Markers Clues	Review Task 4
12		Unit 9: Comparison / Contrast Clues	
13		Unit 10: Cause / Effect Clues	Review Task 5
14	Part IV: Reading Comprehension	Unit 11: Manual / Instruction	
15		Unit 12: Articles / Textbooks	Review Task 6
16	Posttest		
17	Vocabulary Level Tests & Questionnaire II		
18	Final exam		

A number of difficulties occurred in designing and implementing these lessons and materials. Firstly, the process of the corpus compilation did not facilitate the designing practices. Texts had not been balanced and graded before being saved into the corpus so it was very difficult for the students to read the corpus information. All texts were authentic and most of them were aimed at professional reading. Therefore, the corpus data was condensed with technical terms beyond the students' proficiency level. A lot of words in the texts were unknown for them and language patterns used were quite complicated. Moreover, the unbalanced topics in the small size corpus made the texts less focused in particular areas so typical recurrent patterns of the target language were unlikely to be easily observable. This also made it difficult for the teacher to find proper examples on particular language points which were the focuses in the lessons as planned. In addition, some topics from other fields of engineering such as aviation and mining were unexpectedly included in the corpus and such language was clearly irrelevant to the students and did not motivate them.

Secondly, the set number of target words also posed problems. Seventy words became too many to be included in one weekly lesson. Although this number was possible for designing the activities for the concordance-based group, it was rather impractical to contextualize all target words in the materials designed for the other group. Apart from being difficult in designing parallel lessons, the lessons were consequently too condensed and became an overload for the students.

Thirdly, language presentation in classes did not motivate the students, especially in the concordance-based group. Since the materials did not facilitate learning by linking various aspects of words to be learned together. For example, word senses and functions were learned separately. Therefore, such lexical knowledge was suspected to be memorized as fragments.

Fourthly, learner training was not provided so the students were not properly prepared for the concordance-based method before the lessons started. The method was introduced at the start of the first lesson because it was estimated that a concordancer used in the study was not so complicated so that the students would gradually become familiar with it during the process of language learning. However, the appearance of a concordance format at first sight seemed formidable for them rather than motivating. However, the draft of the handouts did not include enough examples of paper-based concordances so they did not facilitate students' understanding much.

4. Research instruments, data collection and findings

The instruments used in the pilot study included the first set of the questionnaire, the pretest, teacher's field notes and students' logs. The first set of the questionnaire and the pretest were administered at the beginning of the study for collecting students' data before the study. The results of the pretests were used to verify the equality of the groups. Teacher's field notes and students' logs were recorded after four lessons dealing with the concordance-based method. In addition, some students were informally interviewed after the end of the study.

Based on the data collected from teacher's field notes, at the beginning of the first lesson, the teacher observed that the students in the experimental group were fully motivated because they liked using computers and were eager to use them for studying English. When dealing with the texts on the computer screens for linguistic study, however, their motivation was clearly reduced since they tried to read all texts word by word but most of the texts were unknown to them. Therefore, they were suggested to screen out irrelevant information and instead paid attention only to the language points focused at one time. In the following three lessons, students gradually became more familiar with the operation of the concordancer for accessing a corpus. When they were trained to observe only the contexts of the keywords to get helpful hints for interpreting such words or phrases, they could cope with the tasks somewhat better. However, it was observed that some students were still used to reading all texts without screening irrelevant information and this discouraged them. This suggested that learner training on concordancing skills was needed.

According to the data collected from students' logs and informal interviews, students reported that there was not much difficulty in using the concordancing skills and they were sure that they could operate the program better if it was used for a longer period of time. The difficulties were more on dealing with linguistic information. Unfamiliar words in contexts were so many that they were not helpful for interpreting the texts focused. Most of them thought that the main cause was their insufficient proficiency in English. However, their attitudes towards the concordance-based method were fairly positive. They realized that the method was useful for studying English but they needed longer training before they could deal with it well enough.

5. Suggestions for the main study

According to the difficulties found in the pilot study, a framework and a set of guidelines were suggested for the main study on corpus compilation, the number of target words, lesson plan, the designs of lessons and classroom materials, and test and review tasks.

5.1 Corpus compilation

A corpus had to be carefully re-compiled. It was the starting point of the whole process and also was the main linguistic resource for the designing practices. The unsystematic compilation in the pilot study could not serve the specific needs of the study and even affected various areas of the process. In compiling a new corpus, text selection should facilitate students' comprehension of authentic language by grading texts before storing them in the corpus. Accordingly, text topics should not be concerned much with professional, but fundamental knowledge in engineering since such topics might more conform to students' existing knowledge and level of proficiency. In addition, text topics should be clustered in particular areas familiar to the students so that language samples somewhat comprehensible for students can be obtained and some recurrent linguistic items and patterns in those areas become noticeable. Regarding this issue, the size of a corpus should also be considered. Although a specialized corpus in language teaching was not necessarily large to prevent overwhelming data, it should be large enough for students to notice recurrent items and patterns. Only language items and patterns often recurring in the target language would be worth studying since they are used often in students' academic texts. Finally, text types should be representative of engineering academic texts.

In conclusion, language to be studied in classrooms should not only be authentic, but also more comprehensible and representative of the target language. In so doing, students' pace in authentic reading could be accelerated, thus allowing them to get the best return for their learning efforts.

5.2 The number of target words

As discussed earlier, the number of target words i.e. 70 words set for each lesson, caused a problem in designing parallel lessons for the two groups. With the concordance-based method, students had a concordancer to facilitate word contextualization whereas it was difficult to contextualize all target words in the lessons designed for the other class using the conventional methods. Although it could be done, it consequently made the lesson too condensed. Therefore, the number of target words in each lesson must be reduced.

5.3 Lesson plan

The whole lesson plan should also be revised. Instead of using strategy-based design, the lesson plan should be based on particular themes in order that various aspects of target words could be learned together. For example, words might be grouped according to the themes of the lessons such as '*cause and effects*'. In this case, words signifying causes and effects could be grouped together such as '*cause'*, '*lead to*', '*due to*', '*result'*, '*as a result*', '*therefore'*, '*thus*', and '*hence*'. Apart from learning word meanings, word functions and typical collocations of each word could be integrated so that different uses of words in the same set could be compared. In addition, a good reading strategy of using cause and effect clues for inferring the meaning of the texts could also be trained simultaneously. In this way, more than one aspect of a word could be learned accumulatively.

5.4 The designs of lessons and classroom materials

As the corpus had to be re-compiled with different frequency lists, most target words would have to be changed as well. Although many high frequency words in one academic text would likely be on top ranks of another academic corpus, not all words in the first list would be included in the new corpus. The change in target wordlist would in turn lead to the change in the focuses of each lesson. Consequently, new sets of classroom materials, tests and tasks would have to be re-designed accordingly.

It was suggested that all activities in one lesson should be linked together according to a particular theme to facilitate students' understanding as well as to make the lesson more interesting. Moreover, in the concordance-based group, learner training should be provided at the beginning of the study to prepare students for hands-on concordancing activities. Furthermore, handouts used in the first few lessons should include enough examples of paper-based concordances. Finally, the introduction to the concordance-based method should be conducted step by step to prevent students' confusion and discouragement.

Appendix D

The GSL and the AWL

…………………………………………………………………………………………..

I. West's (1953) General Service List of English Words (GSL)

(Source: Available at http://www.uefap.co.uk/vocab/select/gsl/htm-intro)

GSL Headwords: The original list had about 2000 headwords

a	aloud	asleep	Become	both	canal	class
able	already	association	Bed	bottle	cap	clay
about	also	astonish	Before	bottom	cape	clean
above	although	at	Beg	bound	capital	clear
abroad	altogether	attack	Begin	boundary	captain	clerk
absence	always	attempt	Behave	bow	car	clever
absolutely	ambition	attend	Behind	bowl	card	cliff
accept	among	attract	Being	box	care	climb
accident	amongst	audience	Believe	boy	carriage	clock
accord	amount	August	bell	brain	carry	close
account	amuse	aunt	belong	branch	cart	cloth
accuse	ancient	autumn	below	brass	case	cloud
accustom	an	avenue	belt	brave	castle	club
ache	and	average	bend	bread	cat	coal
across	anger	avoid	beneath	break	catch	coarse
act	angle	awake	berry	breakfast	cattle	coast
actual	angry	away	beside	breath	cause	coat
add	animal	awkward	best	bribe	caution	coffee
address	annoy	axe	better	brick	cave	coin
admire	another	baby	between	bridge	cent	cold
admit	answer	back	beyond	bright	centre	collar
adopt	anxiety	bad	bicycle	bring	century	collect
advance	any	bag	big	broad	ceremony	college
advantage	apart	baggage	bill	brother	certain	colony
adventure	apologise	bake	bind	brown	chain	colour
advertise	appear	balance	bird	brush	chair	comb
advice	applaud	ball	birth	bucket	chalk	combine
aeroplane	apple	band	bit	build	chance	come
affair	apply	bank	bite	bunch	change	comfort
afford	appoint	bar	bitter	bundle	character	command
afraid	approve	barber	black	burn	charge	commerce
after	April	bare	blade	burst	charm	committee
afternoon	arch	bargain	blame	bury	cheap	common
again	argue	barrel	bless	bus	cheat	companion
against	arise	base	blind	bush	check	company
age	arm	basin	block	business	cheer	compare
agent	army	basket	blood	busy	cheese	compete
ago	around	bath	blow	but	cheque	complain
agree	arrange	battle	blue	butter	chest	complete
agriculture	arrest	bay	board	button	chicken	complicated
ahead	arrive	be	boast	buy	chief	compose
aim	arrow	beak	boat	by	child	concern
air	art	beam	body	cage	chimney	condition
alike	article	bean	boil	cake	choose	confess
alive	artificial	bear	bold	calculate	Christmas	confidence
all	as	beard	bone	call	church	confuse
allow	ash	beast	book	calm	circle	congratulate
almost	ashamed	beat	border	camera	city	connect
alone	aside	beauty	born	camp	civilize	conquer
along	ask	because	borrow	can	claim	conscience

GSL Headwords

conscious	current	develop	due	equal	fashion	flower
consider	curse	devil	dull	escape	fast	fly
contain	curtain	diamond	during	especial	fat	fold
content	curve	dictionary	dust	essence	fate	follow
continue	cushion	die	duty	even	father	fond
control	custom	difference	each	evening	fatten	food
convenience	cut	difficult	eager	event	fault	fool
conversation	damage	dig	ear	ever	favour	foot
cook	damp	dinner	early	every	favourite	for
cool	dance	dip	earn	evil	fear	forbid
copper	danger	direct	earnest	exact	feast	force
copy	dare	dirt	earth	examination	feather	foreign
cork	dark	disappoint	ease	example	February	forest
corn	date	discipline	east	excellent	feed	forget
corner	daughter	discover	easy	except	feel	forgive
correct	day	discuss	eat	excess	fellow	fork
cost	dead	disease	edge	excite	female	form
cottage	deaf	disgust	educate	excuse	fence	formal
cotton	deal	dish	effect	exercise	fever	former
cough	dear	dismiss	effort	exist	few	forty
council	debt	distance	egg	expect	field	four
count	decay	distinguish	either	expense	fierce	fourteen
country	deceive	district	eight	experience	fifteen	fortune
courage	December	disturb	eighteen	experiment	fifty	forward
course	decide	ditch	eighty	explain	fight	frame
court	declare	dive	elastic	explode	figure	free
cousin	decrease	divide	elder	explore	fill	freeze
cover	deed	do	elect	express	film	frequency
cow	deep	doctor	electricity	extend	find	frequent
coward	deer	dog	elephant	extra	fine	fresh
crack	defeat	dollar	eleven	extraordinary	finger	friend
crash	defend	donkey	else	extreme	finish	Friday
cream	degree	door	empire	eye	fire	fright
creature	delay	dot	employ	face	firm	from
creep	delicate	double	empty	fact	first	front
crime	delight	doubt	enclose	factory	fish	fruit
critic	deliver	down	encourage	fade	fit	fry
crop	demand	dozen	end	fail	five	full
cross	department	drag	enemy	faint	fix	fun
crowd	depend	draw	engine	fair	flag	funeral
crown	descend	drawer	English	faith	flame	fur
cruel	describe	dream	enjoy	fall	flash	furnish
crush	desert	dress	enough	false	flat	further
cry	deserve	drink	enquire	familiar	flavour	future
cultivate	desire	drive	enter	family	flesh	gain
cup	desk	drop	entertain	famous	float	gallon
cupboard	despair	drown	entire	fan	flood	game
cure	destroy	drum	entrance	fancy	floor	gap
curious	detail	dry	envelope	far	flour	garage
curl	determine	duck	envy	farm	flow	garden

GSL Headwords

gas	handle	host	intend	last	long	mention
gate	hang	hot	interest	late	look	merchant
gather	happen	hotel	interfere	latter	loose	mercy
gay	happy	hour	international	laugh	lord	mere
general	harbour	house	interrupt	law	lose	merry
generous	hard	how	into	lay	loss	message
gentle	hardly	human	introduce	lazy	lot	metal
get	harm	humble	invent	lead	loud	middle
girl	harvest	hundred	invite	leaf	love	might
give	haste	hunger	inward	lean	low	mild
glad	hat	hunt	iron	learn	loyal	mile
glass	hate	hurrah	island	least	luck	milk
glory	have	hurry	it	leather	lump	mill
go	hay	hurt	its	leave	lunch	mind
goat	he	husband	January	left	lung	mine
god	head	hut	jaw	leg	machine	minister
gold	heal	I	jealous	lend	mad	minute
good	health	ice	jewel	length	mail	mis-
govern	heap	idea	join	less	main	miserable
grace	hear	ideal	joint	lesson	make	miss
gradual	heart	idle	joke	let	male	mistake
grain	heat	if	journey	letter	man	mix
grammar	heaven	ill	joy	level	manage	model
grand	heavy	imagine	judge	liberty	manners	moderate
grass	height	imitate	juice	library	manufacture	modern
grateful	hello	immediate	July	lid	many	modest
grave	help	immense	jump	lie	map	moment
grease	here	important	June	life	March	Monday
great	hesitate	impossible	just	lift	mark	money
greed	hide	improve	keep	light	market	monkey
green	high	in	key	like	marry	month
greet	hill	inch	kick	likely	mass	moon
grey	hinder	include	kill	limb	master	moral
grind	hire	increase	kind	limit	mat	more
ground	his	indeed	king	line	match	moreover
group	history	independent	kiss	lip	material	morning
grow	hit	industry	kitchen	liquid	matter	most
guard	hold	influence	knee	list	May	mother
guess	hole	inform	knife	listen	meal	motion
guest	holiday	ink	knock	literature	mean	motor
guide	hollow	in-law	knot	little	meanwhile	mountain
guilty	holy	inn	know	live	measure	mouse
gun	home	inquire	lack	load	meat	mouth
habit	honest	insect	ladder	loaf	mechanic	move
hair	honour	inside	lady	loan	medicine	much
half	hook	instant	lake	local	meet	mud
hall	hope	instead	lamp	lock	melt	multiply
hammer	horizon	instrument	land	lodging	member	murder
hand	horse	insult	language	log	memory	music
handkerchief	hospital	insure	large	lonely	mend	must

GSL Headwords

my	oar	pale	place	price	race	reproduce
mystery	obey	pan	plain	pride	radio	republic
nail	object	paper	plan	priest	rail	reputation
name	observe	parcel	plant	print	rain	request
narrow	occasion	pardon	plaster	prison	raise	rescue
nation	ocean	parent	plate	private	rake	reserve
native	October	park	play	prize	rank	resign
nature	of	part	please	probable	rapid	resist
near	off	particular	plenty	problem	rare	respect
neat	offend	party	plough	procession	rat	responsible
necessary	offer	pass	plural	produce	rate	rest
neck	office	passage	pocket	profession	rather	restaurant
need	often	past	poet	profit	raw	result
needle	oil	paste	point	programme	ray	retire
neglect	old	path	poison	progress	razor	return
neighbour	omit	patient	police	promise	reach	revenge
neither	on	patriotic	polish	prompt	read	review
nephew	once	pattern	polite	pronounce	ready	reward
nest	one	pause	political	proof	real	ribbon
net	only	paw	pool	proper	reason	rice
never	onto	pay	poor	property	receive	rich
new	open	peace	popular	propose	recent	rid
next	operation	pearl	population	protect	recognise	ride
nice	opinion	peculiar	position	proud	recommend	right
niece	opportunity	pen	possess	prove	record	ring
night	opposite	pencil	possible	provide	red	ripe
nine	or	penny	post	public	reduce	rise
ninety	orange	people	postpone	pull	refer	risk
nineteen	order	per	pot	pump	reflect	rival
no	ordinary	perfect	pound	punctual	refresh	river
noble	organ	perform	pour	punish	refuse	road
noise	organise	perhaps	poverty	pupil	regard	roar
none	origin	permanent	powder	pure	regret	roast
nonsense	ornament	permit	power	purple	regular	rob
noon	other	person	practical	purpose	rejoice	rock
nor	otherwise	persuade	practice	push	relation	rod
north	ought	pet	praise	put	relieve	roll
nose	ounce	photograph	pray	puzzle	religion	roof
not	our	pick	preach	qualify	remain	room
note	out	picture	precious	quality	remark	root
nothing	over	piece	prefer	quantity	remedy	rope
notice	overcome	pig	prejudice	quarrel	remember	rot
noun	owe	pigeon	prepare	quart	remind	rough
November	own	pile	present	quarter	rent	round
now	pack	pin	preserve	queen	repair	row
nowhere	pad	pinch	president	question	repeat	royal
nuisance	page	pink	press	quick	replace	rub
number	pain	pint	pretend	quiet	reply	rubber
nurse	paint	pipe	pretty	quite	report	rubbish
nut	pair	pity	prevent	rabbit	represent	rude

GSL Headwords

rug	seem	show	solid	steal	summer	test
ruin	seize	shower	solve	steam	sun	than
rule	seldom	shut	some	steel	Sunday	thank
ruler	self	sick	son	steep	supper	that
run	sell	side	soon	steer	supply	the
rush	send	sight	sore	stem	support	theatre
rust	sense	sign	sorrow	step	suppose	their
sacred	sentence	signal	sorry	stick	sure	then
sacrifice	separate	silence	sort	stiff	surface	there
sad	September	silk	soul	still	surprise	therefore
saddle	serious	silver	sound	sting	surround	these
safe	serve	simple	soup	stir	suspect	they
sail	set	since	sour	stock	swallow	thick
sake	settle	sincere	south	stocking	swear	thief
salary	seven	sing	sow	stomach	sweat	thin
sale	seventeen	single	space	stone	sweep	thing
salt	seventy	sir	spade	stop	sweet	think
same	several	six	spare	store	swell	thirst
sample	severe	sixty	speak	storm	swim	thirteen
sand	sew	sixteen	special	story	swing	thirty
satisfy	shade	sister	speed	stove	sword	this
Saturday	shadow	sit	spell	straight	sympathy	thorn
sauce	shake	situation	spend	strange	system	thorough
saucer	shall	size	spill	strap	table	those
save	shallow	skill	spin	straw	tail	though
saw	shame	skin	spirit	stream	tailor	thought
say	shape	skirt	spit	street	take	thousand
scale	share	sky	spite	strength	talk	Thursday
scarce	sharp	slave	splendid	stretch	tall	thread
scatter	shave	sleep	split	strict	tame	threaten
scene	she	slide	spoil	strike	tap	three
scent	sheep	slight	spoon	string	taste	throat
school	sheet	slip	sport	strip	tax	through
science	shelf	slope	spot	stripe	taxi	throw
scissors	shell	slow	spread	strong	tea	thumb
scold	shelter	small	spring	struggle	teach	thunder
scorn	shield	smell	square	study	tear	thus
scrape	shilling	smile	staff	stuff	telegraph	ticket
scratch	shine	smoke	stage	stupid	telephone	tide
screen	ship	smooth	stain	subject	tell	tidy
screw	shirt	snake	stair	substance	temper	tie
sea	shock	snow	stamp	succeed	temperature	tight
search	shoe	so	stand	success	temple	till
season	shoot	soap	standard	such	tempt	time
seat	shop	society	star	suck	tend	tin
second	shore	sock	start	sudden	tender	tip
secret	short	soft	state	suffer	tent	tire
secretary	should	soil	station	sugar	ten	title
see	shoulder	soldier	stay	suggest	term	to
seed	shout	solemn	steady	suit	terrible	tobacco

GSL Headwords

today	umbrella	watch	wise
toe	uncle	water	wish
together	under	wave	with
tomorrow	understand	wax	within
ton	union	way	without
tongue	universe	we	witness
tonight	university	weak	woman
too	unless	wealth	wonder
tool	until	weapon	wood
tooth	up	wear	wool
top	upon	weather	word
total	upper	weave	work
touch	upright	Wednesday	world
tough	upset	weed	worm
tour	upward	week	worry
toward	urge	weigh	worse
towel	use	welcome	worship
tower	usual	well	worst
town	vain	west	worth
toy	valley	wet	would
track	value	what	wound
trade	various	wheat	wrap
train	veil	wheel	wreck
translate	verb	when	wrist
trap	verse	where	write
travel	very	whether	wrong
tray	vessel	which	yard
treasure	victory	while	year
treat	view	whip	yellow
tree	village	whisper	yes
tremble	violent	whistle	yesterday
trial	virtue	white	yet
tribe	visit	who	yield
trick	voice	whole	you
trip	vote	whose	young
trouble	vowel	why	youth
true	voyage	wicked	zero
trunk	wage	wide	
trust	waist	widow	
try	wait	wife	
tube	wake	wild	
Tuesday	walk	will	
tune	wall	win	
turn	wander	wind	
twelve	want	window	
twenty	war	wine	
twist	warm	wing	
two	warn	winter	
type	wash	wipe	
ugly	waste	wire	

II. Coxhead's (2000) Academic Word List (AWL)

(Source: Available at http://www.uefap.co.uk/vocab/select/awl/htm-intro)

AWL Headwords: There are 570 headwords. The most frequency words are in italics.

abandon	*author*	*concept*	define	equip	goal
abstract	*authority*	conclude	*definite*	*equivalent*	*grade*
academy	automate	*concurrent*	*demonstrate*	erode	grant
access	*available*	*conduct*	*denote*	*error*	*guarantee*
accommodate	*aware*	confer	*deny*	establish	guideline
accompany	*behalf*	confine	depress	*estate*	*hence*
accumulate	*benefit*	confirm	derive	*estimate*	hierarchy
accurate	*bias*	*conflict*	*design*	ethic	highlight
achieve	*bond*	conform	*despite*	*ethnic*	*hypothesis*
acknowledge	*brief*	*consent*	detect	evaluate	*identical*
acquire	*bulk*	consequent	deviate	eventual	identify
adapt	*capable*	*considerable*	*device*	evident	*ideology*
adequate	*capacity*	consist	devote	evolve	ignorant
adjacent	category	*constant*	differentiate	*exceed*	illustrate
adjust	cease	constitute	dimension	exclude	*image*
administrate	*challenge*	constrain	diminish	*exhibit*	immigrate
adult	*channel*	construct	discrete	expand	*impact*
advocate	*chapter*	consult	discriminate	*expert*	implement
affect	*chart*	consume	displace	*explicit*	implicate
aggregate	*chemical*	*contact*	*display*	exploit	*implicit*
aid	circumstance	*contemporary*	dispose	*export*	imply
albeit	cite	*context*	distinct	expose	impose
allocate	*civil*	*contract*	distort	*external*	*incentive*
alter	clarify	contradict	distribute	*extract*	*incidence*
alternative	classic	*contrary*	diverse	*facilitate*	incline
ambiguous	*clause*	*contrast*	*document*	factor	*income*
amend	*code*	contribute	*domain*	feature	incorporate
analogy	coherent	*controversy*	*domestic*	*federal*	*index*
analyse	*coincide*	convene	dominate	fee	*indicate*
annual	*collapse*	converse	*draft*	*file*	*individual*
anticipate	colleague	convert	drama	*final*	induce
apparent	commence	convince	*duration*	finance	inevitable
append	comment	cooperate	*dynamic*	*finite*	infer
appreciate	*commission*	coordinate	economy	flexible	*infrastructure*
approach	commit	*core*	edit	fluctuate	*inherent*
appropriate	*commodity*	*corporate*	element	*focus*	inhibit
approximate	communicate	correspond	*eliminate*	*format*	*initial*
arbitrary	*community*	*couple*	emerge	*formula*	initiate
area	compatible	*create*	*emphasis*	*forthcoming*	injure
aspect	compensate	*credit*	*empirical*	found	innovate
assemble	compile	*criteria*	*enable*	*foundation*	*input*
assess	*complement*	*crucial*	encounter	*framework*	*insert*
assign	*complex*	culture	*energy*	*function*	insight
assist	component	*currency*	enforce	fund	inspect
assume	compound	*cycle*	enhance	*fundamental*	*instance*
assure	*comprehensive*	*data*	*enormous*	*furthermore*	*institute*
attach	*comprise*	*debate*	*ensure*	*gender*	instruct
attain	compute	decade	entity	generate	*integral*
attitude	conceive	*decline*	*environment*	*generation*	integrate
attribute	concentrate	deduce	equate	globe	*integrity*

AWL Headwords

intelligent	*minimum*	*plus*	relax	*status*	*uniform*
intense	*ministry*	*policy*	*release*	*straightforward*	unify
interact	minor	*portion*	*relevant*	strategy	*unique*
intermediate	*mode*	pose	reluctance	*stress*	utilise
internal	modify	*positive*	rely	*structure*	valid
interpret	monitor	*potential*	remove	style	vary
interval	motive	practitioner	require	submit	*vehicle*
intervene	*mutual*	precede	*research*	*subordinate*	*version*
intrinsic	negate	*precise*	reside	*subsequent*	*via*
invest	*network*	predict	resolve	subsidy	violate
investigate	*neutral*	predominant	resource	substitute	virtual
invoke	*nevertheless*	*preliminary*	respond	successor	*visible*
involve	*nonetheless*	presume	*restore*	*sufficient*	*vision*
isolate	norm	*previous*	restrain	*sum*	*visual*
issue	*normal*	*primary*	restrict	*summary*	*volume*
item	*notion*	*prime*	retain	supplement	*voluntary*
job	*notwithstanding*	*principal*	reveal	*survey*	*welfare*
journal	*nuclear*	*principle*	*revenue*	*survive*	*whereas*
justify	*objective*	*prior*	*reverse*	suspend	*whereby*
label	obtain	*priority*	revise	sustain	*widespread*
labour	*obvious*	proceed	*revolution*	symbol	
layer	occupy	*process*	*rigid*	tape	
lecture	*occur*	*professional*	*role*	*target*	
legal	*odd*	prohibit	*route*	*task*	
legislate	*offset*	*project*	*scenario*	*team*	
levy	*ongoing*	*promote*	*schedule*	*technical*	
liberal	*option*	*proportion*	*scheme*	technique	
licence	orient	*prospect*	*scope*	*technology*	
likewise	outcome	*protocol*	*section*	*temporary*	
link	*output*	*psychology*	*sector*	tense	
locate	*overall*	*publication*	secure	terminate	
logic	*overlap*	publish	seek	*text*	
maintain	*overseas*	*purchase*	*select*	*theme*	
major	*panel*	*pursue*	*sequence*	*theory*	
manipulate	*paradigm*	*qualitative*	*series*	*thereby*	
manual	*paragraph*	quote	*sex*	*thesis*	
margin	*parallel*	*radical*	*shift*	*topic*	
mature	parameter	*random*	*significant*	*trace*	
maximise	participate	*range*	*similar*	tradition	
mechanism	partner	*ratio*	simulate	*transfer*	
media	*passive*	*rational*	*site*	transform	
mediate	perceive	react	*so-called*	transit	
medical	*percent*	recover	sole	transmit	
medium	*period*	*refine*	*somewhat*	*transport*	
mental	persist	*regime*	*source*	*trend*	
method	*perspective*	*region*	*specific*	*trigger*	
migrate	*phase*	register	specify	ultimate	
military	*phenomenon*	regulate	*sphere*	*undergo*	
minimal	*philosophy*	reinforce	stable	underlie	
minimise	*physical*	reject	statistic	undertake	

Appendix E

Questionnaire for Engineering Instructors

……………………………………………………………………………………………..

Please fill the information in the blanks or tick (✓) in appropriate boxes ☐. If any available spaces are not enough, please use the blank sheets at the back of paper.
(กรุณากรอกข้อมูลในช่องว่าง หรือใส่เครื่องหมาย ✓ ในกรอบ ☐ ที่กำหนดให้ ถ้าช่องว่างใดมีเนื้อที่ไม่เพียงพอ กรุณาเขียนลงบนกระดาษเปล่าด้านหลัง)

Part I: Personal Information (ข้อมูลเกี่ยวกับผู้กรอกแบบสอบถาม)

Name (ชื่อ-นามสกุล) ………..………………………………… Age (อายุ) …….……………

Working in the Department of (สังกัดแผนก / คณะ)………………………………………………

Teaching experience (ประสบการณ์การสอน) …………..…… years (ปี)

Teaching courses (วิชาที่สอน) :

1. ……………… Level (สอนระดับ) ☐ diploma (ปวส.) / ☐ undergraduate (ปริญญาตรี)
2. ……….………Level (สอนระดับ) ☐ diploma (ปวส.) / ☐ undergraduate (ปริญญาตรี)
3. ……………….Level (สอนระดับ) ☐ diploma (ปวส.) / ☐ undergraduate (ปริญญาตรี)
4. ……….………Level (สอนระดับ) ☐ diploma (ปวส.) / ☐ undergraduate (ปริญญาตรี)

Part II: Questionnaire (แบบสอบถาม)

1. Do you assign students to read any related academic textbooks, journals, magazines, newspapers, or reports in English? If yes, please specify the names of the publication, the titles of the chapters or articles, and the published years. (ท่านได้มอบหมายให้นักศึกษาอ่านตำรา วารสาร นิตยสาร หนังสือพิมพ์ หรือรายงานเชิงวิชาการที่เกี่ยวข้องกับวิชาที่สอน เป็นภาษาอังกฤษ บ้างหรือไม่ ถ้าเคยมอบหมาย กรุณาระบุชื่อหนังสือ ชื่อบท / บทความ และปีที่พิมพ์)

1. Name of publication (ชื่อหนังสือ) …...……………………………………………….
   Title (ชื่อบท / บทความ) ……………………………… Year (ปีที่พิมพ์) ..……………
2. Name of publication (ชื่อหนังสือ) ……………………………………………………
   Title (ชื่อบท / บทความ) ……………………………… Year (ปีที่พิมพ์) ..……………
3. Name of publication (ชื่อหนังสือ) ……………………………………………………
   Title (ชื่อบท / บทความ) ……………………………… Year (ปีที่พิมพ์) ……………
4. Name of publication (ชื่อหนังสือ) …………………...……………………………….
   Title (ชื่อบท / บทความ) ……………………………… Year (ปีที่พิมพ์) ..……………
5. Name of publication (ชื่อหนังสือ) ……………………………………………………
   Title (ชื่อบท / บทความ) ……………………………… Year (ปีที่พิมพ์) ..……………

2. Are there any published texts on the Internet that you assign students to read? If yes, please specify the website address and the titles of the articles. (ท่านได้มอบหมายให้นักศึกษาอ่านบทความที่เผยแพร่ทางอินเตอร์เน็ตบ้างหรือไม่ ถ้าเคยมอบหมาย กรุณาระบุเว็บไซด์และชื่อบทความ)

1. http://www……………………………………………………………………………
   Title (ชื่อบทความ) ………………………………………………………………..
2. http://www……………………………………………………………………………
   Title (ชื่อบทความ) ………………………………………………………………..
3. http://www……………………………………………………………………………
   Title (ชื่อบทความ) ………………………………………………………………..
4. http://www……………………………………………………………………………
   Title (ชื่อบทความ) ………………………………………………………………..
5. http://www……………………………………………………………………………
   Title (ชื่อบทความ) ………………………………………………………………..

3. Are there any English published texts which you do <u>not</u> assign students to read but you think they are interesting for both instructors and students in your field of study? Please recommend. (มีสิ่งพิมพ์หรือบทความใด ตีพิมพ์เป็นภาษาอังกฤษที่ท่าน<u>ไม่</u>เคยมอบหมายให้นักศึกษาอ่าน แต่ท่านคิดว่าเป็นหนังสือหรือบทความที่น่าสนใจสำหรับ อาจารย์และ นักศึกษาในสาขาวิชาของ ท่าน กรุณาแนะนำ)

3.1 <u>Textbooks</u> (ตำราเรียน หรือหนังสืออ่านประกอบการเรียน)

1. Name of publication (ชื่อหนังสือ) ……………………………………………………
   Title (ชื่อบท / บทความ) ……………………………… Year (ปีที่พิมพ์) ..……………
2. Name of publication (ชื่อหนังสือ) ……………………………………………………
   Title (ชื่อบท / บทความ) ……………………………… Year (ปีที่พิมพ์) ..……………
3. Name of publication (ชื่อหนังสือ) ……………………………………………………
   Title (ชื่อบท / บทความ) ……………………………… Year (ปีที่พิมพ์) ..……………
4. Name of publication (ชื่อหนังสือ) ……………………………………………………
   Title (ชื่อบท / บทความ) ……………………………… Year (ปีที่พิมพ์) ..……………
5. Name of publication (ชื่อหนังสือ) ……………………………………………………
   Title (ชื่อบท / บทความ) ……………………………… Year (ปีที่พิมพ์) ..……………

3.2 <u>Journals/Magazines/Newspapers/Reports</u> (วารสาร/นิตยสาร/หนังสือพิมพ์/รายงาน)

1. Name of publication (ชื่อสิ่งพิมพ์) ……………………………………………………
2. Name of publication (ชื่อสิ่งพิมพ์) ……………………………………………………
3. Name of publication (ชื่อสิ่งพิมพ์) ……………………………………………………
4. Name of publication (ชื่อสิ่งพิมพ์) ……………………………………………………
5. Name of publication (ชื่อสิ่งพิมพ์) ……………………………………………………

3.3 The websites of Journals/Magazines/Newspapers/Reports (เว็บไซต์ของวารสาร/นิตยสาร/หนังสือพิมพ์/รายงาน)

1. http://www………………………………………………………………………
   Name (ชื่อหนังสือ) ………………………………………………………………..
2. http://www………………………………………………………………………
   Name (ชื่อหนังสือ) ………………………………………………………………..
3. http://www………………………………………………………………………
   Name (ชื่อหนังสือ) ………………………………………………………………..
4. http://www………………………………………………………………………
   Name (ชื่อหนังสือ) ………………………………………………………………..
5. http://www………………………………………………………………………
   Name (ชื่อหนังสือ) ………………………………………………………………..

……………………………………………………………………………………………………...

Thank you for your cooperation.

Appendix F

Details in the Engineering Corpus

	Topics / Types	Common Interests		Electrical Power & Electronics	Mechanics & Automotives	Computers & IT
1	Textbooks & handouts		50 files	50 files	50 files	50 files
		Engineering	Engineering	Basic concepts	Machine and engine	Computer
			Electrical Engineering	Electric power basics	Simple machine	PC: a personal computer
			Power Engineering	Basic electronics	Mechanical bearing	Computer applications
			Electronic Engineering	Basic electronic passive components	Gear	Introduction to computer
			Mechanical Engineering	Electricity	Screw	Introduction to computer systems
			Mechanical Engineering2	Ground – electricity	Lever	Electricity and computer
			Industrial Engineering	What is electricity?	Spring	Computer Hardware
			Computer Engineering	What is electricity?2	Inclined plane - wedge	Computer Software
			Computer Science	Circuit	Wheel	Computer Networks
			Nature of Work	Circuits	Pulley	Motherboard
			Working conditions & employment	Electric power	Winch	CPU: the central processing unit
			Training qualification advancement	Electric current	Gas compressor	Microprocessor
			Introduction to industrial engineering	Electric filed	Pump	64-bit component
		Physics	What is physics	Electrical wiring	External & internal combustion engine	Computer storage
			Atoms & molecules	Electromagnetism	Turbine	Data storage device
			Mass	Manetic fields and force	Gasoline engine	Computability
			Force	TCI electrical module	Diesel engine	Programming
			Torque	AC-alternating current	Four-stroke cycle	Programming language
			Power	Measurement of currents	Two-stroke cycle	Operating system
			Work	AC-DC measurement	Wankel engine	Microsoft Windows
			Motion	Voltage	Steam engine	Word Processor
			Force and motion	Voltage regulation	Stirling engine	Microsoft Word
			Fundamental force	Electrical generator	Gas turbine	Web Browser
			Energy	Electric motor	Steam turbine	Internet Explorer
			What is energy?	Three phase	Water turbine	Data
			Energy forms	Conductors and insulators of electricity	Windmill	Database
			Energy types	Electrical conduction	Robot - automated machine	Data processing
			Potential & kinetic energy	Electricity generation	Industrial robot	Data networking
			Alternative energy sources	Electric power transmission	Pressure	Internet
			Work, energy & power	Power transmission	Dynamics and thermodynamics	World Wide Web
			Electromechanical devices and mechatronics	Electricity distribution	Introduction to dynamic system	Freeware

	Topics / Types	Common Interests		Electrical Power & Electronics	Mechanics & Automotives	Computers & IT
		Materials	Materials	Power conversion	Introduction to dynamic systems	Shareware
			Materials types	Electricity markets	TCI mechanical module	Adware
			Material-structure-property-processing	Transmission line	TCI thermal expansion and fluid module	Spyware
			Material-effects-design-selection	Transformer	Motor car	Spyware and virus
			TCI material module	Semiconductor	Engine system	Computer virus
			Strength of materials	Fuse - circuit breaker	Engine configurations	Firewall and virus protecttion
		Drawing	Drafting: technical drawing	Insulators	Electrical systems in automobiles	Performance tuning
			Engineering drawing	Resistor	Automotive batteries	Web cams
			CAD	Resistors	Causes of battery failure	IT
			AutoCAD	Transistor	Mechanical advantage	Information
			General Characteristics of AutoCad	Electronic circuit	Machine tool	Information processing system
		General	Calculus	PCB: Printed circuit board	CNC	Information technology
			Practical calculus	Analogue circuit	What is CNC?	Globalization
			Production & manufacturing	Digital circuit	What is CNC machine?	Globalisation
			CAE - Computer-aided engineering	IC: Intergrated Circuit	CNC introduction	Telecommunication
			CAM - Computer-adied manufacturing	Introduction to integrated circuit devices	Basic CNC - introduction	Communication technology
			Quality control	Introduction to IC technology	Drill-lathe-milling machine	CMC: computer-mediated communicaiton
			Engineering management study	Intro to switching-mode power supply	CNC lathe equipment	Artificial Intelligence
			Engineering within ecological constraints	Potential difference	CNC mill equipment	Technological contexts of engineering
2	Advertisements		35 files	35 files	35 files	35 files
	Engineering	Education	NTE - Online engineering program	Electrical safety handbook	SMB bearing	Desktop-tower
			Multidisciplinary Engineering Program	Electrician tool sets	Ball bearings	IBM computer hardware
			CNC Lathe Training	Flexible circuit manufacture	Hydraulic tools for bearing mounting	Procom DVD tower
			Electrical power training	Circuit analyzer	Worm gear speed reducer	PC case
			AutoCad Training Online	Magnet	Gear - Onsite training	Motherboard
		Jobs	Engineers	Magnetic field products	Stainless steel deck screws	Microprocessors
			Engineers – TAI	DC Electromagnet	Pro-kit springs	Intel Pentium4 CPU
			Electrical Engineer	AC voltage & current detector	Coil springs	Computer power supply
			Mechanic Machine Engineer	Digital multimeter	Compression springs	Fujitsu hard drive
			Automotive Engineer	nanoVolt, micro-Ohm Meter	Tire-wheel package	Lava PCI computer bus
		Announcement	IEEE electrical engineering conference	Generator	CL20 wheel	USB
			Automotive Engineering Asia 2005	Electric motors	Pulleys and sprockets	Com monitor
			Machine tools conference	Motor-generator maintainance & troubleshooting	Gearbelt pulley	Keyboard
	Product	Physics	Liberta Digital Pocket Scale	Resistors	Power hydraulic pump	Modem
			Torque measurement	Fuses	Fluid dynamic siphon	Printer
			Force guage	Circuit breakers	HYSPEC - Hydraulic component systems	Scanner
			Rotary torque	Transformer	Model car engine	CD-DVD duplicator
			Testing instruments	Step-down converter	Model engine builder	OEM software
			Kill a watt kWh monitor	Adapter and surge protector	V-8 combustion engine	Backup software

	Topics Types	Common Interests		Electrical Power & Electronics	Mechanics & Automotives	Computers & IT
			Batteries	World electric adapter set	Combustion analyzer	Window XP package
			Energy machine	Mobile air-conditioner	Turbonator - supercharger	Window server
		Materials	HTS-2000 Aluminum Repair	Cables	Auto & marine batteries	Microsoft office
			Rotor bar - Foundry - Copper Fabrication	Transmission lines	Performance meter	Microsoft office visio
			Insulating materials product	Wire management products	Disc brake pads	Tweaker
			Reinforcement materials	RFQ ElectronICs	Products for carwash business	Photoshop graphic software
			Silicon carbide elements	Power Meter	Corded drill	Dreamweaver - web building software
			Online metals	Conductor bar	Multi-drill	McAfee Internet security
			Allmetal works	Green power - solar electric	Cutting tool	Virus scan
			Thermoprene – polymer	Phase converter	Lead screw tapping machines	Virus scan
			Rubber extrusion	Three phase transformer	Industrial robotics	Spyware removal software
		Drawing	Technical drawing kit	Motor-generator sets	EPSON robots	Network cabling
			Tech Drawing tools for CoreIDRAW	PCB manufacture	CNC lathe	Optical wireless ROI
			3D MCAD software	Voltage inverter	CNC milling	System management server
			SmartDraw	Ics for automotive markets	CD-Rom CNC course	UTP remote minibridge
			CADPro-4	Power Ics	Virtual Gibbs CAM System	NETGEAR firewall
3	Manuals & handbooks		35 files	35 files	35 files	35 fiels
		Engineering	How to find a job	How to deal with electric utilities	Safety in battery diagnosis and testing	How to build a PC
			Hot tips for engineering job seekers	How to read a schematic	Adjusting worm shaft bearing	How to buy a computer
			Tips for job interview	How to draw schematic diagram	How to service steerin gears	How to choose a desktop computer
			How to write a resume / CV	Build a series circuit	Measuring sector shaft gear	How to choose the right processors
			Memory Techniques	Build a parallel circuit	Adjusting sector gear lash	How to choose the right amount of RAM
		Physics	How to study physics	Xcircuit compile and install	How to replace coil spring	Set up a PC
			How to solve physics problem	Using Xcircuit	Tire-wheel installation	Install motherboard
			Calculating the amount of work by force	How to build a zapper circuit	Wheel cover installabion instruction	Install RAM
			Lab on work energy power	Circles of magnetism I	Wheel lug nut torquing	Install an internal drive
			Driving more efficiently	Circles of magnetism IV	How to make a simple pulley	Troubleshoot a hard drive
			How to save energy	Manetic line of force	Culculating pulley speeds	Troubleshoot an un-starting computer
			Tips for buying an air-conditioner	Electrical flea	Fluid dynamic siphon installation	Troubleshoot a crashing computer
			Engineer's tips on fuel economy	Motor effect	How to clean your pump	Protect your PC
			How to measure small force	Stripped down motor	Lab on heat transfer and thermodynamics	Computer maintenance tips
			Demonstrate atmospheric pressure	How to make electric motor	Maintenance vehicles checklist	Install computer program safely
			Demonstrating principles of hydraulics	How to build an electric motor in 10 minutes	Checking the coolant	Uninstall a window program safely
		Materials	Material classification - testing	Build reed switch motor	How to maintain a car	Use TWEAK to customize a computer
			HTS-2000 Aluminum repair	Measuring voltage & current in a motor	How to diagnose an engine problem	Tweaking Windows
			HTS-528 Cast iron repair	Troubleshooting guides: electric motor	How to cool an overheated engine	Securing Windows
			Choosing materials	Test conductor or insulators	How to measure the drag on a car	Resize the task bar
			How to make a composite tube	Finding a value of a resistor	How to make biodiesel	Virus protection

	Topics / Types		Common Interests	Electrical Power & Electronics	Mechanics & Automotives	Computers & IT
			How to make copper rings	Short circuit	How to check brakes	How to use VirusScan
			How to make ceramic tile	Safety survey	Brake inspection	How to keep computer from hurting your eyes
			Cutting glass circle	Electrical and electronic safety	Proper speed for maximum fuel efficiency	Get Internet access
			How to make metal wrench chime	Hand battery	How to replace a car battery	Understand domain name systems
		Drawing	Creating CAD isometric projection	How to make a transformer	How to replace an electrical fuse in a car	Understand TCP/IP
			Tips and tricks for tech CoreIDRAW	Transformer safety instruction	How to check automatic transmission fluid	Speed up Internet connection
			How to draw UML diagrams	How to wire a power supply	How to use the turbine table	Troubleshoot an Internet connection
			Using AutoCAD to draw a polyline	Working with battery	How to drill glass	Establish a web presence
			How to draw an arc	IC lab sheet	How to build a simple robot	Network your computer
			Designing an automobile with CAD	IC assembly instruction	Mitsubishi M64 CNC	Choose a computer network hub
		General	Principles of product development	PCB milling	Training manual - CNC safety	Install wireless communication cards
			Steps in production process	PCB instruction sheet	Build your own CNC machine	Convert a computer into a file server
			How to use an engineering statistic handbooks	How to make PCBs	How to mount stock and change tooling	Connect computers to a network
			Managing CAD/CAM/CAE	Electrical industrial troubleshooting	How to use AUTOSKETCH- in CNC mills	Share files between two computers
4	Articles & News		35 files	35 files	35 files	35 files
		Engineering	A skill all its own	Electric Outlook	IMechE	64-Bit CPU
			Quality engineering education	Green Power	The future of mechanical engineering	Reasons to use 64-bit CPUs
			On course principles	World electric guide	Employment in automotive industry	A guide to buy a new computer
			Informational interview	Future energies: Superconducting cables	The secret of the force machine	Computer hardware and software
			Engineers for developing countries	Internal electricity markets	How bearing works	Athlon 64 microprocessor
		Physics	Obtaining reliable torque data	IEEE	Gear from scratch	Intel introduces new processors
			Torque and Horsepower	Wiring error investigation	Moving up a gear	IBM develops autonomous chips
			Joint torque and power	Beginner's guide to potentiometer	Breaking in your tires	IBM exits PC business
			Energy Star	Basic electronic tools and techniques	Wheel construction	Automate Windows Installation
			High-efficiency energy conversion systems	How an electric motor works	Alloy wheels you choose	IT - industry focus
			Energy - something from nothing	How air-conditionters work	Brakes 101	Microsoft wants to serve your software
			Experiment confirm zero point energy	50 years of transistors	How brakes work	Microsoft and Sun difficult dance
			Energy economics	Solar electric cells	How car engines work	Microsoft & Autodesk
			How battries work	Plug in power	Memory for cars	Exploring the new world
			How force, toque, power & energy work	The right choice of magnet	How Harley-Davidson work	Power direct
		Materials	Best application for a new material	Fibre link – transmission	How hydraulic machine work	Grid middleware
			Composite fibres light up	Power management	The operation of fluid dynamic siphon	Testing time for software
			Making cheaper supercrystals	Power management for FPGAs	Child starts engines	Sketch and search
			Alsic - silicon carbide reinforced aluminum	Mini generator packs	Rebuilt engine guide	Distributed computing toolbox
			Metal matrix composites	Ultra thin PCB	How to get maximum acceleration	Bluetooth software
			Growth opportunity for composites	Strong resistance in a little package	Mazda RX-8 performance	1GHz power PC on VME
			Plastic fantastic	Battery connector goes mobile	Biodiesel recipe	VME with power PC
			Prototype from powder	Power converter	Engine overhall goes to Germany	Closing the loop

	Topics / Types	Common Interests		Electrical Power & Electronics	Mechanics & Automotives	Computers & IT
			Material science & engineering for 1990s	Siemens to modernise power supply	Stuck in low gear	Big hard drive is small
		Drawing	Drafting	Testing times for transistors	New motor line	Multi-media comes to PMC markets
			CAD problems with WinXP SP2	World's smallest nanotube transistor	Lightweight diesel on parade	Uniting incompatible databanks
			New betas of CAD software	Semiconductor sales rise	New Partners for engine programme	Fully funtioning PC card adapters
			CAD takes on new roles	Boom time for batteries	Hi Robot	300 Gbyte hard drives
		General	A vision of the future	RF power detector	New horizons for robotics	Putting I/O on PC104
			Engineering management studies	Doped dioades	Robot investment on the up	Network security
			Management skill training	Faster smarter testing	Fundamental of CNC concepts	Handheld drive interface
			Deltegating management skill training	High-power blue LEDs	CNC programming for beginner	Computer health check
			Professional skill	Oscillator family branches out	CNC tip-jaw chucks	Improving interfaces
			OEE - Overall equipment effectiveness	Two-phase PWM controller	Homemade CNC milling machine	Network could operate 100 times faster
			Effective teamwork	Alternatives to wirewound resistors	Latest CNC technology	Computer brains
5	Abstracts		35 files	35 files	35 files	35 files
		Engineering	Engineering technology bibliography	Simulation of electrohydraulic system	Oil-free thrust bearings	Effective distributed requirement engineering
			Simple and effective engineering control	Miniature hybrid power supplies	High torque power engine	Computer viruses
			Quality engineering education	Analogue circuit design	Moveable roller control	Trends in high perfomance computers
			Engineering management study	A means of minimizing power dissipation	Fluid dynamic behavior - rotary pump	Multidimensional integration
		Physics	Physics and current understanding	High-speed links technology	Torque analysis of rotary seals	Automated extraction
			Kinetic energy supported electrically	Power performance efficiency	Control of integrated servo actuator	High rate Li-on batteries
			Joint torque and power	Advance in circuit technology	Bearing performance in gear pump	DMFC-Battery hybrid
			Physics of episodic quantized redshift	Future of electrical backpane	Modelling & simulation in mobile hydraulics	Wireless LAN
			Enhanced alternative kinetic energy	Systems and circuits	On cavitation in fluid power	Challenges in microprocessor design
			Innovative energy generation	Analog - Digital converter	Chaotic oscillation in pnuematic cylinder	Recent advances in CMOS technology
			Comparison of energy	Low power circuit and technology	Hydraulic servo-system	IBM global technology outlook
			Energy decay	Recent advances in SOI circuit design	Hydraulic servo drives	Web engineering
		Materials	Semicondutor to metallic transition	Training RF circuit design	Lubricating gaps of displacement machines	Storage area network
			Glass-ceramic superconductor	LC-tuned oscillator	Fluid flow pulsations in hydraulic system	Global outsourcing on IT providers
			Concrete-like materials	Blue laser diode and LED	Single-stage electrohydraulic servovalve	Web and web security
			Development of reinforced materials	Power supply instability	Control of pneumatic servosystem	Spyware: the ghost in the machine
			Heavy alloy kinetic energy penatrators	Sinusoid to currrent control	Hydraulic filter performance	Intelligent agents
			Joining metals and ceramics	Optimization of electric power system	Control of mobile hydraulic cranes	Wireless communication
			Process to produce titanium alloy	Microengineered electrically circuit breaker	Heat transfer characteristics	Global diffusion of the Internet
			Ceramic-based composite	Electrical contact resistance	Effects of valve wheel sizes	Growth of computer and Internet
			Alsic - silicon carbide reinforced aluminum	Enhanced transmission lines	Dynamic modelling of a robot	Computer simulation
			New silver-metal oxide graded composite	Electromagnetic interfereance reduction	Minimum fuel powered dynamic	How long before superintelligence?
			Plasticity - strength of superconductivity	Defects in shielded cables	Magnetic bearings	Afraid of virtual world
		General	Computer-aided drafting	Optical magnetic field probe	Starter motor sizing for gas turbine	Website delays
			The engineer in the enterprise	Antenna pattern synthesis	Gas Turbine performance	Humor in computer-mediated communicaiton
			Macroergonomics in manufacturing	Double exponential pulses	Centrifugal process compressors	Complexity of computer

	Topics / Types		Common Interests	Electrical Power & Electronics	Mechanics & Automotives	Computers & IT
			ANSI/IEEE and system engineerings	Electric vehicles	Stress evaluation in rotating machinery	Putting innovation to work
			Safety-based incident investigation	Hybrid electric vehicles	Cooling and lubrication of helical gears	Overview of supercomputer
			Assignment of safety system	Basic of power factor measurement	Maintenance and diagnostic of gearboxes	Design for validation
			Computer supports engineering courses	Power delivery system	Flow recirculation in centrifugal pumps	Computer science supports engineering
			Microprocessor for industrial engineering	Transmission systems	Screw gas compressors	What computer scientists teach engineers
			Human performance engineering	Changes in power industry	Effeciency improvement on steam turbine	Design of neural networks
			Waste minimization technique	Transistor feedback capacitance	Turbine overhall frequency	Teach programming principles
			Multi project management	Wireless transmission	System thermodynamics	Packing software process
			Learning styles of engineering students	Robotic sensor agents	Velocity measurement of flow	What is document?

Appendix G

Target Wordlist & all Distributed Wordlists

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I. A target wordlist

There were 480 words in total. All target words were:

- words in the lists of GSL & AWL
- words frequency occurring at least 15 times in the Engineering Corpus

No.	Target Wordlist		F	No.	Target Wordlist		F	No.	Target Wordlist		F
1	ability	GSL	142	51	avoid	GSL	79	101	conventional	AWL	80
2	able	GSL	147	52	aware	AWL	31	102	convert	AWL	139
3	absolute	GSL	32	53	become	GSL	294	103	corporate	AWL	34
4	academic	AWL	54	54	behavior	GSL	79	104	correct	GSL	133
5	accept	GSL	61	55	bend	GSL	52	105	cover	GSL	171
6	access	AWL	178	56	benefit	AWL	86	106	create	AWL	387
7	according	GSL	100	57	boundary	GSL	35	107	criteria	AWL	27
8	accuracy	AWL	32	58	brief	AWL	36	108	critical	GSL	64
9	achieve	AWL	134	59	bring	GSL	120	109	current	GSL	973
10	active	GSL	63	60	calculate	GSL	117	110	damage	GSL	267
11	activity	GSL	83	61	capability	AWL	119	111	dangerous	GSL	34
12	actual	GSL	165	62	capacity	AWL	102	112	deal	GSL	67
13	addition	GSL	128	63	carry	GSL	126	113	decision	GSL	50
14	adjust	AWL	30	64	case	GSL	319	114	decrease	GSL	48
15	advance	GSL	128	65	category	AWL	35	115	define	GSL	180
16	advantage	GSL	143	66	cause	GSL	326	116	deliver	GSL	93
17	advice	GSL	17	67	certain	GSL	138	117	demand	GSL	93
18	affect	AWL	63	68	challenge	AWL	59	118	demonstrate	AWL	57
19	aid	AWL	72	69	characteristics	GSL	97	119	depend	GSL	152
20	aim	GSL	39	70	choose	GSL	150	120	derive	AWL	46
21	allow	GSL	470	71	classify	GSL	25	121	describe	GSL	228
22	alternate	AWL	81	72	combine	GSL	84	122	desire	GSL	56
23	alternative	AWL	71	73	comfortable	GSL	26	123	despite	AWL	25
24	although	GSL	159	74	common	GSL	438	124	detail	GSL	155
25	amount	GSL	222	75	compare	GSL	145	125	detect	AWL	43
26	analysis	AWL	155	76	compatible	AWL	36	126	determine	GSL	189
27	angle	GSL	139	77	compensate	AWL	20	127	develop	GSL	355
28	another	GSL	259	78	competitive	GSL	52	128	device	AWL	544
29	appear	GSL	129	79	complete	GSL	243	129	different	GSL	400
30	application	GSL	592	80	complex	AWL	121	130	difficult	GSL	77
31	apply	GSL	290	81	complicate	GSL	33	131	dimension	AWL	83
32	approach	AWL	134	82	component	AWL	431	132	direct	AWL	276
33	appropriate	AWL	77	83	compose	GSL	20	133	direction	AWL	226
34	approximate	AWL	65	84	compute	AWL	127	134	discipline	GSL	50
35	area	AWL	321	85	concept	AWL	151	135	discover	GSL	39
36	arrange	GSL	52	86	concern	GSL	79	136	discuss	GSL	104
37	artificial	GSL	56	87	condition	GSL	138	137	distance	GSL	166
38	as	GSL	3315	88	conduction	AWL	55	138	distortion	AWL	31
39	aspect	AWL	61	89	consequence	AWL	25	139	distribute	AWL	74
40	assembly	AWL	82	90	consider	GSL	205	140	divide	GSL	109
41	assessment	AWL	28	91	considerable	AWL	41	141	document	AWL	76
42	assist	AWL	28	92	consist	AWL	76	142	domestic	AWL	18
43	assume	AWL	75	93	constant	AWL	152	143	drag	GSL	55
44	attach	AWL	143	94	consume	AWL	36	144	due	GSL	153
45	attempt	GSL	59	95	contact	AWL	241	145	during	GSL	224
46	attention	GSL	34	96	contain	GSL	172	146	duty	GSL	28
47	attract	GSL	34	97	context	AWL	41	147	economical	AWL	175
48	automate	AWL	41	98	continue	GSL	120	148	edge	GSL	72
49	available	AWL	382	99	contrast	AWL	49	149	education	GSL	111
50	average	GSL	96	100	convenient	GSL	31	150	effect	GSL	162

Target Wordlist

No.	Target Wordlist		F	No.	Target Wordlist		F	No.	Target Wordlist		F
151	effective	GSL	151	211	foundation	AWL	27	271	like	GSL	452
152	efficient	GSL	130	212	frequent	GSL	32	272	like	GSL	61
153	effort	AWL	63	213	fundamental	AWL	88	273	local	GSL	72
154	element	AWL	141	214	furthermore	AWL	24	274	locate	AWL	77
155	eliminate	AWL	54	215	gain	GSL	77	275	maintain	AWL	88
156	emphasis	AWL	29	216	general	GSL	332	276	manual	AWL	117
157	energy	AWL	1014	217	generate	AWL	166	277	manufacture	GSL	284
158	enhance	AWL	61	218	generation	AWL	101	278	matter	GSL	85
159	ensure	AWL	107	219	goal	AWL	72	279	maximum	AWL	127
160	entire	GSL	97	220	gradual	GSL	19	280	mean	GSL	354
161	environment	AWL	138	221	handle	GSL	124	281	measure	GSL	306
162	equal	GSL	165	222	hence	AWL	30	282	mechanical	GSL	380
163	equation	AWL	167	223	horizontal	GSL	54	283	medium	AWL	64
164	equip	AWL	22	224	however	GSL	261	284	mention	GSL	34
165	equipment	AWL	238	225	ideal	GSL	83	285	mere	GSL	21
166	equivalent	AWL	65	226	identical	AWL	23	286	method	AWL	261
167	error	AWL	83	227	identify	AWL	81	287	minimize	AWL	36
168	especial	GSL	112	228	image	AWL	136	288	mixture	GSL	62
169	essential	GSL	83	229	imagine	GSL	30	289	mode	AWL	78
170	establish	AWL	68	230	immediate	GSL	46	290	model	GSL	394
171	estimate	AWL	27	231	impact	AWL	39	291	modify	GSL	56
172	evaluate	AWL	33	232	implement	AWL	47	292	motion	GSL	236
173	even	GSL	355	233	implication	AWL	21	293	multiple	GSL	88
174	eventual	AWL	35	234	important	GSL	291	294	necessary	GSL	139
175	evidence	AWL	26	235	improve	GSL	185	295	need	GSL	745
176	exact	GSL	66	236	include	GSL	592	296	neutral	AWL	45
177	exceed	AWL	52	237	increase	GSL	102	297	normal	AWL	178
178	except	GSL	36	238	independent	GSL	51	298	notice	GSL	50
179	excess	GSL	31	239	indicate	AWL	99	299	object	GSL	396
180	exist	GSL	168	240	individual	AWL	98	300	observe	GSL	51
181	expand	AWL	56	241	induce	AWL	31	301	obtain	GSL	83
182	expansion	AWL	43	242	influence	GSL	36	302	obvious	AWL	49
183	expect	GSL	115	243	injury	GSL	20	303	occasional	GSL	22
184	experience	GSL	195	244	innovation	AWL	40	304	occur	AWL	103
185	experiment	GSL	70	245	insert	AWL	59	305	offer	GSL	245
186	explain	GSL	93	246	inspection	AWL	33	306	opportunity	GSL	72
187	explicit	AWL	26	247	instance	AWL	70	307	oppose	GSL	28
188	explode	GSL	49	248	instant	GSL	38	308	option	AWL	135
189	expose	AWL	34	249	instead	GSL	97	309	order	GSL	311
190	express	GSL	69	250	instruction	AWL	176	310	ordinary	GSL	20
191	extend	GSL	72	251	instrument	GSL	53	311	organization	GSL	95
192	extension	GSL	31	252	integrate	AWL	177	312	original	GSL	113
193	extensive	GSL	40	253	intelligence	AWL	69	313	other	GSL	1050
194	extreme	GSL	106	254	intend	GSL	54	314	overall	AWL	142
195	facility	AWL	49	255	intensive	AWL	23	315	overcome	GSL	28
196	fact	GSL	112	256	interact	AWL	30	316	pad	GSL	79
197	failure	GSL	49	257	interest	GSL	126	317	paradigm	AWL	21
198	fair	GSL	28	258	introduce	GSL	87	318	parallel	AWL	135
199	familiar	GSL	33	259	invent	GSL	44	319	particular	GSL	191
200	faulty	GSL	57	260	investigate	AWL	29	320	passive	AWL	25
201	feature	AWL	285	261	investment	AWL	42	321	perfect	GSL	56
202	feed	GSL	53	262	involve	AWL	126	322	performance	GSL	325
203	field	GSL	383	263	issue	AWL	130	323	permanent	GSL	40
204	figure	GSL	208	264	item	AWL	81	324	perspective	AWL	31
205	find	GSL	235	265	kind	GSL	112	325	phenomenon	AWL	50
206	firm	GSL	75	266	label	AWL	50	326	physical	AWL	156
207	flexible	AWL	50	267	lack	GSL	44	327	place	GSL	299
208	follow	GSL	286	268	law	GSL	160	328	plant	GSL	99
209	form	GSL	382	269	layer	AWL	162	329	plus	AWL	56
210	formula	AWL	66	270	light	GSL	247	330	position	GSL	233

Target Wordlist

No.	Target Wordlist		F	No.	Target Wordlist		F	No.	Target Wordlist		F
331	potential	AWL	313	381	remain	GSL	62	431	straight	GSL	51
332	practical	GSL	91	382	remove	AWL	221	432	strip	GSL	50
333	practice	GSL	135	383	repeat	GSL	47	433	stripe	GSL	39
334	precise	AWL	62	384	replace	GSL	185	434	substantial	GSL	21
335	prefer	GSL	43	385	represent	GSL	123	435	such	GSL	805
336	prepare	GSL	69	386	require	AWL	461	436	sufficient	AWL	43
337	present	GSL	153	387	research	AWL	180	437	suggest	GSL	72
338	press	GSL	105	388	resource	AWL	94	438	suitable	GSL	59
339	prevent	GSL	118	389	response	AWL	99	439	supply	GSL	369
340	previous	AWL	66	390	responsible	GSL	33	440	support	GSL	302
341	primary	AWL	146	391	result	GSL	381	441	surface	GSL	185
342	principle	AWL	116	392	reverse	AWL	59	442	symbol	AWL	91
343	prior	AWL	41	393	review	GSL	68	443	target	AWL	45
344	procedure	AWL	81	394	revolve	AWL	55	444	task	AWL	157
345	produce	GSL	139	395	rigid	AWL	27	445	tension	AWL	23
346	professional	AWL	111	396	risk	GSL	45	446	term	GSL	294
347	proper	GSL	119	397	satisfy	GSL	26	447	terminal	AWL	96
348	property	GSL	164	398	science	GSL	204	448	theory	AWL	138
349	proportional	AWL	47	399	search	GSL	101	449	therefore	GSL	113
350	propose	GSL	41	400	section	AWL	167	450	though	GSL	99
351	protect	GSL	82	401	secure	AWL	60	451	thus	GSL	145
352	prove	GSL	46	402	select	AWL	149	452	tight	GSL	46
353	provide	GSL	513	403	sense	GSL	107	453	traditional	AWL	61
354	publish	AWL	102	404	separate	GSL	106	454	transfer	AWL	94
355	purchase	AWL	66	405	sequence	AWL	39	455	transform	AWL	35
356	purpose	GSL	163	406	series	AWL	203	456	transmit	AWL	63
357	qualify	GSL	36	407	severe	GSL	24	457	trial	GSL	35
358	quality	GSL	238	408	shift	AWL	96	458	typical	GSL	223
359	quantity	GSL	131	409	sign	GSL	47	459	unique	AWL	70
360	quite	GSL	91	410	significant	AWL	134	460	universal	GSL	32
361	random	AWL	30	411	similar	AWL	169	461	unless	GSL	53
362	range	AWL	280	412	simple]	GSL	440	462	useful	GSL	108
363	rapid	GSL	87	413	since	GSL	284	463	usual	GSL	334
364	rather	GSL	137	414	site	AWL	210	464	utility	AWL	106
365	ratio	AWL	132	415	situation	GSL	56	465	value	AWL	405
366	reach	GSL	116	416	skill	GSL	285	466	various	GSL	134
367	react	AWL	81	417	slight	GSL	51	467	vary	AWL	108
368	reason	GSL	106	418	solution	GSL	187	468	version	AWL	213
369	receive	GSL	69	419	sort	GSL	45	469	via	AWL	79
370	recent	GSL	112	420	special	GSL	163	470	virtual	AWL	101
371	recognize	GSL	50	421	specific	AWL	168	471	visible	AWL	16
372	recommend	GSL	68	422	specify	AWL	119	472	vision	AWL	45
373	reduce	GSL	260	423	spend	GSL	48	473	visual	AWL	33
374	refer	GSL	152	424	spin	GSL	97	474	volume	AWL	139
375	reflect	GSL	38	425	split	GSL	31	475	warn	GSL	46
376	regular	GSL	48	426	spread	GSL	35	476	waste	GSL	76
377	relate	GSL	154	427	stable	GSL	25	477	wear	GSL	76
378	release	AWL	114	428	state	GSL	283	478	whereas	AWL	20
379	relevant	AWL	23	429	steady	GSL	36	479	whether	GSL	108
380	reliable	AWL	53	430	stiff	GSL	20	480	wrap	GSL	46

II. Weekly Wordlists

Weekly Wordlists 1-6: There were 40 words per list.

No.	Wordlist 1	Wordlist 2	Wordlist 3	Wordlist 4	Wordlist 5	Wordlist 6
1	academic	allow	ability	accept	able	active
2	application	alternate	aid	advance	actual	activity
3	approach	angle	another	advantage	addition	aim
4	assembly	apply	artificial	as	amount	arrange
5	attempt	area	assist	correct	aspect	attach
6	component	boundary	automate	define	category	attention
7	concept	bring	become	demonstrate	certain	average
8	concern	carry	calculate	describe	characteristics	case
9	condition	consider	capacity	during	classify	combine
10	context	contain	complete	essential	compare	compose
11	current	convert	compute	exist	conduction	consist
12	deal	create	continue	express	consume	contact
13	device	demand	dangerous	general	divide	cover
14	discipline	desire	decrease	imagine	energy	environment
15	education	develop	direct	important	equal	equip
16	element	dimension	effective	instance	equation	expand
17	equipment	direction	efficient	interest	exact	expansion
18	experience	distance	gradual	introduce	extend	expect
19	fact	edge	handle	invent	familiar	flexible
20	field	establish	implement	like	figure	goal
21	firm	experiment	increase	maintain	formula	intend
22	fundamental	extension	integrate	mean	frequent	item
23	include	feature	intelligence	mixture	kind	label
24	instrument	follow	interact	motion	matter	layer
25	law	form	manual	necessary	multiple	locate
26	manufacture	generate	mechanical	original	obvious	medium
27	method	generation	other	prepare	occasional	mode
28	object	identify	physical	primary	parallel	model
29	order	indicate	potential	provide	plus	neutral
30	organization	involve	practical	react	precise	passive
31	phenomenon	light	property	refer	quantity	position
32	plant	measure	rapid	represent	ratio	purpose
33	principle	mention	relate	revolve	reduce	rigid
34	science	need	reliable	significant	regular	series
35	site	produce	repeat	simple	separate	state
36	situation	recognize	replace	such	sort	stiff
37	skill	require	special	term	split	strip
38	solution	section	typical	traditional	straight	stripe
39	task	surface	various	useful	supply	target
40	theory	value	virtual	usual	symbol	via

Weekly Wordlists 7-12: There were 40 words per list.

No.	Wordlist 7	Wordlist 8	Wordlist 9	Wordlist 10	Wordlist 11	Wordlist 12
1	accuracy	achieve	adjust	absolute	according	analysis
2	alternative	appear	advice	access	affect	approximate
3	appropriate	attract	avoid	although	assume	assessment
4	available	common	aware	behavior	cause	benefit
5	choose	constant	bend	brief	challenge	compensate
6	comfortable	deliver	conventional	capability	consequence	complex
7	compatible	derive	detect	considerable	critical	complicate
8	competitive	distribute	discover	contrast	depend	criteria
9	convenient	domestic	discuss	despite	distortion	damage
10	corporate	explode	drag	different	due	decision
11	detail	expose	eliminate	difficult	effect	determine
12	duty	gain	ensure	entire	effort	document
13	economical	individual	feed	equivalent	error	emphasis
14	enhance	induce	find	especially	except	estimate
15	facility	local	horizontal	even	failure	evaluate
16	ideal	normal	immediate	exceed	faulty	eventual
17	image	obtain	improve	excess	hence	evidence
18	influence	occur	instant	extensive	impact	explain
19	maximum	ordinary	instruction	extreme	independent	explicit
20	minimize	overcome	modify	fair	injury	foundation
21	offer	practice	notice	furthermore	inspection	implication
22	option	present	pad	however	instead	innovation
23	perfect	previous	place	identical	investigate	investment
24	prefer	prior	press	insert	lack	issue
25	proper	procedure	quite	intensive	purchase	observe
26	propose	reach	random	likely	rather	opportunity
27	prove	receive	recommend	mere	reason	overall
28	quality	reverse	remove	oppose	recent	paradigm
29	range	sequence	review	particular	reflect	perspective
30	release	spin	search	performance	remain	prevent
31	satisfy	spread	sense	permanent	resource	professional
32	secure	stable	shift	proportional	response	protect
33	select	steady	sign	relevant	result	publish
34	sufficient	terminal	specify	responsible	risk	qualify
35	suitable	transfer	spend	similar	severe	research
36	support	transform	suggest	slight	since	tension
37	trial	transmit	tight	specific	therefore	visible
38	unique	unless	warn	substantial	thus	vision
39	universal	utility	wear	though	waste	visual
40	version	vary	wrap	whereas	whether	volume

III. A list of the tested words in the pretest/posttest and delayed test

There were 101 words in total: 51 words in Definition Part and 50 words in Cloze Part.

Definition Part	**No.**	**Tested Words**	**F**	**No.**	**Tested Words**	**F**
	1	advantage	143	27	issue	130
	2	although	159	28	manually	117
	3	area	321	29	mechanically	380
	4	average	96	30	obtain	83
	5	capacity	102	31	overall	142
	6	case	319	32	particularly	191
	7	complex	121	33	position	223
	8	concept	151	34	practice	135
	9	constantly	152	35	prevent	118
	10	damage	267	36	properly	119
	11	describe	228	37	provide	513
	12	discuss	104	38	publish	102
	13	distance	166	39	quantity	131
	14	divide	109	40	reach	116
	15	during	224	41	search	101
	16	economic	175	42	section	167
	17	Energy	1014	43	separate	106
	18	environment	138	44	shift	96
	19	especially	112	45	since	284
	20	extreme	106	46	specify	119
	21	Figure	208	47	surface	185
	22	Ideal	83	48	symbol	91
	23	important	291	49	vary	108
	24	improve	185	50	version	213
	25	individual	98	51	volume	139
	26	interest	126			
Cloze Part	**No.**	**Tested Words**	**F**	**No.**	**Tested Words**	**F**
	1	Able		26	firm	
	2	accuracy		27	include	
	3	Aid		28	instruction	
	4	amount		29	intensive	
	5	Appear		30	invent	
	6	available		31	measure	
	7	combine		32	necessary	
	8	component		33	need	
	9	Cover		34	notice	
	10	Current		35	organization	
	11	dangerous		36	place	
	12	despite		37	produce	
	13	Device		38	professional	
	14	different		39	range	
	15	direction		40	rather	
	16	discipline		41	relate	
	17	Due		42	resource	
	18	Effect		43	result	
	19	efficient		44	select	
	20	Equal		45	special	
	21	Except		46	support	
	22	Excess		47	terminal	
	23	expand		48	unless	
	24	field		49	virtual	
	25	find		50	whereas	
Total of tested words		**101**				

IV. Lists of the reviewed words in the review tasks

In each list, there were 30 words in total: 15 words in Definition Part and another 15 words in Cloze Part.

		Task 1		Task 2		Task 3		Task 4	
Definition Part	**No.**	**Reviewed Words**	**F**	**Reviewed Words**	**F**	**Reviewed Words**	**F**	**Reviewed Words**	**F**
	1	allow	470	activity	83	achieve	134	access	178
	2	artificial	56	actual	165	appropriate	77	according	100
	3	contain	172	certain	138	avoid	79	assume	75
	4	continue	120	compare	145	conventional	155	behavior	80
	5	effective	151	equation	167	detail	97	difficult	77
	6	experience	195	expect	50	image	136	document	76
	7	fact	112	flexible	66	local	72	entire	115
	8	increase	102	item	81	modify	56	error	83
	9	indicate	99	locate	77	normal	178	insert	59
	10	integrate	177	purpose	163	procedure	81	observe	51
	11	object	396	reduce	260	quite	91	protect	82
	12	physical	156	series	203	release	114	recent	112
	13	principle	116	state	283	secure	60	remain	62
	14	property	164	supply	369	spin	97	research	54
	15	task	157	term	294	suggest	72	similar	169
Cloze Part	**No.**	**Reviewed Words**	**F**	**Reviewed Words**	**F**	**Reviewed Words**	**F**	**Reviewed Words**	**F**
	1	another		as		adjust		benefit	
	2	application		attach		choose		capability	
	3	become		classified		distribute		cause	
	4	create		conduction		ensure		challenge	
	5	develop		consist		explode		criteria	
	6	form		define		immediate		determine	
	7	identify		general		maximum		explain	
	8	involve		instance		minimize		however	
	9	light		kind		occur		innovation	
	10	manufacture		mean		option		instead	
	11	plant		motion		quality		performance	
	12	require		original		remove		purchase	
	13	solution		parallel		transfer		qualify	
	14	theory		revolution		transform		response	
	15	typical		simple		wear		specific	
Total		**30**		**30**		**30**		**30**	

Appendix H

Detailed Outline of the Lesson Plan

Lessons	Themes	Vocabulary	Language Points & Skills	Reading Texts
1	Engineering Fields	Words referring to contexts, objects, workplaces, studies and practices	• Homonyms and Polysemies • Collocations	Engineering Fields
2	Engineering Drawing	Words concerning with technical drawing	Grammar Revision: • Noun Phrases • Verb Phrases	Engineering Drawing Computer-aided Design (CAD)
3	Computers in Engineering	Words concerning with computers, their ability and features	Grammar Revision: Modifiers • Adjectives • Adverbs	Computer-aided Engineering (CAE): CAD & CAM
4	Machines and Engines	Words used for giving definitions and examples	• Contexts Clues • Word Formation: - Compounds - Affixes	Machine and Engines Combustion engines
5	Energy and Electricity	Words concerning with calculation and ways of grouping things	Classification	Electrical Energy
6	Electrical Systems in Automobiles	Words used for describing equipment's parts, components, position, material property and ways of putting things together	Nouns and Adjectives	Electrical systems in automobiles
7	Engineering Products	Common words in advertisements for describing good features of products	Reading advertisements	Advertisements
8	Power Transmission	Words used for describing processes	• Active and passive forms • Sequence markers	Electrical power transmission
9	How to build an Electric Motor	Words used for giving instructions, suggestions and warning as well as for emphasizing instructions	• Imperative • Actions verbs • Adverbs of manners	How to build an electric motor
10	Latest Technology	Words used for comparison and contrast	• Intensifiers • Discourse makers	Industrial Robots
11	Causes of Failure	Words used for describing causes and effects, concerning with damage and malfunction	Discourse markers	Causes of battery failure
12	Electric Vehicles	Words concerning with estimation and publication	Reading abstracts	Electric vehicles

Appendix I

A Sample Plan for One Lesson

……………………………………………………………………………………………………

Lesson Plan 4
Machines & Engines

Objectives:

1. To study 40 target words from the Weekly Wordlist 4
2. To study context clues: definition, description and example clues
3. To study word formation: suffixes

Contents:

- 40 target words from the Weekly Wordlist 4

Weekly Wordlist 4

accept	demonstrate	general	invent	necessary	refer	term
advance	describe	imagine	like	original	represent	traditional
advantage	during	important	maintain	prepare	revolve	useful
as	essential	instance	mean	primary	significant	usual
correct	exist	interest	mixture	provide	simple	
define	express	introduce	motion	react	such	

- Context Clues from definitions, descriptions, and examples
- Word Formation: Suffixes

Language and Skill Focus:

- Skill of guessing word meaning from definition, description and example clues
- Skill of guessing word meaning from word parts i.e. suffixes

Duration: 150 minutes

Materials:
1. Handout 4 for classroom material
2. Task sheet 4 assigned as homework
3. CDs containing a corpus and a concordancer for the concordancing group

Method of teaching:

- Paper-based activities (including some hands-on activities for the concordancing group)
- Plenary discussion
- Teacher's demonstration and explanation
- Students' practice

Procedure:

Part I: Warm Up (10 minutes)

(Raising awareness on using context clues to guess word meaning)

- The students look at some given technical terms and discuss how well they know these terms.
- They are asked to read the given concordances / sentences having the highlighted target words '*term*', '*mean*' and '*refers*' as clues.
- Then they discuss whether they can find the meaning of these terms from contexts.

Part II: Presentation and Practice (130 minutes)

Note: A is an abbreviation of 'Activity'.
T is an abbreviation of 'Time'.
P is an abbreviation of 'Language Presentation'.

A	T	The Comparison Group	A	T	The Experimental Group
P	5	• The students are pointed out that many technical terms frequently occurring in academic texts are mostly defined and the meanings of such terms can possibly be found from the contexts without referring to a dictionary. • Some words typically used for giving definitions and descriptions of these terms are provided.	P	5	• The students are pointed out that many technical terms frequently occurring in academic texts are mostly defined and the meanings of such terms can possibly be found from the contexts without referring to a dictionary. • Some words typically used for giving definitions and descriptions of these terms are provided.
1	20	• The focus of this activity is on studying definition clues i.e. '*mean*', '*define*' and '*refer*' in terms of their meaning, collocations and uses as definitions clues. • In Activity 1.1, a short reading passage entitled 'Machine' is given for students to notice the definition clues while reading	1	20	• The focus of this activity is on studying definition clues i.e. '*mean*', '*define*' and '*refer*' in terms of their meaning, collocations and uses as definitions clues. • In Activity 1.1, students are assigned to search the target words in the corpus to answer the given questions about the mostly

		and then to answer the following questions used for comprehension checks as well as for raising their awareness on using these target words as definition clues. • In Activity 1.2, students study different collocations of the target words from the given sentences, match some technical terms with their definitions, and then practise making up sentences by using the typical collocations of the target words. • In Activity 1.3, students practise observing the immediate contexts of the omitted words in the given sentences and then fix the target words in the right places.			used form of each target word as well as to observe their different collocations. • In Activity 1.2, students continue searching the information of the target words in the corpus in order to complete the given concordances and practise reading these concordances containing word definitions. • In Activity 1.3, students practise observing immediate contexts of the omitted words in the given sets of concordances to identify the typical collocations of each word omitted in each set of concordances. Then they fix the target words in the right places.
2	20	• The focus is shifted to the target words '*represent*', '*express*' and '*describe*' to study description clues. • In Activity 2.1, students study different collocation from different uses of '*represent*' as active or passive forms in the given sentences and then fix the words to complete the given sentences. • In Activity 2.2, students observed typical collocations of '*express*' and '*describe*' in the given sentences and then fix the words to complete the given sentences.	2	20	• The focus is shifted to the target words '*represent*', '*express*' and '*describe*' to study description clues. • In Activity 2.1, students observe different collocations of the target words from finding the information of the target words to answer the given questions. • In Activity 2.2, students complete the given concordances by finding information from the corpus and then practise reading the concordances containing word descriptions. • In Activity 2.3, students practise observing immediate contexts of the omitted words in the given concordances to identify the typical collocation of each omitted word and then fix the target words in the right places.
P	5	• Words used for giving examples are provided.	P	5	• Words used for giving examples are provided.
3	20	• The focus is on studying the example clues i.e. '*like*', '*instance*', and '*such as*'. • In Activity 3.1, students read the given sentences and then identify the examples of the given keywords. • In Activity 3.2, students are asked to observe the typical collocation of the target words from the given sentences in Activity 3.1 and then fix these target words in the blanks of the given sentences in Activity 3.2.	3	20	• The focus is on studying the example clues i.e. '*like*', '*instance*', and '*such as*'. • In Activity 3.1, students practise how to deduce the meaning of the target words in the given concordances and then find two example sentences of each target word from the corpus. • In Activity 3.2, students fix the target words in the right sets of concordances.

-	-	---------------	P	5	• The concept of word formation concerning affixes is introduced.
4	15	• In this activity, students identify the definition and example clues after reading the given sentences concerning with 'Engines'.	4.	15	• In Activity 4.1, students use a wildcard search to find the noun type of the target verbs as well as to break these nouns into parts. Then, they inferred the typical suffixes i.e. '-*ion*' of the verbs when changing into nouns. • In Activity 4.2, students repeat the practice as in Activity 4.1 but focus on another typical suffixes i.e. '-*ce*'.
P	5	• The concept of word formation concerning affixes is introduced.	-	-	--------------
5	15	• In Activity 5.1, students study the given pairs of verbs and nouns and then guess the nouns of the other given verbs. They check their guesses from a dictionary before breaking the resulting nouns into parts. Then, they inferred the typical suffixes i.e. '-*ion*' of verbs when changing into nouns. • In Activity 5.2, students repeat the practice as in Activity 5.1 but focus on another typical suffixes i.e. '-*ce*'.	5	15	• The Activity 5 is similar to Activity 4 on the practice to infer the typical suffixes of the given words but the Activity 5 shifts the focus on the suffixes of adjectives when changing into nouns and adverbs.
6	15	• The Activity 6 is like the Activity 5 on the practice to infer the typical suffixes of the given words. However, the Activity 6 shifts the focus on the suffixes of adjectives when changing into nouns and adverbs.	6	15	• Students pracise to interpret the different meaning of three target words in the given concordances.

Part III: Application (15 minutes)

(Retrieving words in new contexts)

This activity in this part is similar in both groups of students in order for them to retrieve words just learnt in the lessons for using in reading. Two cloze passages were available: one is entitled '*Machine*' and the other one is '*Engine*'. Some sentences in the passages have been found earlier in the lesson in order to reduce the difficulty in reading as well as to recycle word and sentence encounters. In the passages, target words just learnt in the lessons were omitted but given at the top of each passage as options. Target words which have been learnt from previous lessons were highlighted to encourage students to recall them. In this activity, students are assigned to complete the cloze passages with the given target words. As the time limitation, the first passage is expected to be done during class activity whereas the other passage is for working on outside class.

Appendix J

A Sample Handout for the Experimental Group

……………………………………………………………………………………..

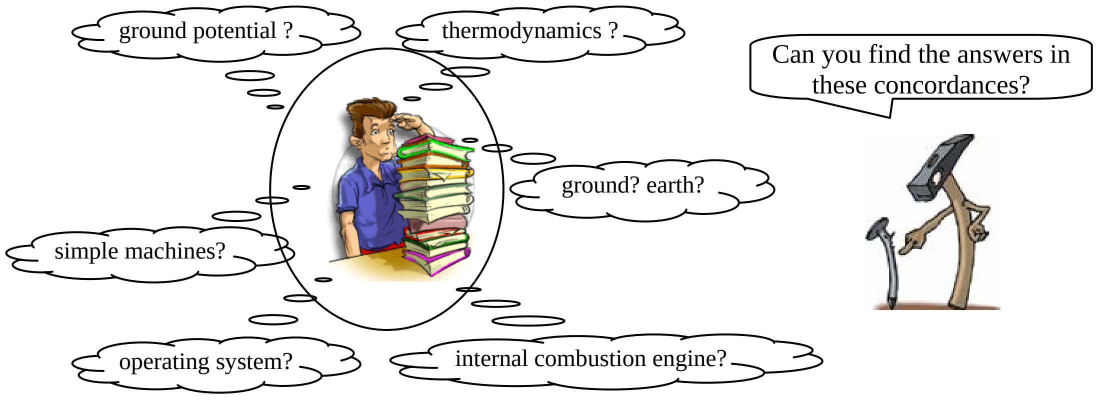
Lesson 4
Machines & Engines

Target Wordlist 4

accept	demonstrate	general	invent	necessary	Refer	term
advance	describe	imagine	like	original	represent	traditional
advantage	during	important	maintain	prepare	revolve	useful
as	essential	instance	mean	primary	significant	usual
correct	exist	interest	mixture	provide	simple	
define	express	introduce	motion	react	Such	

Warm Up

What do these words mean?



The	**term**	"*thermodynamics*" usually **refers to** the physical study of the state of a system.
The	**term**	"*internal combustion engine*" normally **refers to** any engine operating by burning fuel inside.
The	**term**	"*operating system*" **means** a computer software used for the direct control of basic system operation.
The	**term**	"*ground* (**or** *earth*)" usually **means** a common return in circuits.
The	**term**	"*ground potential*" **means** there is no difference in potential between a circuit point and earth.
The	**term**	"*simple machines*" **means** any devices required only a single force to work.

Presentation & Practice

I. Context Clues

In academic texts, technical terms are frequently used. When introducing new words or technical terms, writers often include other words or phrases to facilitate readers' understanding of the new words. The words surrounding an unfamiliar word are called '*contexts*'. They are built into the sentences around the difficult words. These surrounding words provide clues to the meaning of an unfamiliar word.

If the readers are aware of using the contexts surrounding unknown words to reveal the meaning, they will be able to make logical guesses about the meanings of many words. Moreover, learning the meaning of words from the contexts is a very useful strategy to increase our reading comprehension. There are many types of context clues. In this lesson, the definition and example context clues are introduced.

II. Definition Clues

Definition clues are direct clues to give the meaning of particular words. They are often used in subject area reading such as physics, calculus, computer science, and engineering materials etc. when new technical terms are introduced. For example:

- The **term** '*ground* (**or** *earth)*' usually **means** a <u>common return in circuits</u>.
- The '*potential difference'* **is defined as** <u>the amount of work per charge needed to move electric charge from the second point to the first</u>.

The terms '*ground'*, '*earth'*, and '*potential difference'* have particular meaning in engineering and their meanings are different from those in general English. In these examples, the **bold words** are used to directly tell the particular meaning of these terms as in the underlined phrases. This kind of context clues is called '***definition clues***'.

<u>Definition clues</u> which are often used are as follows.

- To give the meaning or information of something

o is, are	o defined as	o referred to as	o expressed as
o means	o refer(s) to	o described as	o i.e.

- To say the (other) name of something

o called	o stand for	o or
o known as	o represent(s)	o i.e.
	o represented by	

These words have close meanings as in the following definitions.

- o mean = indicate, say what something is
- o define = give the meaning to something
- o refer to = have a meaning of
- o describe = tell about something
- o express = make something known
- o represent = stand for, show or give a picture or symbol

Activity 1: Studying context clues of definitions

Access the sub-corpus '*Textbook*' to get the information for doing the following activities.

<u>Activity 1.1</u>: Search the words '*refer**', '*define**', and '*mean**' to find the answers to the following questions.

1. Which form of each searched word, active or passive, is mostly used? …………..
2. Which keyword is often followed by '*to*'? ……………………………………..
3. Which keywords are often followed by '*as*'? ……………………………………..
4. When is '*as*' used after these searched words? …………………………………….
5. What are typical collocations of these searched words?

   mean = ……………………………………………………………
   define = ……………………………………………………………
   refer = ……………………………………………………………

<u>Activity 1.2</u>: Complete the definitions of the given words in the following concordances, using the information from the corpus. Then guess the meaning of the technical terms highlighted in ***italics***.

1	Microfarad	means	millionths of a Farad.
2	Kinetic energy	means	movement …………………………………………..
3	In RF circuits, Fo	means	……………………………………………………….
4	AutoCAD is	defined	as interactive drawing ………………………………..
5	Power is	defined	formerly as …………………………….. per unit time.
6	Energy is	defined	as '…………………………………..…………'.
7	Currents	refer	to …………………………………………………..
8	Primary storages	refer	to ……………………………………………………
9	Engineering drawing	refer	to ……………………………………………………
10	The flow of electrons is	referred	to as ………………..………………………………… .
11	A CPU designs is often	referred	to as ....
12	A semiconductor is	referred	to as a ………. that may act as a conductor or insulator.

<u>Activity 1.3</u>: Each set of the given concordances has the same keywords which are missing from the lines. Read the concordances and determine which given keyword is missing from each set.

means defined referred

Set 1	Q is	……	as the frequency divided by the bandwidth, measured f
	One horsepower was	……	as the amount of power needed to lift 33,000 pounds
	The volt was	……	as the potential difference across a conductor when a
	The potential difference is	……	as the amount of work per change.
Set 2	"Q = 0.5 C"	……	the quantity of electric charge is 0.
	An intangible thing	……	a thing you can't grab it and throw it against the wall.
	Work	……	moving something, lifting something, warming something,
	The term 'ground potential'	……	there is no difference in potential (voltage) between a circuit
Set 3	Historically, 'memory'	……	to "magnetic core memory" in the 1950s.
	Engineering drawing are	……	to as "blue prints'.
	Such circuits are	……	to as 'conventional' current as opposed to electron flow.
	A family of CPU designs is	……	to as a CPU architecture

Activity 2: Studying and practising with context clues of examples

Access the sub-corpus '*Textbook*' to get the information for doing the following activities.

<u>Activity 2.1</u>: Search the words '*descri**', '*express**', and '*represent**' to find the answers to the following questions.

1. Which form of each searched word, active or passive, is mostly used? …………..
2. Which words often come after '*be described*'? ……………………………………..
3. Which words often come after '*be expressed*'? …………………………………….
4. Which words often come after '*be represented*'? …………………………………..
5. Is there any word often come after '*represent*' and '*represents*'? …………………..
5. What are typical collocations of these searched words?

   described = ……………………………………………………
   expressed = ……………………………………………………
   represented = ……………………………………………………
   represent(s) = ……………………………………………………

Activity 2.2: Complete the definitions of the given words in the following concordances, using the information from the corpus. Then guess the meaning of the technical terms highlighted in ***italics***.

1	A ***kilowatt***	represents	……………………………….. watts.
2	***Main memory***	represents	………………………………………………….
3	***Current*** is	represented	by …………………, and is measured in amperes.
4	Any ***value*** can also be	represented	by ……………...……….. digits.
5	***Circuit*** can be	described	as …………………………………… conductors.
6	***Electric power***, is often	described	as power or ………, involves the generation of electricity.
7	***Vector*** may be	described	by …………………………………………………….
8	***Conductions*** are often	described	by ……………………………………………………..
9	***Acceleration values*** are	expressed	in …………………………………………………..
10	Sometimes, ***gravity*** is also	expressed	in …………………………………………………..
11	***Voltage*** is	expressed	as: ………………………………………………….
12	***Potential energy*** can be	expressed	as …………………………………………………..

Activity 2.3: Each set of the given concordances has the same keywords which are missing from the lines. Read the concordances and determine which given keyword is missing from each set.

described expressed represents/represented

Set 1	Voltage is	………….	as the force which causes current to flow
	A computer architecture is	………….	as '64 bit'.
	The motion of objects may be	………….	by distance, speed, displacement etc.
	The dynamic system can be	………….	by partial differential equations (PDE).
Set 2	A mathematical model	………….	a system.
	A BTU	………….	British thermal Unit.
	Zero volts can be	………….	by binary 0.
	Voltage is	………….	by the symbol V.
Set 3	Current is	………….	in Amperes, or amp for short.
	Power value may be	………….	in horsepower.
	The velocity of an object is	………….	as: KE = ½ mv2.
	Mathematically, power is	………….	as P = W/Dt.

III. Example Clues

Another clue is an '***example clue***'. This kind of context clues does not tell the meaning of the word directly but the examples of an unknown word can give clues to its meaning. If the reader knows the given samples, he/she has more chance to guess the meaning of the unknown word correctly. For example:

- *Electronic devices* **such as** transistors, diodes, capacitor and resistors form the basis of the modern computer.
- A *two-state device*, **like** a switch on the wall, can be in only one of two possible states.

If you are familiar with the examples in the underlined words, it is likely that you can somewhat guess the meaning of the things to which these examples belong.

Example clues which are often used are as follows.

- To give examples of something

o as	o (for) example
o such as	o (for) instance
o like	o e.g.

Activity 3: Studying context clues of examples

Access the sub-corpus '*Textbook*' to get the information for doing the following activities.

Activity 3.1: Guess the meaning of the ***bold italic words*** in the given concordances by using the context clues. Discuss in groups to check the answers.

1	A ***browser***	**such as**	*Internet Explorer* or *Netscape Navigator* is a program.
2	Some common ***inductive components***	**such as**	*transformers* are not often used in audio.
3	An ***operating system***	**such as**	*Microsoft Window* or *MacIntosh*).
4	Sometimes ***secondary memory devices***	**like**	the *hard disk* are called I/O devices.
5	Interest in robotics entered many large ***firms***	**like**	*General Electric* and *General Motor*.
6	An	**instance**	of ***operating systems*** is *MS-DOS*.
7	Different useful ***form of energy*** (**for**	**instance**	, *heat*, *light*, or *motion*) is converted into power.

- Access the corpus to find two more example sentences of each keyword or phrase used for giving examples.

1. such as …………………………………………………………………………
…………………………………………………………………………
2. like …………………………………………………………………………
…………………………………………………………………………
3. instance …………………………………………………………………………
…………………………………………………………………………

Activity 3.2: Each set of the given concordances has the same keywords which are missing from the lines. Read the contexts of each line in the set. Determine which given keyword is missing from each set. Complete each set of the concordances with the right word.

like *such* *instance*

Set 1	A browser,		as Internet Explorer or Netscape Navigator is a program
	Some operating systems,		as Linux, extend this logical computation.
	Previous word processors,		as WordStar and Word Perfect, used text-only display
	The first electronic computers,		as the ENIAC were huge devices.
	Engineers process raw materials		as petroleum and natural gas to create new things.
Set 2	The best		of WAN is the Internet.
	A Ludobot is an		of a social robot for entertainment.
	Springs are a special		of a device which can store elastic potential energy.
	On many wheeled vehicles (for		, automobiles) a wheel does not directly contact with su
	The operating machine tools, for		lathe and mill are now integrated with CNC programs.
	AutoCAD can do drafting tasks (for		, draw a dot on screen).
Set 3	Big manufacturers,		Hewlett-Packard, have sold the Athlon 64-bits machines
	The evaporation of a refrigerant,		Freon, is used to provide cooling.
	Japanese motorcycle manufacturers		Honda, Yamaha and Kawasaki increase production.
	Data are transferred to PC applications		Microsoft Office Excel and Word.
	Some data are kept in optical disks		CD-ROM, CD-R, CD-RW, DVD-Rom, DVD-R etc.

Guessing word meaning from word parts: Affixes

In English, the basic part of a word is called a '*base form*' or '*root*'. The root contains the basic meaning of the word. Many words in English are formed by adding other words or word parts to the root words. An **affix** is a letter or a group of letters added to the beginning or the end of a word to form a new word.

The affix is divided into '**prefix'** or '**suffix'**.

- **A prefix** is a group of letters added to the *beginning* of a root and changes its meaning.
- **A suffix** is a group of letters added to the *end* of a root and changes its grammatical function.

Since many English words are formed in these ways, learning about word formation is helpful when dealing with new or unknown words during reading. It is possible for the reader to guess the meaning of an unknown word when one knows the meaning of its root and uses the knowledge of prefix and suffixes to assist the guess.

With a wildcard search, a concordancer can quickly display various forms of each word. The practice of observing word parts will help us remember some regular affixes, recognize when they are combined with other words, identify such word function in different contexts, and interpret their meanings.

For example: From searching '**advantage** in the Engineering Corpus, some of its related forms are displayed as in the following concordances. If you know the meaning of the root i.e., '*advantage*', you can use knowledge of word formation to somewhat identify the particular functions and meaning of its related forms as follows. Try to use the definitions of the root '*advantage'* to interpret its related forms.

Definition: advantage = (n.) a good feature, benefit

- advantages = advantage + -s = its plural form
- advantageous = advantage + -ous = its adjective form
- disadvantage = dis + advantage = a noun with opposite meaning

1	The	**advantage**	of hydrogen is that it combustion produces only water.
2	Their main	**advantage**	is the ability to be turned on and off within minutes.
3	Its	**advantages**	are its short length, heavy crankshaft, attractive body.
4	There are two	**advantages**	of this approach: space saving and ease of redefinition.
5	Hydraulic robots are	**advantageous**	in applications such as spray painting.
6	The change in direction may be	**advantageous**	for other reasons.
7	The big	**disadvantage**	of 64-bit architectures is that the data is slightly larger.
8	The primary	**disadvantage**	of analog signaling is that any system has noise in it.

Activity 4: Observing the verbs with noun suffixes

- Search the given verbs with a wildcard (*) as shown in the '*searched words*' column of the tables.
- Complete the table below with the related forms of the searched words.
- Divide the **roots** from the **suffixes**. The first searched word has been done as examples.
- Use the information from the search to answer the following questions and match the words with their definitions.

Activity 4.1

Searched Words	Roots (Verbs)	Noun	Roots + suffixes
*defin**	**define**	definition	defin(e) + -ition
*demonstrat**	**demonstrate**		+
*descri**	**describe**		+
*express**	**express**		+
*introduce**	**introduce**		+
*correct**	**correct**		+
*imagin**	**imagine**		+
*invent**	**invent**		+
*prepar**	**prepare**		+
*react**	**react**		+
*represent**	**represent**		+
*revol**	**revolve**		+

- What **suffixes** are often found to change word functions from verbs to nouns?
  ……………………………………………………………………………………….

Match the words with their definitions.

………… 1. demonstrate	a. turn around
………….2. introduce	b. create a new thing
………….3. imagine	c. act against something
………….4. correct	c. make something ready
………… 5. invent	d. show something by doing
………… 6. prepare	e. make something right, not wrong
………… 7. react	f. form a picture or idea in one's mind
………….8. revolve	g. make something known for the first time

Activity 4.2

Searched Words	**Roots (Verbs)**	**Noun**	**Roots + suffixes**
*accept**	**accept**	acceptance	accept + -ance
*maint**	**maintain**		
*provid**	**provide**	providence	provid(e) + -ence
*Exist**	**exist**		+
*Refer**	**refer**		+

- What **suffixes** are often found to change word functions from verbs to nouns?
  …………………………………………………………………………………………

Match the words with their definitions.

………….1. accept	a. give
………….2. maintain	b. have a meaning of
………… 3. provide	c. happen, be present
………… 4. exist	d. take something, agree to
………… 5. refer	e. keep something continue or in good condition

Activity 5: Observing the adjectives with noun and adverb suffixes

- Search the given verbs with a wildcard (*) as shown in the '*searched words*' column of the tables.
- Complete the table below with the related forms of the searched words.
- Divide the **roots** from the **suffixes**. The first searched word has been done as examples.
- Use the information from the search to answer the following questions and match the words with their definitions.

Activity 5.1: Words concerning '*needed*'

Definitions

- essential = needed, basic, fundamental
- important = needed, meaningful
- necessary = needed
- useful = needed, able to be used
- primary = first, main, basic, needed part of something

Searched Words	**Adverb**	**Roots (Adjective)**	**Noun**	**Roots + noun suffixes**
*essen**		**essential**	essence	essen(tial) + -ce
*importan**		**important**		+
*necess**		**necessary**		+
*useful**		**useful**	usefulness	+
*primar**		**primary**		+

- What **suffixes** are often found to change word functions from verbs to nouns?
  …………………………………………………………………………………………

Activity 5.2: Words concerning '*typical*', '*plain*', '*old practice*' and '*earliest*'

Definitions

- general = typical, including everything, having all
- overall = typical, including everything, having all
- usual = typical, happening often
- simple = plain, easy
- traditional = doing in a group of people for a long time without changing
- original = first, earliest

Searched Words	Adverb	Roots (Adjective)	Noun	Roots + noun suffixes
*general**	generally	**general**	generalization	general + -ization
*overall**	---		---	+
usual	---			+
*simpl**				
*traditional**				
*original**				

Activity 6: Identifying the meanings of homonyms and polysemies

- Study different definitions and grammatical functions of each given word.
- Match its definitions and functions of the given words with the right concordance by writing a letter in front of each concordance line.

Activity 6.1 '*advance*'

Definitions of '*advance*'

a. (n.) before a particular time
b. (n.) new invention, improvement
c. (v.) go forward, move something forward
d. (v.) make something very much better
e. (adj.) highly developed

……1	This	**advance**	led to the development of the first stored-program.
……2	Engineers may	**advance**	to become technical specialists or a supervisor.
……3	Prof. Ted and his research team	**advance**	the use of one laser beam.
……4	AGM is a major	**advance**	in battery design.
……5	The power supplies use	**advance**	technology to produce superior performance.
……6	By answering questions in	**advance**	, you will be able to make use of the features.
……7	To know in	**advance**	that you will use it.
……8	Another important	**advance**	in the technology was Micros' Java program.

Activity 6.2: '*means*'

Definitions of '*means*'

a). (n.) a method or way of doing something
b). (v.) give meaning, stand for

……1	The most useful	**means**	of storing them for CNC is dxf. format.
……2	The earth connection also	**means**	that the round building is at the same voltage.
……3	The term 'mF' almost certainly	**means**	uF – especially if the source is the US.
……4	Electric field lines provide a	**means**	of viewing the electric field.
……5	In air cooling of engine, various	**means**	are used to give the heat an outlet and carry it off .
……6	The nature of computer development	**means**	new uses for computers are frequently.
……7	A piston is connected to the crankshaft by	**means**	of a link known as a 'connecting rod'.
……8	AC power system is still the primary	**means**	of delivering electrical energy to consumers,

<u>Activity 6.3</u>: ‘*<u>interest</u>*’

Definitions of ‘*interest*’

a. (n.) attention
b. (v.) pay attention
c. (n.) good feature, benefit

……1		**Interest**	in industrial robotics expanded in the late 1970s.
……2		**Interest**	in car should be fixed in the mind of mechanics.
……3	Work experience is of	**interest**	to any engineers.
……4	This improved method gives	**interest**	to the development of new materials.
……5	A new concept gets great	**interest**	in Japan.
……6	Manufacturers must take care of the	**interest**	of their customers.

Application

Retrieving words in new contexts

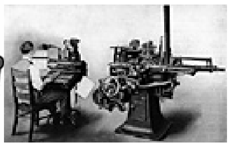
- Read the following passages and then complete the gaps with the words given above each passage.
- Pay attention to the *italic words* which are the words learned in this and previous lessons.
- Assess yourself how well you can remember and use these words.

Passage 1: *as* *generally* *primary* *term*

Machine

(Source: Adapted from http://encyclopedia.thefreedictionary.com/engine)





A **machine** is any *mechanical* or electrical *device* that sends or *converts* energy to work or *assist* in *implementing tasks*. *Mechanical* mechanisms and machines have been (1)…………… used to *increase* the *abilities* of *human* beings. The (2)…………… difference between *simple* tools and *simple* mechanisms *or* machines is a power source and an operation. The (3)…………… ‘machine’ *typically applies* to an *assembly* of *parts* operating together to do work. *Generally* these *devices increase* intensity of *applied force*, changing *direction* of *force*, or changing one *form* of motion or energy into *another*.

The mechanical advantage of a machine is the ratio between the resistance or load, and the *force required* to overcome it, although this ratio is not *completely* accurate *as force* is *required* to overcome friction, *as* well. To compensate for this, mechanical advantage is *calculated as* the ratio between the *distance* moved by the *force applied*, and the *distance* moved by the resistance.

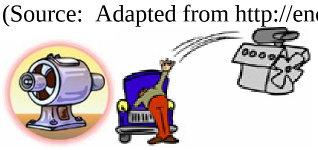
Efficiency of a machine is the degree or percentage to which a machine can complete the work it could *potentially* do, without the restrictions of friction.

Modern power tools, *automated* machine tools, and *human* operated power machinery make this *definition* change. Machines used to send heat or *other* energy into *mechanical* energy are known (4)…………… engines.

2. *definition* *describe* *described* *like* *meanings* *referred*

Engine

(Source: Adapted from http://encyclopedia.thefreedictionary.com/engine)



An **engine** is *defined as* a *device* that *produces* some effect from a given input. The origin of engineering was the working of engines. There is an overlap in English between two (5)…………… of the word "engineer": 'those who operate engines' and 'those who design and *construct* new *objects'*.

In the first *definition*, an engine was (6)…………… *as* any sort of *mechanical device*. *Practically* every *device* from the industrial *revolution* was (7)…………… to *as* an engine, and this is where the steam engine got its name. This *form* of the *term* has recently come into use again in computer *science*, where *terms* (8)…………… "search engine", "3-D graphics rendering engine" and "text-to-speech engine" are common.

In more recent (9)……………, the *term* is *typically* used to (10)…………… *devices* that *produce mechanical* work, follow-ons to the steam engine. In most cases the work is supplied *as* torque, which is used to operate *other* machinery, *generate* electricity, pump water or compress gas.

Appendix K

A Sample Handout for the Comparison Group

……………………………………………………………………………………………..

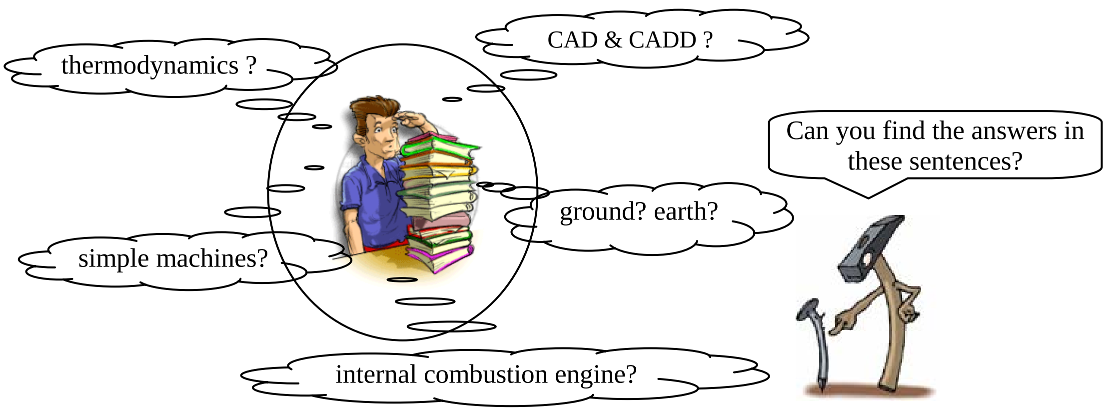
Lesson 4
Machines & Engines

Target Wordlist 4

accept	demonstrate	general	invent	necessary	refer	term
advance	describe	imagine	like	original	represent	traditional
advantage	during	important	maintain	prepare	revolve	useful
as	essential	instance	mean	primary	significant	usual
correct	exist	interest	mixture	provide	simple	
define	express	introduce	motion	react	such	

Warm Up

What do these words mean?



From the following sentences, discuss the meanings of the **bold** and *italic* words.

- The ***term*** "*thermodynamics*" usually **refers to** the physical study of the state of a system.
- The ***term*** "*internal combustion engine*" **refers to** any engine operating by burning fuel inside.
- All these ***terms*** , "*CAD and CADD*", **refer to** the designing and technical drawing.
- The ***term*** "*ground* (**or** *earth*)" usually **means** a common return in circuits.
- The ***term*** "*simple machines*" **means** any devices or mechanical components required only a single force to work.

Presentation & Practice

I. Context Clues

In academic texts, technical terms are frequently used. When introducing new words or technical terms, writers often include other words or phrases to facilitate readers' understanding of the new words. The words surrounding an unfamiliar word are called '*contexts*'. They are built into the sentences around the difficult words. These surrounding words provide clues to the meaning of an unfamiliar word.

If the readers are aware of using the contexts surrounding unknown words to reveal the meaning, they will be able to make logical guesses about the meanings of many words. Moreover, learning the meaning of words from the contexts is a very useful strategy to increase our reading comprehension. There are many types of context clues. In this lesson, the definition and example context clues are introduced.

II. Definition Clues

Definition clues are direct clues to give the meaning of particular words. They are often used in subject area reading such as physics, calculus, computer science, and engineering materials etc. when new technical terms are introduced. For example:

- The **term** '*ground (***or** *earth)*' usually **means** a <u>common return in circuits</u>.
- The '*potential difference'* **is defined as** <u>the amount of work per charge needed to move electric charge from the second point to the first</u>.

The terms '*ground*', '*earth*', and '*potential difference'* have particular meaning in engineering and their meanings are different from those in general English. In these examples, the **bold words** are used to directly tell the particular meaning of these terms as in the underlined phrases. This kind of context clues is called '***definition clues***'.

<u>Definition clues</u> which are often used are as follows.

- To give the meaning or information of something

o verb to be	o define as	o described as	o i.e.
o mean	o refer to (as)	o expressed as	

- To say the (other) name of something

o called	o stand for	o or
o known as	o represent	o i.e.

These words have close meanings as in the following definitions.

- o mean = indicate, say what something is
- o define = give the meaning to something
- o refer to = have a meaning of
- o describe = tell about something
- o express = make something known
- o represent = stand for, show or give a picture or symbol

Activity 1: Studying context clues of definitions

<u>Activity 1.1</u>: Read the following passage and answer the questions.

1. How many words are defined in the following passage?
2. What are they?

Machines

The *term* 'machine' *means* an assembly of parts operating together to perform work. A machine *is* generally *referred to* any mechanical or electrical device that transmits or modifies energy to perform or assist in the performance of tasks.

A simple machine is *defined as* a mechanical component *such as* bearing, gear, lever, screw whereas a machine tool is *defined as* a powered mechanical device *such as* lathe, mill, drill etc. The term 'machine tool' is usually *referred* to tools that used a power source.

A computer-controlled machine *is known as* a computer-numerical-controlled (CNC) machine. A CNC machine *refers* specifically *to* the machine tools which are controlled by computers in manufacturing work. It *is* sometimes *called* machine intelligence or artificial intelligence. In one sense, CNC machines may be said to *represent* special industrial robot systems.

Answer the following questions.

1. What is a machine?
2. What is a simple machine?
3. What are examples of a simple machine?
4. What is a machine tool?
5. What are examples of a machine tool?
6. What is a CNC machine?
7. What is another name of a CNC machine?
8. What does a CNC machine stand for?

Activity 1.2: Study the following sentences.

- A machine **means** an assembly of parts operating together to perform work.
- A machine **is defined as** an assembly of parts operating together to perform work.
- A machine **is referred to** as an assembly of parts operating together to perform work.

Match the words in column A with their definitions in column B. Then make up sentences as in the above sentences.

A	B
………. Power	a. movement energy
………. Energy	b. an electric current.
………. Kinetic energy	c. an ability to do work.
………. A semiconductor	d. units of energy per unit time
……….. The flow of electron	e. a material that may act as a conductor or as an insulator.

Activity 1.3: Complete the following sentences with the given words.

means *defined* *referred*

1. 'Binary', coming from the Latin, ………………… twice or two.
2. In this context, data is …………………… as a collection of numbers or characters.
3. A device from the industrial revolution was ………………….. to as an engine.
4. Technology ……………………… the study and science of techniques.
5. Random Access Memory (RAM) ……..… that the memory cells can be accessed in any order.
6. Artificial intelligence is …..………as intelligence shown by anything manufactured by humans.
7. One AMP is ………………as 625,000,000,000,000,000,000 electrons moving across a circuit every second!

Activity 2: Studying context clues of description

Activity 2.1: Study the following sentences.

- A CNC machine **represents** a special industrial robot system.
- A special industrial robot system can **be represented by** a CNC machine.

Complete the following sentences with the given words.

represent *represented*

1. A kilowatt …………………… s 1,000 watts.
2. Voltage is ………………… by the symbol V.
3. A mathematical model ……………………. a system.
4. Computer instructions are …………………. by binary digits.

Activity 2.2: Study the following set of sentences.

- Power value may **be expressed in** horsepower.
- The velocity of an object **is expressed as** KE = ½ mv2.

- A dynamic system **is described by** partial differential equations. (PDE).
- Molecules **are** best **described as** objects.

Complete the following sentences with the given words.

expressed *described*

1. Sometimes, gravity is also …………………… in N/kg.
2. Mathematically, power is …………………….. as P=W/Dt.
3. A computer architecture is …………………… as '64-bit'.
4. Potential energy is mathematically …………….as PE = mgh.
5. de Fermat is sometimes ………………… as the 'father' of differential calculus.
6. Thickness of the edge is ……………………… in millimeters.
7. Acceleration values are ……………………. in units of velocity per time.
8. The motion of objects can be ……………………by distance, speed, displacement etc.

III. Example Clues

Another clue is an '***example clue***'. This kind of context clues does not tell the meaning of the word directly but the examples of an unknown word can give clues to its meaning. If the reader knows the given samples, he/she has more chance to guess the meaning of the unknown word correctly. For example:

- *Electronic devices* **such as** transistors, diodes, capacitor and resistors form the basis of the modern computer.
- A *two-state device*, **like** a switch on the wall, can be in only one of two possible states.

If you are familiar with the examples in the underlined words, it is likely that you can somewhat guess the meaning of the things to which these examples belong.

Example clues which are often used are as follows.

- To give examples of something

o as	o (for) example
o such as	o (for) instance
o like	o e.g.

Activity 3: Studying and practising with context clues of examples

Activity 3.1: From the following sentences, identify the examples of the objects.

1. Examples of operating systems are MS-DOS, Linum, Mac,OS.
2. A browser such as Internet Explorer or Netscape Navigator is a program.
3. Sometimes secondary memory devices like the hard disk are called I/O devices.
4. The word 'gratisware' as a synonym for 'freeware' makes the distinction clearer.
5. This is important for an operating system (e.g. Microsoft Window or MacIntosh).
6. Interest in robotics entered many large firms like General Electric and General Motor.
7. Some common inductive components such as transformers are not often used in audio.
8. Different forms of energy (for instance, heat, light or motion) can be converted into power.

Write the examples of the given objects.

Objects	Examples
1. Operating system	…………………………………………
2. A browser	…………………………………………
3. Secondary memory devices	…………………………………………
4. Gratisware	…………………………………………
5. An operating system	…………………………………………
6. Large firms	…………………………………………
7. Inductive components	…………………………………………
8. Forms of energy	…………………………………………

Activity 3.2: Complete the following sentences with the given words.

like *such* *instance*

1. The best ……………………. of WAN is the Internet.
2. AutoCAD can do drafting tasks (for …………………., draw a dot on screen).
3. Big manufacturers, ……….……. Hewlett-Packard, produce the Athlon 64-bits machines.
4. A browser, ……………………. as Internet Explorer or Netscape Navigator is a program.
5. Springs are a special ……………. of a device which can store elastic potential energy.
6. Data can be transferred to PC applications …………. Microsoft Office Excel and Word.
7. Engineers process raw materials ………………as petroleum and gas to create new things.
8. On many wheeled vehicles (for ……………., automobiles) a wheel does not directly contact with surface.
9. The operating machine tools, for …… lathe and mill are now integrated with CNC programs.
10. Japanese motorcycle manufacturers ……………. Honda and Yamaha increase production.

Activity 4: Identifying context clues

- Read the following sentences about '*Engines'* and identify context clues helpful for getting information.

Engine
1. An engine is defined as a device that produces some effect from a given input.
2. The word 'engineer' means those who operate engines and design new objects.
3. An engine was described as any sort of mechanical device.
4. Every device from the industrial revolution was referred to as an engine.
5. The term 'engine' has recently been used in computer science where the terms like 'search engine' and '3-D graphic rendering engine' are common.
6. In most recent definition, the term is typically used to describe devices that produce mechanical work.

Answer the questions.

1. How many definitions of 'engine' are given in the text?
2. Which sentences do not define 'engine'?
3. Which definition is the oldest?
4. Which definition is the newest?
5. Which sentences give examples?

Guessing word meaning from word parts: Affixes

In English, the basic part of a word is called a '*base form*' or '*root'*. The root contains the basic meaning of the word. Many words in English are formed by adding other words or word parts to the root words. An **affix** is a letter or a group of letters added to the beginning or the end of a word to form a new word.

The affix is divided into '**prefix'** or '**suffix'**.

- A **prefix** is a group of letters added to the *beginning* of a root and changes its meaning.
- A **suffix** is a group of letters added to the *end* of a root and changes its grammatical function.

Since many English words are formed in these ways, learning about word formation is helpful when dealing with new or unknown words during reading. It is possible for the reader to guess the meaning of an unknown word when one knows the meaning of its root and uses the knowledge of prefix and suffixes to assist the guess. The practice of observing word parts will help us remember some regular affixes, recognize when they are combined with other words, identify such word function in different contexts, and interpret their meanings.

For example:

If you know the meaning of the root i.e., '*advantage*', you can use knowledge of word formation to somewhat identify the particular functions and meaning of its related forms as follows. Try to use the definitions of the root '*advantage'* to interpret its related forms.

Definition: advantage = (n.) a good feature, benefit

- advantages = advantage + -s = its plural form
- advantageous = advantage + -ous = its adjective form
- disadvantage = dis + advantage = a noun with opposite meaning

Activity 5: Studying the verbs with noun suffixes

- From some examples in the table below, guess the related nouns of the given verbs.
- Complete the tables with the related nouns of the given verbs.
- Check your guesses by consulting the dictionary.
- Divide the **roots** from the **suffixes** as in the examples.

Activity 5.1:

Roots (Verbs)	**Noun**	**Roots + suffixes**
define	definition	defin(e) + -ition
demonstrate	demonstration	demonstrat(e) + - ion
describe	description	descri(be) + -ption
express	expression	express + - ion
introduce		+
correct		+
imagine		+
invent		+
prepare		+
react		+
represent		+
revolve		+

- What **suffixes** are often found when verbs changes to nouns?
  ……………………………………………………………………………………………

❖ Use a dictionary, if needed, to match the given verbs with their definitions.

………… 1. demonstrate — a. turn around
………….2. introduce — b. create a new thing
………….3. imagine — c. act against something
………….4. correct — c. make something ready
………… 5. invent — d. show something by doing
………… 6. prepare — e. make something right, not wrong
………… 7. react — f. form a picture or idea in one's mind
………….8. revolve — g. make something known for the first time

Activity 5.2:

Roots (Verbs)	**Noun**	**Roots + suffixes**
accept	acceptance	accept + -ance
maintain		
provide	providence	provid(e) + -ence
exist		+
refer		+

- What **suffixes** are often found when this group of verbs changes to nouns?
  ……………………………………………………………………………………………

❖ Use a dictionary, if needed, to match the given verbs with their definitions.

………….1. accept — a. give
………….2. maintain — b. have a meaning of
………… 3. provide — c. happen, be present
………… 4. exist — d. take something, agree to
………… 5. refer — e. keep something continue or in good condition

Activity 6: Studying the adjectives with noun and adverb suffixes

- From some examples in the table below, guess the related nouns and adverbs of the given adjectives.
- Complete the tables with the related nouns and adverbs of the given adjectives.
- Divide the **roots** from the **noun suffixes** as in the examples.

Activity 6.1: Words concerning '*needed*'

Definitions

- essential = needed, basic, fundamental
- important = needed, meaningful
- significant = needed, meaningful
- necessary = needed
- useful = needed, able to be used
- primary = first, main, basic, needed part of something

Adverb	**Roots (Adjective)**	**Noun**	**Roots + noun suffixes**
	essential	essence	essen(tial) + -ce
	important		+
	significant		+
	necessary		+
	useful	usefulness	+
	primary	primary	---

- What **suffixes** are often found to change word functions from verbs to nouns?
  ………………………………………………………………………………………….

Activity 6.2: Words concerning '*typical*', '*plain*', '*old practice*' and '*earliest*'

Definitions

- usual = typical, happening often
- general = typical, including everything, having all
- overall = typical, including everything, having all
- simple = plain, easy
- traditional = doing in a group of people for a long time without changing
- original = first, earliest

Roots (Adjective)	**Adverb**	**Roots + adverb suffixes**
usual		+
general	generally	general + ly
overall	-----	-----
simple		+
traditional		+
original		+

Application

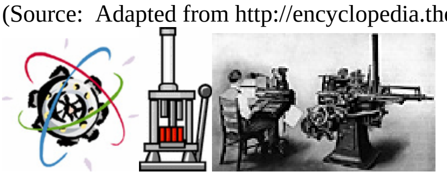
Retrieving words in new contexts

- Read the following passages and then complete the gaps with the words given above each passage.
- Pay attention to the *italic words* which are the words learned in this and previous lessons.
- Assess yourself how well you can remember and use these words.

Passage 1: *as* *generally* *primary* *term*

Machine

(Source: Adapted from http://encyclopedia.thefreedictionary.com/engine)



A **machine** is any *mechanical* or electrical *device* that sends or *converts* energy to work or *assist* in *implementing tasks*. *Mechanical* mechanisms and machines have been (1)…………… used to *increase* the *abilities* of *human* beings. The (2)…………… difference between *simple* tools and *simple* mechanisms *or* machines is a power source and an operation. The (3)…………… 'machine' *typically applies* to an *assembly* of *parts* operating together to do work. *Generally* these *devices increase* intensity of *applied force*, changing *direction* of *force*, or changing one *form* of motion or energy into *another*.

The mechanical advantage of a machine is the ratio between the resistance or load, and the *force required* to overcome it, although this ratio is not *completely* accurate *as force* is *required* to overcome friction, *as* well. To compensate for this, mechanical advantage is *calculated as* the ratio between the *distance* moved by the *force applied*, and the *distance* moved by the resistance.

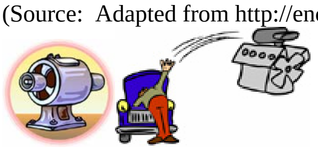
Efficiency of a machine is the degree or percentage to which a machine can complete the work it could *potentially* do, without the restrictions of friction.

Modern power tools, *automated* machine tools, and *human* operated power machinery make this *definition* change. Machines used to send heat or *other* energy into *mechanical* energy are known (4)…………… engines.

2. *definition* *describe* *described* *like* *meanings* *referred*

Engine

(Source: Adapted from http://encyclopedia.thefreedictionary.com/engine)



An **engine** is *defined as* a *device* that *produces* some effect from a given input. The origin of engineering was the working of engines. There is an overlap in English between two (5)…………… of the word "engineer": 'those who operate engines' and 'those who design and *construct* new *objects*'.

In the first *definition*, an engine was (6)…………… *as* any sort of *mechanical device*. *Practically* every *device* from the industrial *revolution* was (7)…………… to *as* an engine, and this is where the steam engine got its name. This *form* of the *term* has recently come into use again in computer *science*, where *terms* (8)…………… "search engine", "3-D graphics rendering engine" and "text-to-speech engine" are common.

In more recent (9)……………, the *term* is *typically* used to (10)…………… *devices* that *produce mechanical* work, follow-ons to the steam engine. In most cases the work is supplied *as* torque, which is used to operate *other* machinery, *generate* electricity, pump water or compress gas.

Appendix L

Checklist and Results for Validating the Classroom materials

....

This checklist is used for assessing classroom materials. Each set of the materials includes a lesson plan, a handout and a task sheet. The checklist consisted of three main parts.

1. A checklist for assessing each activity in each lesson.
2. A checklist for assessing the whole lesson in overall.
3. An open-ended part for giving other comments or suggestions.

PART I: A CHECKLIST FOR ASSESSING EACH ACTIVITY IN EACH LESSON

1. In the following table, please give comments whether each activity is justified or not according to the following issues.
   - objectives = serving the objectives of the lesson
   - contents = appropriate contents
   - instruction = clear instruction
   - design = appropriate design of activity
   - time = appropriate of estimated time in the lesson plan
2. Please use the following symbols for giving comments in the checklists.
   - ✓ = Yes
   - X = No
   - ? = Unsure
3. If needed, please give comments in the available column, write directly in the materials / lesson plans, or use a separate piece of paper.

Lesson	**Activity**	**Lesson Parallels**	**For the Comparison Group**					**For the Experimental Group**				
			Objectives	**Contents**	**Instruction**	**Design**	**Time**	**Objectives**	**Contents**	**Instruction**	**Design**	**Time**
Introduction	Warm Up											
	Activity 1	---										
	Activity 2	---										
	Activity 3	---										

	Activity 4	---										
	Activity 5	---										
	Activity 6	---	---	---	---	---	---					
	Activity 7	---	---	---	---	---	---					
	Activity 8	---	---	---	---	---	---					
	Activity 9	---	---	---	---	---	---					
	Application	---										
	Task 1	---										
	Task 2	---										
	Task 3	---	---	---	---	---	---					
Comments and Suggestions for Introduction Lesson												

Lesson	**Activity**	**Lesson Parallels**	**For the Comparison Group**					**For the Experimental Group**				
			Objectives	**Contents**	**Instruction**	**Design**	**Time**	**Objectives**	**Contents**	**Instruction**	**Design**	**Time**
Lesson 1	Warm Up											
	Activity 1											
	Activity 2											
	Activity 3											
	Activity 4											
	Activity 5											
	Activity 6							---	---	---	---	---
	Application											
	Task 1											
	Task 2											
	Task 3											
Comments and Suggestions for Lesson 1												

Lesson	Activity	Lesson Parallels	For the Comparison Group					For the Experimental Group				
			Objectives	**Contents**	**Instruction**	**Design**	**Time**	**Objectives**	**Contents**	**Instruction**	**Design**	**Time**
Lesson 2	Warm Up											
	Activity 1											
	Activity 2											
	Activity 3											
	Activity 4											
	Activity 5											
	Activity 6											
	Application											
	Task 1											
	Task 2											
	Task 3											
	Task 4											
	Task 5											
	Task 6											
Comments and Suggestions for Lesson 2												

Lesson	Activity	Lesson Parallels	For the Comparison Group					For the Experimental Group				
			Objectives	**Contents**	**Instruction**	**Design**	**Time**	**Objectives**	**Contents**	**Instruction**	**Design**	**Time**
Lesson 3	Warm Up											
	Activity 1											
	Activity 2											
	Activity 3											
	Activity 4											
	Activity 5											
	Activity 6											

	Activity 7											
	Activity 8							---	---	---	---	---
	Application											
	Task 1											
	Task 2											
	Task 3											
	Task 4											
	Task 5											
Comments and Suggestions for Lesson 3												

Lesson	**Activity**	**Lesson Parallels**	**For the Comparison Group**					**For the Experimental Group**				
			Objectives	**Contents**	**Instruction**	**Design**	**Time**	**Objectives**	**Contents**	**Instruction**	**Design**	**Time**
Lesson 4	Warm Up											
	Activity 1											
	Activity 2											
	Activity 3											
	Activity 4											
	Activity 5											
	Activity 6											
	Application											
	Task 1											
	Task 2											
	Task 3											
	Task 4											
	Task 5											
	Task 6											
Comments and Suggestions for Lesson 4												

Lesson	Activity	Lesson Parallels	For the Comparison Group					For the Experimental Group				
			Objectives	**Contents**	**Instruction**	**Design**	**Time**	**Objectives**	**Contents**	**Instruction**	**Design**	**Time**
Lesson 5	Warm Up											
	Activity 1											
	Activity 2											
	Activity 3											
	Activity 4											
	Activity 5											
	Activity 6											
	Activity 7											
	Activity 8											
	Application											
	Task 1											
	Task 2											
	Task 3											
	Task 4											
	Task 5											
	Task 6											
	Task 7											
Comments and Suggestions for Lesson 5												

PART II: A CHECKLIST FOR ASSESSING THE WHOLE LESSON IN OVERALL

1. In the following tables, please give comments whether the given issues are justified or not.
2. Please use the following symbols for giving comments in the checklists.

   ✓ = Yes

   X = No

   ? = Unsure
3. If needed, please give comments in the available column, or write in a separate piece of paper.

Table 1: Please give comments whether the given issues are justified or not <u>for teaching engineering students at an undergraduate level</u>.

Issues	Yes / No / Unsure	Comments and Suggestions
1. Contents		
1.1. Topics		
1.2. Difficulty level		
1.3. Order of contents		
2. Activities		
2.1. Design format		
2.2. Clear instruction		
2.3. Length of time		
3. Parallel of activities between both groups		
4. Others (if any)		

Table 2: Please give comments whether the given issues are justified or not for serving the objectives of the study.

Issues	Yes / No / Unsure	Comments and Suggestions
1. Contents		
2. Activity Design		

PART III: AN OPEN-ENDED PART TO GIVE OTHER COMMENTS OR SUGGESTIONS

………
………
………
………
………
………
………
………
………
………
………
………
………
………
………
………
………

Thank you very much for your time and assistance.

Results from the checklists for validating classroom materials

To validate the classroom materials, three experts were consulted and they gave their opinions in the checklists on the issues of contents selection, activity design and consistency to the objectives of the study.

To calculate the data from the checklists, the items marked with agreement on justification is rated 1, those with disagreement is -1, and those with unsure is 0. Then, these results are calculated for means and the overall results were shown in the following table. The issues are considered justified if the mean values are over 0.5.

	N	Minimum	Maximum	Mean	Std. Deviation
Contents selection – topics	3	1	1	1.00	.000
Contents selection – difficulty level	3	0	1	.67	.577
Contents selection – order of contents	3	1	1	1.00	.000
Activity design – design format	3	1	1	1.00	.000
Activity design – clear instruction	3	1	1	1.00	.000
Activity design – length of time	3	0	0	.00	.000
Activity design – parallel in both groups	3	1	1	1.00	.000
Consistency to the objectives – contents	3	1	1	1.00	.000
Consistency to the objectives – activity design	3	1	1	1.00	.000

Appendix M

Four Review Tasks

…………………………………………………………………………………….

Review Task 1

Description:

1. The task consists of two parts: the definition part and the cloze-passage part.
2. Thirty items of words are totally reviewed i.e. 15 items in each part.
3. The time for doing the task is 1 hour.

Part I: Match the words with the right definitions in the same set as in the following example.

For example:

Definitions	Words	
……f…… part of a house	a. business	d. pencil
……c…… animal with four legs	b. clock	e. shoe
……d…… something used for writing	c. horse	f. wall

	Definitions	Words	
………….1	a thing	a. fact	d. task
………….2	Information	b. edge	e. condition
………….3	a piece of work	c. object	f. organization
………….4	a basic idea or rule	a. property	d. experience
………….5	quality in material	b. attention	e. principle
………….6	knowledge or skill getting through doing	c. human	f. equipment
………….7	hold within	a. research	d. convert
………….8	Make bigger or larger	b. increase	e. allow
………….9	let something happening	c. attract	f. contain
………..10	keep doing	a. continue	d. prepare
………..11	join things together	b. consume	e. indicate
………..12	show or make clear	c. integrate	f. receive
………..13	related to body or material	a. effective	d. physical
………..14	Made by man, not by nature	b. artificial	e. gradual
………..15	able to do things successfully	c. direct	f. traditional

Part II: Fill the given words into the gaps of the passages. For each passage, there are more given words than needed.

I. Engineers: Nature of Work

(Source: Adapted from the document of US Department Labor, available at http://stats.bls.gov/oco/ocos027.htm)

applications attach develop expand force plants solutions theories

Most engineers work in offices, laboratories, or industrial (1)…………… . Others may spend time outdoors at construction sites, mines, and oil or gas production sites. Some engineers travel regularly to plants or worksites.

Engineers apply the (2)…………… and principles of science and mathematics to research and develop (3)…………… to technical problems. Their work is the link between social needs and commercial (4)…………… . Engineers design products, machinery, factories, and the systems. They take out, process, and use raw materials. They also (5)…………… new materials that both improve the performance of products and take advantage of advances in technology.

II. Energy Types

(Source: Adapted from the passage on http://www.energyquest.ca.gov/story/chapter01.html)

another applied becomes created follows form light various

Energy causes things to happen around us. During the day, the sun gives out light and heat energy. At night, street lamps use electrical energy to (6)…………… our way.

Energy makes everything happen and can be divided into two types:

* Stored energy is called potential energy.
* Moving energy is called kinetic energy.

Energy can be transformed into another sort of energy. But it cannot be (7)…………… AND it cannot be destroyed. Energy has always existed in one form or (8)…………… . For example, stored energy in a flashlight's batteries (9)…………… light energy when the flashlight is turned on. A television changes electrical energy into light and sound energy.

There are also many different forms of energy. Heat is one (10)…………… of energy. Heat is used for warming our homes, cooking our food, heating hot water.

III. CNC Machines

(Source: Adapted from ‘CNC Concepts, Inc. by Mike Lynch, at http://www.cncci.com/)

alternating briefly edit involve manufacturing identified required typically

CNC stands for **C**omputer **N**umerical **C**ontrol and has been around since the early 1970's. CNC has been used in almost every form of manufacturing process in one way or another. If you work in manufacturing, it's likely that you will (11)…………… with CNC on a regular basis.

CNC machines (12)…………… replace (or work together with) some existing manufacturing processes. Take one of the simplest (13)…………… processes, drilling holes, for example.

Before CNC, a drill press can be used to make holes. As you can easily see, there is a lot of manual operation required to use a drill press to drill holes. A person is (14)…………… to do something almost every step along the way! The machines without CNC like this are often (15)…………… as the *conventional* machine.

By comparison, the CNC drilling machine can be programmed to perform this operation in a much more automatic fashion. Everything that the drill press operator was doing manually can now be done by the CNC machine.

Review Task 2

Description:

1. The task consists of two parts: the definition part and the cloze-passage part.
2. Thirty items of words are totally reviewed i.e. 15 items in each part.
3. The time for doing the task is 1 hour.

Part I: Match the words with the right definitions in the same set as in the following example.

For example:

Definitions	Words	
……f…… part of a house	a. business	d. pencil
……c…… animal with four legs	b. clock	e. shoe
……d…… something used for writing	c. horse	f. wall

……………………………………………………………………………………………..

	Definitions	Words	
…….1	a word or vocabulary	a. demand	d. series
…….2	a group of similar things placed in order	b. term	e. behavior
…….3	a mathematical statement that two amounts are equal	c. equation	f. desire
…….4	an aim	a. purpose	d. impact
…….5	a thing	b. progress	e. item
…….6	a happening action	c. delay	f. activity
…….7	say formally	a. reduce	d. state
…….8	make smaller	b. replace	e. locate
…….9	find out where something is	c. satisfy	f. sense
…..10	give something that is wanted	a. list	d. rise
…..11	think that something will happen	b. supply	e. influence
….12	look for similarity or difference between things	c. expect	f. compare
…..13	Real	a. brief	d. suitable
…..14	sure to happen	b. regular	e. certain
….15	able to change or bend	c. actual	f. flexible

………………………………………………………………………………………………

Part II: Fill the given words into the gaps of the passage. For each passage, there are more given words than needed.

I. Electric Current

(Source: Adapted from a passage available at http://encyclopedia.thefreedictionary.com)

advantage as conduction corrected defined internal means original

Electric current is any flow of charge, usually through some electrical conductors. In the past, current was (1)…………… in the history of electrical science (2)…………… a flow of positive charge. However, in the case of metallic (3)……………, current is caused by a flow of negatively charged electrons in the opposite direction. Despite this misunderstanding, the (4)…………… definition of current still stands.

The symbol *'I'* is typically used for the amount of current or charge flowing per unit of time. Historically, the symbol for current, *I*, came from the German word *Intensität*, which (5)…………… *'intensity'*. The SI unit of electrical current is called the *ampere*.

II. Mechanical Bearing

(Source: Adapted from a passage available at http://encyclopedia.thefreedictionary.com)

classified general influences kinds motion compatible proved revolution

A **bearing** is a component used to reduce friction in a machine. Bearings may be (6)…………… broadly according to the motions they allow and according to their principle of operation.

(7)…………… motions include linear and rotary. A linear bearing allows motion along a straight line, for example, a drawer being pulled out and pushed in. A rotary bearing allows (8)…………… about a center, such as a wheel on a shaft or a shaft through a housing. Common (9)…………… of rotary motion include both one-direction rotation and oscillation where the motion only goes through part of a (10)…………… .

III. Webcams

(Source: Adapted from an article written by Marshall Brian available at http://computer.howstuffworks.com/webcam.htm)

attached consists depends instance parallel replaces sequence simple

Webcams let you monitor your home, share live video with friends and show the world what's going on in your fridge. Webcams, like most things, range from (11)…………… to complex. Let's start with simple.

A simple Webcam (12)…………… of a *digital camera*. This camera is (13)…………… to your computer. Cameras like these have dropped well below $100 and they are easy to connect through a USB port (earlier cameras connected through a card or the (14)…………… port).

A piece of software connects to the camera and grabs a frame from it periodically. For (15)……………, the software might grab a still image from the camera once every 30 seconds. The software then turns that image into a normal JPG file and uploads it to your Web server. The JPG image can be placed on any Web page.

Review Task 3

Description:
1. The task consists of two parts: the definition part and the cloze-passage part.
2. Thirty items of words are totally reviewed i.e. 15 items in each part.
3. The time for doing the task is 1 hour.

Part I: Match the words with the right definitions in the same set as in the following example.

For example:

Definitions	Words	
……f…… part of a house	a. business	d. pencil
……c…… animal with four legs	b. clock	e. shoe
……d…… something used for writing	c. horse	f. wall

……………………………………………………………………………………………..

	Definitions	Words	
……….1	a picture	a. lack	d. track
……….2	a method of doing something	b. detail	e. procedure
……….3	a part of information about something	c. schedule	f. image

……………………………………………………………………………………………..

……….4	let something out	a. label	d. reverse
……….5	turn around quickly	b. release	e. achieve
……….6	finish doing something successfully	c. spin	f. adjust

……………………………………………………………………………………………..

……….7	make change	a. prefer	d. suggest
……….8	stay away from	b. modify	e. avoid
……….9	give an idea for someone to think about	c. deliver	f. repeat

……………………………………………………………………………………………..

……..10	Usual	a. secure	d. normal
……..11	safe from danger	b. relevant	e. passive
……..12	very much, to a great extent	c. previous	f. quite

……………………………………………………………………………………………..

……..13	Suitable	a. appropriate	d. local
……..14	in a nearby area	b. active	e. perfect
……..15	in a usual and acceptable way of doing	c. public	f. conventional

……………………………………………………………………………………………..

Part II: Fill the given words into the gaps of the passage. For each passage, there are more given words than needed.

I. CNC Milling: EMCOMILL FB-6

(Source: Adapted from a passage available at http://www.emco.at/fb6.php?changelang=en)

active choose deliver ensure maximum neutral option quality

The FB-6 model is the continuation of the FB-4's global success story. The most important of the new features are hydraulic tool clamping and an external coolant system.

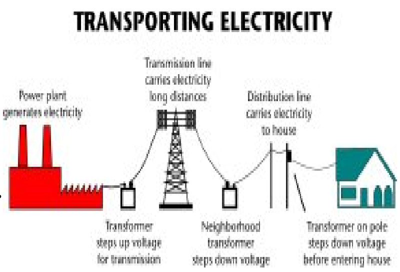
You can (1)…………… your system preference of controllers for our milling machines – the (2)…………… ranges from 3-axis digital display to 3-axis continuous path control. The right controller for the job. And all of the best (3)…………… .

This CNC milling is full of state-of-the-art technology. The EMCOMILL FB-6 combines unique repeat accuracy with (4)…………… flexibility. Digital drives (5)…………… extraordinary high end dynamic machining. Quality speaks for itself, you can be sure of that.

II. Transporting Electricity

(Source: Adapted from a passage on http://www.eia.doe.gov/kids/energyfacts/sources/electricity.html)

adjusts appear distribute minimizes suggest tracking transfers transforming



Electricity is important in our daily lives. It is generated at a power plant before being sent to homes and businesses, which are very far away from the plant. To transport electricity over long distance, George Westinghouse developed a device called a transformer. This device made possible to (6)……… electricity to various places.

Firstly electricity is generated at the power plant. Then it moves along cables to a transformer, which (7)…………… it from low to high voltage. After that it can be sent long distance through transmission lines to a substation. The substation (8)…………… it into proper quantity by (9)…………… the high voltage into the lower one. Finally, the substation (10)…………… suitable amount of electricity to homes, offices, and factories.

III. Safety in Battery Diagnosis and Testing

(Source: Adapted from 'Automotive Technical Articles', Toyota Motor Sales, USA, Inc, p.8 , available at http://www.autoshop101.com,)

explode externally immediately mechanically obtain occur remove wear

When testing or servicing a battery, safety should be your first consideration. The electrolyte contains sulfuric acid. It can possibly damage your skin, eyes, or a car's finish. If electrolyte is splashed on your skin or in your eyes, wash it away (11)…………… with large amounts of water. If electrolyte is pilled on the car, wash it away with a solution of baking soda and water.

When a battery is being charged, either by the charging system or by a separate charger, gassing will (12)…………… . Hydrogen gas is explosive. Any flame or spark can ignite it. If the flame goes into the cells, the battery may (13)…………… .

For safety precautions during working with the battery, make sure to (14)…………… gloves and safety glasses as well as to (15)…………… rings, watches and other jewelry.

Review Task 4

Description:
1. The task consists of two parts: the definition part and the cloze-passage part.
2. Thirty items of words are totally reviewed i.e. 15 items in each part.
3. The time for doing the task is 1 hour.

Part I: Match the words with the right definitions in the same set as in the following example.

For example:

	Definitions	Words	
……f……	part of a house	a. business	d. pencil
……c……	animal with four legs	b. clock	e. shoe
……d……	something used for writing	c. horse	f. wall

…………………………………………………………………………………………..

	Definitions	Words	
….1	a mistake	a. event	d. error
….2	a formal paper	b. document	e. assessment
….3	a particular way of acting	c. behavior	f. consequence
..….4	see, notice	a. access	d. fail
..….5	reach, enter	b. observe	e. employ
……6	keep something safe from danger	c. target	f. protect
..….7	put something in	a. research	d. insert
..….8	study something systematically	b. steer	e. assume
..….9	believe as true without questions	c. receive	f. investigate
…..10	not easy	a. remaining	d. visual
…..11	as stated by	b. considerable	e. according
…..12	being exist / the same	c. approximate	f. difficult
…..13	alike, being the same	a. similar	d. entire
…..14	having all in one piece	b. extensive	e. predictive
….15	in the past, but not very long ago	c. recent	f. excellent

…………………………………………………………………………………………..

Part II: Fill the given words into the gaps of the passage. For each passage, there are more given words than needed.

I. Energy Star Label

(Source: Adapted from a passage available at http://hes.lbl.gov/hes/makingithappen/products.html)

benefits criteria hence instead observing purchasing severe specific

Look For the ENERGY STAR® Label

Saving the Earth. Saving Your Money.

The U.S. Environmental Protection Agency (EPA) and the U.S.Department of Energy (DOE) are working together to promote the use of energy-efficient equipment. They award the ENERGY STAR label to products that save energy.

In general, the ENERGY STAR label is not intended to increase product sales, but (1)………….. to promote energy saving. Consumers get (2)…………… by reducing the cost for electricity consumption.

The agencies set criteria of energy efficiency for (3)…………… consumers and commercial products. These (4)…………… are higher than the minimum national efficiency standards. Manufacturers and retailers will fix the ENERGY STAR label on those products that meet the criteria set by EPA and DOE.

The ENERGY STAR label can help customers make (15)…………… decisions easier. These products not only save energy, but they also help prevent air pollution and save money, frequently with better performance. Remember to look for the ENERGY STAR label - the symbol of energy efficiency.

ENERGY STAR is for better utility.

II. Disc Brake Pads

(Source: Adapted from a passage available at http://www.tirerack.com/brakes/brakes.jsp?make=EBC&model=Greenstuff+brake+pads)

analyses cause however innovations isolated qualified responses since

Award-Winning, Disc Brake Pads

EBC Greenstuff disc brake pads are designed for sports cars, coupes and sedans used for high performance driving on the road. They are (6)…………… which will be more responsive than most standard original brakes. With outstanding features, they can give instant (7)……………, because no warm-up is needed. Therefore, safety can be guaranteed.

(8)……………, brakes are safety critical parts of a motor vehicle.

Brake components should be installed by a skillful and (9)…………… mechanic in a professional manner. Any incorrect installation of brake components can (10)…………… a major safety problem or an accident. If you are not a qualified mechanic, you should not attempt to install these products, but should take the vehicle to a vehicle dealer or component automotive mechanic for their installation.

III. Low Power Circuits and Technology for Wireless Digital Systems

(Source: Adapted from http://www.cisl.columbia.edu/old_seminars.html)

aiming assume capabilities challenges determining explain performance

Abstract

CMOS technology is an advance in the fields of computers and telecommunication. At present, it is used widely to optimize system and performance of particular applications.

CMOS technology is highly complex and its scales are in deep submicron lengths. Thus, designers of applications face new (11)……………in determining the proper balance of high and low performance devices.

(12)…………… this balance is important for wireless digital systems because the unbalance will limit their (13)…………… . This article will suggest some ways to get such balance. Then it will (14)…………… research in developing low power communication systems. These systems make use of the (15)…………… of advanced CMOS technology.

Appendix N

Pretest, Immediate Posttest and Delayed Posttest

……………………………………………………………………………………………….

I. Pretest, Immediate Posttest and Delayed Posttest

Description:

1. The test consists of two parts: the definition part and the cloze-passage part.
2. There are totally 101 items of words to be tested:
   - 51 items in the definition part
   - 50 items in the cloze-passage part.
3. The time for doing the test is 3 hours.

Part I: Match the words with the right definitions in the same set as in the following example.

For example:

Definitions	Words	
……f…… part of a house	a. business	d. pencil
……c…… animal with four legs	b. clock	e. shoe
……d…… something used for writing	c. horse	f. wall

……………………………………………………………………………………………….

	Definitions	Words	
…….1	Give	a. improve	d. press
…….2	Receive	b. bend	e. obtain
…….3	make better	c. detect	f. provide
…….4	look for	a. search	d. decrease
…….5	tell about	b. permit	e. shift
…….6	make change	c. satisfy	f. describe
…….7	make apart	a. attempt	d. divide
…….8	become different	b. follow	e. assist
…….9	talk or write about	c. discuss	f. vary
…..10	make something bad	a. notice	d. specify
…..11	say about something clearly	b. spend	e. prevent
…..12	stop something from happening	c. damage	f. supply
…..13	pay attention	a. publish	d. review
…..14	get to, arrive at	b. reach	e. enhance
…..15	make information available to people	c. interest	f. imagine
…..16	a picture or drawing	a. education	d. figure
….17	a surrounding condition	b. issue	e. advance
…..18	a topic being talked about	c. waste	f. environment

……………………………………………………………………………………………….

…..19	a part of something	a. concept	d. evidence
…..20	a way of doing something	b. trial	e. section
…..21	an abstract idea to understand something	c. practice	f. couple

……………………………………………………………………………………..

…..22	a place, location	a. version	d. cost
…..23	power to do work	b. tension	e. area
…..24	something a little different from others of the same type	c. energy	f. method

……………………………………………………………………………………..

…..25	an amount or number of	a. quantity	d. investment
…..26	a good feature, benefit	b. estimate	e. advantage
…..27	an amount of space between two points	c. sequence	f. distance

……………………………………………………………………………………..

…..28	ability to do or hold things	a. equipment	d. symbol
…..29	a box to hold things	b. case	e. trend
…..30	a sign or a mark to represent something	c. information	f. capacity

……………………………………………………………………………………..

…..31	a top part of something	a. volume	d. behavior
…..32	an amount of space to hold things	b. skill	e. position
…..33	a point or a place where something is	c. surface	f. category

……………………………………………………………………………………..

…..34	apart, not together	a. several	d. separate
…..35	useful, necessary	b. important	e. average
…..36	at about the middle level or degree	c. rigid	f. flexible

……………………………………………………………………………………..

…..37	perfect, most suitable	a. economical	d. isolate
…..38	saving money or fuel	b. rare	e. overall
…..39	including everything in general	c. ideal	f. visible

……………………………………………………………………………………..

…..40	very much	a. complex	d. academic
…..41	not easy, not simple	b. extreme	e. individual
…..42	of each person or thing	c. fundamental	f. obvious

……………………………………………………………………………………..

…..43	by using hands	a. rapidly	d. randomly
…..44	in a special manner	b. especially	e. manually
…..45	in a suitable manner	c. properly	f. permanently

……………………………………………………………………………………..

…..46	done by machines	a. constantly	d. particularly
…..47	in a specific manner	b. universally	e. mechanically
…..48	without stopping or changing	c. regularly	f. explicitly

……………………………………………………………………………………..

…..49	from that time	a. during	d. although
…..50	but, despite the fact that	b. since	e. therefore
…..51	while, within a period of time	c. via	f. furthermore

……………………………………………………………………………………..

Part II: Fill the given words into the gaps of the passage. For each passage, there are more given words than needed.

I. Electric Current: DC and AC

(Source: Adapted from a passage available at http://encyclopedia.thefreedictionary.com.)

current direction efficient handle hence rather reaction result

In electricity, electric current is the flow of charges, usually through a metal wire or some other electrical conductors. Electric (1)…………… has two basic types. One is a direct current (DC) and the other is an alternating current (AC).

In DC, the electric charge moves continuously in the same (2)…………… . In AC, on the other hand, the electric charges oscillates (i.e., moves back and forth), (3)…………… than moving in line. As a (4)……………, the oscillation of AC can make different waveforms such as triangular, square, and sine waves. The best waveform is a perfect sine wave because it can produce the most (5)…………… transmission of energy.

II. Energy

(Source: Adapted from a passage available at http://www.energyquest.ca.gov/story/chapter01.html)

amount different element equal integral invented measured medium

Energy causes things to happen around us. It can be found in several (6)…………… forms. It can be chemical energy, electrical energy, heat (thermal) energy, light (radiant) energy, mechanical energy, and nuclear energy.

Energy is measured in many ways. One of the basic measuring units is called a Btu. Btu stands for 'British thermal unit', and was (7)…………… by the English scientist. Btu is the (8)…………… of heat energy used to raise the temperature of one pound of water by one degree Fahrenheit, at sea level.

Energy also can be (9)…………… in joules. A thousand joules is (10)…………… to a British thermal unit (i.e., 1,000 joules = 1 Btu).

III. AutoCAD

(Source: Adapted from a passage available at http://www.fbe.unsw.edu.au/learning/autocad/cadnotes/chap1.htm)

able component effect except measure shifts stable supports

AutoCAD is an interactive drawing system. It is designed to allow a user to construct or edit a drawing on a computer screen. It is similar to a word-processing program, (11)…………… that the thing being processed in AutoCAD is a drawing. Each drawing is stored on a disk file, and AutoCAD is only (12)…………… to edit one drawing (or file) at a time. The main (13)…………… of AutoCAD is known as the *drawing editor*.

In earlier versions, AutoCAD was a two-dimensional drawing system. Now, it (14)…………… a full three-dimensional database. This support has the (15)…………… that AutoCAD can be used either as 2D or 3D systems.

IV. CNC Lathe

(Source: Adapted from an advertisement available at http://www.emco.at)

accuracy *combines* *depends* *due* *produce* *command* *single* *special*

The CONCEPT TURN 345 is a PC-controlled CNC lathe that has been used by industrial companies for years. This CNC is known by the name EMCOTURN345/II. It is a machine from the EMCO industrial machine line. We have adapted to the (16)…………… needs of the training situation with our PC control unit – the interchangeable control panel. (17)…………… to its size, performance and numerous functions, the CONCEPT TURN 345 has everything. It gives the trainees a machine on which they can learn how to (18)…………… parts cost-effectively.

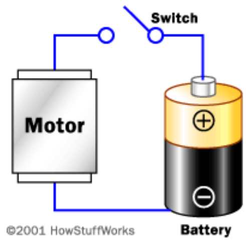
This power pack is full of state-of-the-art technology. The EMCO CONCEPT TURN 345 (19)…………… outstanding features of a CNC lathe together. It has the ability to repeat (20)…………… with maximum flexibility. Moreover, digital drives ensure extraordinary high end dynamic machining. Quality speaks for itself, you can be sure of that.

V. How a battery works

(Source: Adapted from an article written by Marshall Brain available at http://science.howstuffworks.com/battery.htm)

dangerous *notice* *order* *spend* *terminal* *unless* *visible* *whereas*

Batteries are all over the place -- in our cars, our PCs, portable MP3 players, and mobile phones. A battery is essentially a can full of chemicals for producing electrons. Chemical reactions that produce electrons are called *electrochemical reactions*.



If you look at any battery, you'll (21)…………… that it has *two terminals*. One terminal is marked (+), or positive, (22)…………… the other is marked (-), or negative. In an AA cell (normal flashlight batteries), the ends of the battery are the terminals. In a large car battery, there are two heavy lead posts that act as the terminals.

If you connect a wire between the negative and positive terminals, the electrons will flow from the negative to the positive terminal as fast as they can. This direct connection should not be done because it is (23)…………… especially with large batteries. Normally, you connect some type of *load* such as a light bulb or a motor to the battery using the wire.

Electrons flow from the battery into a wire, and must go from the negative to the positive (24)…………… for the chemical reaction to take place. The chemical reaction does not take place (25)…………… electrons are flowing between these terminals. Once you connect a wire, the reaction starts.

VI. How to install a computer program safely

(Source: Adapted from an instruction available at http://www.ehow.com/how_2458_install-computer-program.html)

appear analysis find instructions options place select value

Today, installing a computer program is usually as simple as clicking the *Install* button. These (26)………….. are used to install a computer program for Windows 95 and 98.

Steps:

1. (27)………….. the floppy disk or CD-ROM containing the program in the appropriate drive.
2. A window will immediately (28)………….. asking whether you want to install the program. Click *Install*.
3. If a window doesn't appear, open the *Start* menu and (29)………….. *Settings*, then *Control Panel*.
4. Double-click *Add/Remove Programs*.
5. In the top part of the window that appears, click *Install*.

Tips:

- To install a Windows 3.1 or DOS program in Windows 98, open the *Start* menu and click *Run*. In the box that appears, click *Browse*, then (30)………….. the program or its installer.

Warnings:

- Don't install older utility programs not designed for Windows 98 - they may corrupt your system.

VII. Memory for Cars

(Source: Adapted from a product note published in Design Engineering, 03 December 2004, available at http://www.e4engineering.com)

available bands contact devices include needs potential range

Integrated Silicon Solution (ISSI) has produced EEPROM devices for the automotive market. The new products cover densities from 1K to 64K. They come in all three popular interface protocols: I2C, Microwire, and SPI.

The devices are made up with process technology at SMIC. These (31)………….. are widely used in a broad (32)………….. of automotive applications, each of which (33)………….. to be coded. Applications (34)………….. remote control door locks, power seats and mirrors with memory, radios, and alarm systems.

ISSI's new EEPROMs operate from 2.5 V to 5.5V. They are (35)………….. in 1K, 2K, 4K, 8K and 16K densities.

VIII. Electric Outlook

(Source: Adapted from an article available at http://www.graduatingengineer.com/futuredisc/mechanical2.html)

accepted despite expanded field firm slightly thus virtually

Before the Internet and computers, electrical engineers studied and made all electrical and electronic things. There was no question about who they were or what they did. If anything had to do with electricity or electronics, it was certainly the job of electrical engineers.

However, with the explosion of the high-tech industry, the job of an electrical engineer has (36)……………, and the growth of this (37)…………… shows no signs of slowing.

(38)…………… the economic downturn, electrical engineers are still in demand as ever. Most companies are looking for electrical and computer engineers because business today operates (39)…………… through computers and networking systems. Now electrical engineer can work for most types of business or industry such as a bank, a law (40)……………, or a manufacturing plant.

It is clear that, with the expansion of technology, the future of electrical engineers is very bright.

IX. IMechE: Institution of Mechanical Engineers

(Source: Adapted from an official webpage of the Institution of Mechanical Engineers, IMechE, available at http://www.imeche.org.uk/about/about_us.asp)

cover damages detected disciplines excess organization related targets

The Institution of Mechanical Engineers (IMechE) was established in 1847 in the UK. It is the leading (41)…………… for professional mechanical engineers. The Institution has grown to (42)…………… the whole range of technologies and industries in which engineers work. Its aim is to ensure the highest professional standards.

The world-wide membership of the IMechE is now in (43)…………… of 75,000 engineers. The members are mechanical engineers from all (44)…………… . They work in research, design, development, manufacturing, teaching etc. In its Conferences and Events, all members share experiences and find out the latest development in their own and (45)…………… fields.

X. Article Abstract

(Source: Adapted from an abstract of an article entitled 'What should computer scientists teach to physical scientists and engineers?', written by Gregory V. Wilson in *Computing Science & Engineering*, 1996, Vol.3 No. 2, available at http://csdl.computer.org/comp/mags/cs/1996/02/c2046abs.htm)

aids decrease flexible intensive necessary professionals resources spend

Most physical scientists and engineers do not use computers effectively. Whether students in colleges or (46)…………… working in industry, they write programs when they could use existing software, they rarely use advanced data in their programs, and they make little use of software tools.

Asking physical scientists and engineers to study computer science as well as their own disciplines is impractical. Time is one of the limited (47)…………… in a student or professional's life. While it is easy to make a list of things that would be useful to know, it is much more difficult to say what should be dropped from existing curricula, or what projects should be postponed, to make the (48)…………… room.

In deciding what computing skills to teach to physical scientists and engineers, this article presents a thought experiment. Imagine that every new graduate student in science and engineering at your institution, or every new employee in your company, has to take a/an (49)…………… one-week computing course. What would you want that course to cover?

The author believes that such a one-week course should (1) focus on programming (50)……………, not programming methodology; (2) describe widely available tools, not stand-alone packages; (3) be conservative, that is, be based on tools that have proved themselves and are unlikely to change; and (4) focus on those platforms that practitioners are most likely to have access to.

Appendix O

Checklists and Results in Validating Review Tasks and Test

…………………………………………………………………………………………..…

I. A checklist for validating the review tasks

Part I: Please tick (✓) in the appropriate boxes to give opinions.

Questions	Yes	No	Unsure
Word selection			
• Are the criteria for selecting the reviewed words justified?			
• Does the number of the words reviewed in each task represent the three related weekly wordlists?			
The Part of Definitions			
• Is the instruction clear?			
• Is the test format appropriate?			
• Are the given definitions appropriate?			
• Are the given distracters appropriate?			
The Part of Rational-Deletion Cloze Passages			
• Is the instruction clear?			
• Is the test format appropriate?			
• Is the length of each passage appropriate?			
• Are there enough contexts for guessing each deleted word?			
• Is the variety of the text types appropriate?			
• Are the topics suitable for engineering students?			
• Are the contents suitable for the students' English proficiency level?			
Overall			
• Do the tasks conform to the objectives of the study?			
• Does the length of each task match the time available?			

Part II: Please give some comments or suggestion to improve the tasks.

Thank you for your co-operation.

II. A checklist for validating the task items

Part I:

Task Objectives: To assess definitional knowledge of the given words.

Please do each task in part I and give comments by ticking (✓) in the appropriate boxes whether the given words can be reviewed with the given definitions. If the comments are 'no'/ 'unsure', please note the problems such as unclear definitions, more than one answers etc.

Review Task 1

Items	Reviewed Words	Definitions	Comments			Notes
			Yes	No	Unsure	
1	object	a thing				
2	fact	information				
3	task	a piece of work				
4	principle	a basic idea or rule				
5	property	quality in material				
6	experience	knowledge or skill getting through doing				
7	contain	hold within				
8	increase	make bigger or larger				
9	allow	let something happening				
10	continue	keep doing				
11	integrate	join things together				
12	indicate	show or make clear				
13	similar	alike / being the same				
14	effective	able to do things successfully				
15	physical	related to body or material things				

Reviewed Task 2

Items	Reviewed Words	Definitions	Comments			Notes
			Yes	No	Unsure	
1	term	a word or vocabulary				
2	series	a group of similar thing placed in order				
3	equation	a mathematical statement that two amounts are equal				
4	purpose	aim				
5	item	a thing				
6	activity	a happening action				
7	state	say formally				
8	reduce	make smaller				
9	release	let something out				
10	supply	give something that is wanted				
11	achieve	finish doing something successfully				
12	compare	look for similarity or difference between things				
13	actual	real				
14	certain	sure to happen				
15	artificial	made by man, not by nature				

Review Task 3

Items	Reviewed Words	Definitions	Comments			Notes
			Yes	No	Unsure	
1	image	Picture				
2	formula	a set of scientific or mathematic rules				
3	detail	a part of information about something				
4	spin	turn around quickly				
5	locate	find out where something is				
6	expect	think that something will happen				
7	avoid	stay away from				
8	protect	keep something safe from danger				
9	suggest	give an idea for someone to think about				
10	quite	Very				
11	normal	Usual				
12	flexible	able to change or bend				
13	secure	safe from danger				
14	entire	having all in one piece				
15	conventional	in a usual and acceptable way of doing				

Review Task 4

Items	Reviewed Words	Definitions	Comments			Notes
			Yes	No	Unsure	
1	error	a mistake				
2	document	a formal paper				
3	procedure	a method of doing something				
4	modify	change				
5	access	get into				
6	observe	see or notice				
7	insert	put something in				
8	remain	keep being the same				
9	assume	believe as true without questions				
10	difficult	not easy				
11	according	as stated by				
12	academic	related to studying				
13	appropriate	suitable				
14	local	in a nearby area				
15	recent	in the past, but not very long ago				

Part II:

Task Objectives: To assess ability to transfer lexical knowledge to reading contexts

Please do each task in part II and give comments by ticking (✓) in the appropriate boxes whether the given words are properly reviewed with enough contexts. If the comments are 'no'/ 'unsure', please note the problems.

Review Task 1

Items	Reviewed Words	Comments			Notes
		Yes	No	Unsure	
1	plant				
2	theory				
3	solution				
4	application				
5	develop				
6	light				
7	create				
8	another				
9	become				
10	form				
11	involve				
12	typical				
13	manufacture				
14	require				
15	identify				

Review Task 2

Items	Reviewed Words	Comments			Notes
		Yes	No	Unsure	
1	define				
2	as				
3	conduction				
4	original				
5	mean				
6	classify				
7	general				
8	motion				
9	kind				
10	revolution				
11	simple				
12	consist				
13	attach				
14	parallel				
15	instance				

Review Task 3

Items	Reviewed Words	Comments			Notes
		Yes	No	Unsure	
1	choose				
2	option				
3	quality				
4	maximum				
5	ensure				
6	distribute				
7	adjust				
8	minimize				
9	transform				
10	transfer				
11	immediately				
12	occur				
13	explode				
14	wear				
15	remove				

Review Task 4

Items	Reviewed Words	Comments			Notes
		Yes	No	Unsure	
1	instead				
2	benefit				
3	specific				
4	criteria				
5	purchase				
6	innovation				
7	response				
8	however				
9	qualify				
10	cause				
11	challenge				
12	determine				
13	performance				
14	explain				
15	capability				

III. A checklist for validating the test

Part I: Please tick (✓) in the appropriate boxes to give opinions.

Questions	Yes	No	Unsure
Word selection			
Are the criteria for selecting the tested words justified?			
Does the number of the tested words represent the total target words?			
Part I: Definitions			
Is the instruction clear?			
Is the test format appropriate?			
Are the given definitions appropriate?			
Are the given distracters appropriate?			
Part II: Rational-Deletion Cloze Passages			
• Is the instruction clear?			
• Is the test format appropriate?			
• Is the length of each passage appropriate?			
• Are there enough contexts for guessing each deleted word?			
• Is the variety of the text types appropriate?			
• Are the topics suitable for engineering students?			
• Are the contents suitable for the students' English proficiency level?			
Overall			
Does the test conform to the objectives of the study?			
Does the length of the test match the time available?			

Part II: Please give some comments or suggestion to improve the test.

Thank you for your co-operation.

IV. A checklist for validating the test items

Part I

Test Objectives: To assess definitional knowledge of the given words.

Please do the test in part I and give comments by ticking (✓) in the appropriate boxes whether the given words can be tested with the given definitions. If the comments are 'no'/ 'unsure', please note the problems such as unclear definitions, more than one answers etc.

Items	Tested Words	Definitions	Comments			Notes
			Yes	No	Unsure	
1	provide	give				
2	obtain	receive				
3	improve	make better				
4	search	look for				
5	describe	tell about				
6	shift	make change				
7	divide	make apart				
8	vary	become different				
9	discuss	talk or write about				
10	damage	make something bad				
11	specify	say about something clearly				
12	prevent	stop something from happening				
13	interest	pay attention				
14	reach	get to, arrive at				
15	publish	make information available to people				
16	figure	a picture or drawing				
17	environment	a surrounding condition				
18	issue	a topic being talked about				
19	section	a part of something				
20	practice	a way of doing something				
21	concept	an abstract idea to understand something				
22	area	a place, location				
23	energy	power to do work				
24	version	one form of a thing or product				
25	quantity	an amount or number of				
26	advantage	a good features, benefit				
27	distance	an amount of space between two points				
28	capacity	ability to do or hold things				
29	case	an example, a box to hold things				
30	symbol	a sign or a mark to represent something				
31	surface	a top part of something				
32	volume	an amount of space to contain things				
33	position	a point or a place where something is				
34	separate	apart, not together				
35	important	useful, necessary				
36	average	at about the middle level or degree				
37	ideal	perfect, most suitable				
38	overall	including everything in general				
39	economic	relating to money or production				
40	extreme	very much				

Items	Tested Words	Definitions	Comments			Notes
			Yes	No	Unsure	
41	complex	not easy, not simple				
42	individual	of each person or thing				
43	manually	by using hands				
44	especially	in a special manner				
45	properly	in a suitable manner				
46	mechanically	done by machines				
47	particularly	in a specific manner				
48	constantly	without stopping or changing				
49	since	from that time				
50	although	but, despite the fact that				
51	during	while, within a period of time				

Part II:

Test Objectives: To assess ability to transfer lexical knowledge to reading contexts

Please do the test in part II and give comments by ticking (✓) in the appropriate boxes whether the given words are properly tested with enough contexts. If the comments are 'no'/ 'unsure', please note the problems.

Items	Tested Words	Is each given word properly tested?			Notes
		Yes	No	Unsure	
1	current				
2	direction				
3	rather				
4	result				
5	efficient				
6	different				
7	invent				
8	amount				
9	measure				
10	equal				
11	except				
12	able				
13	component				
14	support				
15	effect				
16	special				
17	due				
18	procedure				
19	combine				
20	accuracy				
21	notice				
22	whereas				
23	dangerous				
24	terminal				
25	unless				

Items	Tested Words	Is each given word properly tested?			Notes
		Yes	No	Unsure	
26	instruction				
27	place				
28	appear				
29	select				
30	find				
31	devices				
32	range				
33	need				
34	include				
35	available				
36	expand				
37	field				
38	despite				
39	virtually				
40	firm				
41	organization				
42	cover				
43	excess				
44	disciplines				
45	relate				
46	professional				
47	resource				
48	necessary				
49	intensive				
50	aid				

V. Results from the checklists for validating test and tasks

To validate the tests and review tasks, two experts were consulted and they gave their opinions in the checklists on the issues of word selection, format and design, and consistency to the objectives of the study.

To calculate the data from the checklists, the items marked with agreement on justification is rated 1, those with disagreement is -1, and those with unsure is 0. Then, these results are calculated for means and the overall results were shown in the following table. The issues are considered justified if the mean values are over 0.5.

	N	Minimum	Maximum	Mean	Std. Deviation
1. Word Selection: Criteria	2	1	1	1.00	.000
Representativeness	2	0	1	.50	.707
2. Part I: Instructions	2	-1	0	-.50	.707
Test format	2	0	1	.50	.707
Definitions	2	0	1	.50	.707
Distractors	2	0	0	.00	.000
3. Part II: Instructions	2	-1	0	-.50	.707
Test format	2	0	1	.50	.707
Length of passage	2	1	1	1.00	.000
Enough contexts	2	1	1	1.00	.000
Variety of text types	2	1	1	1.00	.000
Topics of passage	2	1	1	1.00	.000
Contents	2	0	1	.50	.707
4. Overall: Conform to objectives	2	1	1	1.00	.000
Time	2	0	0	.00	.000
Valid N (listwise)	2				

VI. Results from the checklists for validating each item in Definition Part of the test

To validate the test items, three English instructors tried out the measures and gave their opinions in the checklists on the clarity or ambiguity of test taking. To calculate the data from the checklists, the items marked with agreement on justification is rated 1, those with disagreement is -1, and those with unsure is 0. Then, these results are calculated for means and the overall results were shown in the following table. The issues are considered justified if the mean values are over 0.5.

Test Items	N	Minimum	Maximum	Mean	Std. Deviation
definition 1	3	1	1	1.00	.000
definition 2	3	1	1	1.00	.000
definition 3	3	1	1	1.00	.000
definition 4	3	1	1	1.00	.000
definition 5	3	1	1	1.00	.000
definition 6	3	1	1	1.00	.000
definition 7	3	0	1	.67	.577

definition 8	3	1	1	1.00	.000
definition 9	3	1	1	1.00	.000
definition 10	3	1	1	1.00	.000
definition 11	3	1	1	1.00	.000
definition 12	3	1	1	1.00	.000
definition 13	3	1	1	1.00	.000
definition 14	3	1	1	1.00	.000
definition 15	3	1	1	1.00	.000
definition 16	3	1	1	1.00	.000
definition 17	3	1	1	1.00	.000
definition 18	3	1	1	1.00	.000
definition 19	3	1	1	1.00	.000
definition 20	3	1	1	1.00	.000
definition 21	3	1	1	1.00	.000
definition 22	3	1	1	1.00	.000
definition 23	3	1	1	1.00	.000
definition 24	3	0	1	.67	.577
definition 25	3	1	1	1.00	.000
definition 26	3	1	1	1.00	.000
definition 27	3	1	1	1.00	.000
definition 28	3	1	1	1.00	.000
definition 29	3	0	1	.67	.577
definition 30	3	1	1	1.00	.000
definition 31	3	0	1	.67	.577
definition 32	3	1	1	1.00	.000
definition 33	3	0	1	.67	.577
definition 34	3	1	1	1.00	.000
definition 35	3	1	1	1.00	.000
definition 36	3	1	1	1.00	.000
definition 37	3	1	1	1.00	.000
definition 38	3	1	1	1.00	.000
definition 39	3	1	1	1.00	.000
definition 40	3	1	1	1.00	.000
definition 41	3	1	1	1.00	.000
definition 42	3	1	1	1.00	.000
definition 43	3	1	1	1.00	.000
definition 44	3	1	1	1.00	.000
definition 45	3	1	1	1.00	.000
definition 46	3	1	1	1.00	.000
definition 47	3	1	1	1.00	.000
definition 48	3	1	1	1.00	.000
definition 49	3	1	1	1.00	.000
definition 50	3	1	1	1.00	.000
definition 51	3	1	1	1.00	.000
Valid N (listwise)	3				

Appendix P

Sample of Students' Logs

…………………………………………………………………………..

Name…………………………………….
Date…………………………………….…...

Student's Log
Lesson 1

Please give information as much as possible on what and how you deal with the concordance-based method, according to the following topics.
(กรุณาให้ข้อมูลให้มากที่สุดเท่าที่จะทำได้เกี่ยวกับการกระทำและวิธีการที่คุณเรียนด้วยวิธีแบบคอนคอร์แดนซ์ ตามหัวข้อดังต่อไปนี้)

- What do you learn from the lesson today? (คุณเรียนรู้อะไรจากบทเรียนวันนี้)
- How do you participate with class activities? (e.g., paying fully attention, actively taking notes, being distracted, feeling bored, etc.) (คุณร่วมกิจกรรมในชั้นเรียนวันนี้อย่างไร เช่น ตั้งใจเรียนเต็มที่ จดโน้ตตลอดเวลา ไม่มีสมาธิ หรือรู้สึกเบื่อ ฯลฯ)
- How do you deal with the concordancing method? (e.g., being able to observe contexts from the concordances well, or unable to identify the particular meanings of the given keywords etc.) (คุณเรียนด้วยวิธีการแบบคอนคอร์แดนซ์อย่างไร เช่น สามารถสังเกตบริบทในคอนคอร์แดนซ์ได้ดี หรือไม่สามารถระบุความหมายเฉพาะของคำที่กำหนดให้ได้ ฯลฯ)
- What are your opinions about using the method today? (e.g. difficult / easy, interesting/confusing, etc.) (คุณมีความคิดเห็นเกี่ยวกับวิธีใช้คอนคอร์แดนซ์ในวันนี้อย่างไร เช่น ยาก/ง่าย น่าสนใจ/งง ฯลฯ)
- What are your feelings about the method? (e.g. like/dislike, excited/ challenged/discouraged etc.) (คุณรู้สึกอย่างไรกับการใช้คอนคอร์แดนซ์จากบทเรียนวันนี้ เช่น ชอบ/ไม่ชอบ ตื่นเต้น/ท้าทาย/ท้อใจ ฯลฯ)
- Do you have any problems? If yes, what are they? (e.g., a computer is out of order, unable to understand the reading texts in concordance lines etc.) (วันนี้คุณมีปัญหาจากบทเรียนบ้างหรือไม่ ถ้ามี อะไรคือปัญหา เช่น คอมพิวเตอร์เสีย อ่านข้อความในคอนคอร์แดนซ์ไม่เข้าใจ ฯลฯ)
- What are your comments or suggestions for improving the lessons? (คุณมีความคิดเห็นหรือคำแนะนำเพื่อปรับปรุงบทเรียนหรือไม่)
- Others. If any. (อื่นๆ ถ้ามี)

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Appendix Q

Observation Checklist in Teacher's Field Notes

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Observation List	Yes	No	Unsure	What & Why & How?
I. Students' participation • Do they actively participate in class activities? • Do they understand the instructions? • Do they understand the focus of each activity?				
II. Students' dealing with a concordancer • Can they operate a concordancer well? • Are there any problems in dealing with it?				
III. Students' dealing with corpus information? • Can they observe the contexts of keywords? • Can they make use of such observation? • Do they conduct the activities as suggested? • Can they complete the given tasks? • Can they do the task well? • Are there any problems in dealing with it?				
IV. Students' feelings • Are they motivated to do the activities? • Are they confident in dealing with the method? • Are they confused or discouraged?				
V. Problems • Are there any other problems?				

Appendix R

Questionnaire II

…………………………………………………………………………………………

The information derived from this questionnaire is very useful for improving the concordance-based lessons for EFL students as much as possible. It is not concerned with the evaluation of your studying performance in this semester. Therefore, please give honest answers to all the questions.

The questionnaire consists of 5 parts as follows.

• Part I: Studying Habits	• Part IV: Attitudes towards the method
• Part II: Computer Skills	• Part V: Comments and Suggestions
• Part III: Concordancing Skills	

ข้อมูลที่ได้รับจากแบบสอบถามนี้จะเป็นประโยชน์ในการจัดปรับบทเรียนให้เหมาะสมกับผู้เรียนภาษาอังกฤษเป็นภาษาต่างประเทศ ไม่มีผลกระทบต่อการประเมินผลการเรียนของคุณในภาคเรียนนี้แต่ประการใด กรุณาตอบคำถามให้ครบทุกข้อตามความเป็นจริง

แบบสอบถามแบ่งเป็น 5 ส่วนดังนี้

• ตอนที่ 1: อุปนิสัยในการเรียน	• ตอนที่ 4: ทัศนะคติต่อวิธีการ
• ตอนที่ 2: ทักษะทางคอมพิวเตอร์	• ตอนที่ 5: ความเห็นและคำแนะนำ
• ตอนที่ 3: ทักษะทางคอนคอร์แดนซ์	

Name (ชื่อ-นามสกุล) …………………………………………………………………………..

Faculty (คณะ) ……………………………… Field of study (สาขาวิชา) ………………………

<u>Instruction</u>: Please give the information by ticking (✓) in appropriate boxes or columns and giving short answers where needed.

<u>การตอบแบบสอบถาม</u>: กรุณาให้รายละเอียดด้วยการกรอกข้อมูลที่เกี่ยวข้อง และ ใส่เครื่องหมาย (✓) ลงในกรอบหรือในตาราง ตามความเหมาะสม

Part I: Studying habits (อุปนิสัยในการเรียน)

1. How did you attend English classes? (คุณเข้าเรียนในลักษณะอย่างไร)

☐ Always attend class and never late (เข้าเรียนสม่ำเสมอและไม่เคยสาย)

☐ Always attend class but sometimes late (เข้าเรียนเสมอแต่บางครั้งมาสาย)

☐ Usually attend class with very few absences (เข้าเรียนบ่อยมีขาดเรียน2-3ครั้ง)

☐ Attend class with absence more than three times (เข้าเรียนแต่มีขาดเรียนเกิน 3 ครั้ง)

2. Did you attend class late? (คุณเข้าเรียนสายหรือไม่)

☐ Usually late but never absent (มักจะมาสายแต่ไม่เคยขาดเรียน)

☐ Sometimes late but never absent (เข้าเรียนสายเป็นบางครั้งแต่ไม่เคยขาดเรียน)

☐ Usually late with a few absence (มักจะมาสาย มีขาดเรียน 2-3 ครั้ง)

☐ Usually late with absence more than three times (มักจะมาสายและมีขาดเรียนเกิน 3 ครั้ง)

3. Do you fully participate in class activities? (คุณตั้งใจเข้าร่วมกิจกรรมในชั้นเรียนเต็มที่หรือไม่)

☐ Always (เสมอ)

☐ Often (บ่อย)

☐ Sometimes (บางครั้ง)

☐ Rarely (นานๆครั้ง) Why? (เพราะเหตุใด) ....

☐ Never (ไม่เคย) Why? (เพราะเหตุใด) ....

4. Do you understand the lessons clearly? (คุณเข้าใจบทเรียนอย่างชัดเจนหรือไม่)

☐ Always (เสมอ)

☐ Often (บ่อย)

☐ Sometimes (บางครั้ง)

☐ Rarely (นานๆครั้ง) Why? (เพราะเหตุใด) ....

☐ Never (ไม่เคย) Why? (เพราะเหตุใด) ....

5. When you do not understand some points in the lessons, what do you do? (เมื่อไม่เข้าใจบางเรื่องในบทเรียน คุณทำอย่างไร)

☐ Ask the teacher (ถามอาจารย์)

☐ Ask friends (ถามเพื่อน)

☐ Find answers by yourself such as. by reviewing from handouts (หาคำตอบด้วยตนเอง เช่น จากการทบทวนบทเรียน)

☐ Do nothing (ไม่ได้ทำอะไรเลย)

6. How often do you review the previous lessons? (ท่านทบทวนบทเรียนบ่อยมากน้อยเพียงใด)

☐ Always (เสมอ)

☐ Often (บ่อย)

☐ Sometimes (บางครั้ง)

☐ Rarely (นานๆครั้ง)

☐ Never (ไม่เคย)

7. How often do you complete all assignments and submit them in time? (คุณทำงานที่มอบหมายครบและส่งทันตามกำหนดบ่อยมากน้อยเพียงใด)

☐ Always (เสมอ)

☐ Often (บ่อย)

☐ Sometimes (บางครั้ง)

☐ Rarely (นานๆครั้ง)

☐ Never (ไม่เคย)

Part II: Computer skills (ทักษะทางคอมพิวเตอร์)

1. How well can you use general computer programs? (คุณใช้โปรแกรมคอมพิวเตอร์ทั่วไปได้ดีเพียงใด)
   - ☐ Very well (ดีมาก)
   - ☐ Well (ดี)
   - ☐ Averagely (พอใช้)
   - ☐ Poorly (ไม่ดี)
   - ☐ Very poorly (ไม่ดีมากๆ)
2. How well can you use a concordancer – WCONCORD? (คุณใช้โปรแกรมคอนคอร์แดนเซอร์ WCONCORD ได้ดีเพียงใด)
   - ☐ Very well (ดีมาก)
   - ☐ Well (ดี)
   - ☐ Averagely (พอใช้)
   - ☐ Poorly (ไม่ดี)
   - ☐ Very poorly (ไม่ดีมากๆ)
3. Can you use a concordancer to do the following activities? (คุณสามารถใช้โปรแกรมคอนคอร์แดนเซอร์ทำกิจกรรมต่อไปนี้ได้หรือไม่)

Activities (กิจกรรม)	Yes (ใช่)	No (ไม่ใช่)	Unsure (ไม่แน่ใจ)
• Find statistic information of the corpus (หาข้อมูลเชิงสถิติของ Corpus)			
• Build word frequency list (สร้าง word frequency list)			
• Find frequency information of particular words. (หาจำนวนครั้งของแต่ละคำที่เกิดขึ้นใน corpus)			
• Sort word frequency list (จัดเรียงลำดับใน word frequency list)			
• Search word (ค้นหาคำ Corpus)			
• Search collocation (ค้นหา Collocation)			
• Search word with a wildcard (*) (ค้นหาคำโดยใช้ wildcard (*))			
• Sort left or right contexts of keywords (จัดเรียงลำดับข้อมูลซ้ายขวาของ keywords)			
• Find more contexts in full sentence (หาบริบทเพิ่มเติมเป็นประโยคเต็ม)			
• Find more contexts in the source text (หาบริบทเพิ่มเติมจากแหล่งที่มาหรือจากต้นฉบับ)			
• Delete duplicate/unnecessary sentences (ลบประโยคที่ซ้ำหรือไม่ต้องการ)			

4. How often do you use a concordancer to do these activities? Tick (✓) in the appropriate boxes, according to the given numbers. (ท่านสามารถใช้โปรแกรมคอนคอร์แดนเซอร์ทำกิจกรรมต่อไปนี้บ่อยมากน้อยเพียงใด กรุณาใส่เครื่องหมาย ✓ ตามหมายเลขต่อไปนี้)

- 5 = Always (เสมอ)
- 3 = Sometimes (บางครั้ง)
- 1 = Never (ไม่เคย)
- 4 = Often (บ่อย)
- 2 = Rarely (นานๆครั้ง)

Activities (กิจกรรม)	5	4	3	2	1
• Find statistic information of the corpus (หาข้อมูลเชิงสถิติของ Corpus)					
• Build word frequency list (สร้าง word frequency list)					
• Find frequency of particular words. (หาจำนวนครั้งของแต่ละคำที่เกิดขึ้นใน Corpus)					
• Sort word frequency list (จัดเรียงลำดับใน word frequency list)					
• Search word (ค้นหาคำ Corpus)					
• Search collocation (ค้นหา Collocation)					
• Search word with a wildcard (*) (ค้นหาคำโดยใช้ wildcard (*))					
• Sort left or right contexts of keywords (จัดเรียงลำดับข้อมูลซ้ายขวาของ keywords)					
• Find more contexts in full sentence (หาบริบทเพิ่มเติมเป็นประโยคเต็ม)					
• Find more contexts in the source text (หาบริบทเพิ่มเติมจากแหล่งที่มา)					
• Delete duplicate/unnecessary sentences (ลบประโยคที่ซ้ำหรือไม่ต้องการ)					

5. How quick can you do these activities? Tick (✓) in the appropriate boxes, according to the given numbers. (ท่านสามารถใช้โปรแกรมคอนคอร์แดนเซอร์ทำกิจกรรมต่อไปนี้ได้เร็วมากน้อยเพียงใด กรุณาใส่เครื่องหมาย ✓ ตามหมายเลขต่อไปนี้)

- 5 = Very quick (เร็วมาก)
- 3 = Moderately quick (เร็วปานกลาง)
- 1 = Very slow (ช้ามาก)
- 4 = Quick (เร็ว)
- 2 = Slow (ช้า)

Activities (กิจกรรม)	5	4	3	2	1
• Find statistic information of the corpus (หาข้อมูลเชิงสถิติของ Corpus)					
• Build word frequency list (สร้าง word frequency list)					
• Find frequency of particular words. (หาจำนวนครั้งของแต่ละคำที่เกิดขึ้นใน Corpus)					
• Sort word frequency list (จัดเรียงลำดับใน word frequency list)					
• Search word (ค้นหาคำใน Corpus)					
• Search collocation (ค้นหา Collocation)					
• Search word with a wildcard (*) (ค้นหาคำโดยใช้ wildcard (*))					
• Sort left or right contexts of keywords (จัดเรียงลำดับข้อมูลซ้ายขวาของ keywords)					
• Find more contexts in full sentence (หาบริบทเพิ่มเติมเป็นประโยคเต็ม)					
• Find more contexts in the source text (หาบริบทเพิ่มเติมจากแหล่งที่มา)					
• Delete duplicate/unnecessary sentences (ลบประโยคที่ซ้ำหรือที่ไม่ต้องการ)					

6. Apart from the assignment, how often do you access the corpus for your own purposes? (นอกเหนือจากงานที่ได้รับมอบหมาย ท่านใช้คลังข้อมูลด้วยจุดประสงค์ส่วนตัวบ่อยมากน้อยเพียงใด)
   - ☐ Always (เสมอ)
   - ☐ Often (บ่อย)
   - ☐ Sometimes (บางครั้ง)
   - ☐ Rarely (นานๆครั้ง)
   - ☐ Never (ไม่เคย)
7. How confident do you feel in using the concordancer? (ท่านมั่นใจในการใช้โปรแกรมคอนคอแดนเซอร์มากน้อยเพียงใด)
   - ☐ Very much confident (มั่นใจมากๆ)
   - ☐ Much confident (มั่นใจมาก)
   - ☐ Moderately confident (มั่นใจพอสมควร)
   - ☐ Little confident (มั่นใจเล็กน้อย)
   - ☐ Very little confident (มั่นใจน้อยมาก)
8. Do you like using the concordancer? (คุณชอบใช้โปรแกรมคอนคอร์แดนเซอร์หรือไม่)
   - ☐ Very much (มากๆ)
   - ☐ Much (มาก)
   - ☐ Average (ปานกลาง)
   - ☐ Little (น้อย)
   - ☐ Very little (น้อยมากๆ)

Part III: Concordancing Skills (ทักษะทางคอนคอร์แดนซ์)

1. When you read texts in a concordance format, do you use the following reading strategies? (เมื่ออ่านข้อความในรูปแบบคอนคอแดนซ์ คุณใช้เทคนิคการอ่านต่อไปนี้ใช่หรือไม่)

Reading Strategies (เทคนิคการอ่าน)	Yes (ใช่)	No (ไม่ใช่)	Unsure (ไม่แน่ใจ)
• Read the selected lines words by words. (อ่านบรรทัดที่เลือกคำต่อคำ)			
• Find to read full sentences at the top. (หาประโยคเต็มอ่านจากด้านบน)			
• Select to read short or comprehensible concordances. (เลือกอ่านคอนคอร์แดนซ์ที่สั้นหรือที่เข้าใจ)			
• Locate immediate contexts of the keywords and read words in chunks. (กำหนดหาข้อมูลใกล้เคียง keywords แล้วอ่านเป็นกลุ่มคำ)			
• Ignore unnecessary information (ไม่สนใจข้อมูลที่ไม่จำเป็น)			
• Try to identify keywords' parts of speech to help in interpreting (พยายามระบุหน้าที่ทางไวยากรณ์ของ keywords เพื่อช่วยในการตีความ)			
• Find some clues to help understanding texts. (หาบริบทที่ช่วยให้เข้าใจข้อความ)			
• Find keywords' regular collocation. (หากลุ่มคำที่มักเกิดคู่กับ keywords)			
Do you use any other strategies? If yes, please specify. (คุณใช้เทคนิคการอ่านแบบอื่นหรือไม่ ถ้ามี กรุณาระบุ)			

2. Can you use concordance information to do the following activities? (คุณใช้ข้อมูลคอนคอร์แดนซ์เพื่อทำกิจกรรมต่อไปนี้ได้หรือไม่)

Activities (กิจกรรม)	Yes (ใช่)	No (ไม่ใช่)	Unsure (ไม่แน่ใจ)
• Identify parts of speech of keywords from contexts. (ระบุหน้าที่ทางไวยากรณ์ของ keywords จาก contexts)			
• Identify particular groups of phrases of the keywords. (ระบุกลุ่มคำหรือวลีของ keywords)			
• Identify regular collocation of the keywords. (ระบุกลุ่มคำที่มักเกิดคู่กับ keywords)			
• Deduce words meaning from contexts. (เดาศัพท์จากบริบท)			
• Identify key context clues. (ระบุบริบทที่สำคัญๆ)			
• Find some examples of particular patterns according to grammatical rules. (หาตัวอย่างรูปแบบข้อความตามกฎไวยากรณ์)			

3. How quick can you do the following activities? Tick (✓) in the appropriate boxes, according to these numbers. (คุณทำกิจกรรมต่อไปนี้เร็วมากน้อยเพียงใด กรุณาใส่เครื่องหมาย ✓ ตามหมายเลขต่อไปนี้)

- 5 = Very quick (เร็วมาก)
- 4 = Quick (เร็ว)
- 3 = Moderately quick (เร็วปานกลาง)
- 2 = Slow (ช้า)
- 1 = Very slow (ช้ามาก)

Activities (กิจกรรม)	5	4	3	2	1
• Identify parts of speech of keywords from contexts. (ระบุหน้าที่ทางไวยากรณ์ของ keywords จากบริบท)					
• Identify particular groups of phrases of the keywords. (ระบุกลุ่มคำหรือวลีของ keywords)					
• Identify regular collocation of the keywords. (ระบุกลุ่มคำที่มักเกิดคู่กับ keywords)					
• Deduce words meaning from contexts. (เดาศัพท์จากบริบท)					
• Identify key context clues. (ระบุบริบทที่สำคัญๆ)					
• Find some examples of particular patterns according grammatical rules. (หาตัวอย่างรูปแบบข้อความตามกฎไวยากรณ์)					

4. How many problems do you have when dealing with a large amount of information in the corpus? (คุณมีปัญหามากน้อยเพียงใดเมื่อพบข้อมูลจำนวนมากใน Corpus)

☐ Very many (มากๆ)

☐ Many (มาก)

☐ Average (พอสมควร)

☐ A few (เล็กน้อย)

☐ Very few (น้อยมาก)

5. When dealing with a large amount of information in the corpus, what do you do? (เมื่อพบข้อมูลจำนวนมากใน Corpus คุณทำอย่างไร)
   - ☐ Ignore irrelevant information. (ไม่สนใจข้อมูลที่ไม่เกี่ยวข้อง)
   - ☐ Further search other words. (ค้นคำอื่นต่อไป)
   - ☐ Stop using a concordancer. (หยุดการใช้งานคอนคอแดนซ์)
   - ☐ Others. Please specify. (อื่นๆ โปรดระบุ) ……………………………………………
6. Do you think how much a concordance format can help you in identifying groups of words? (คุณคิดว่ารูปแบบคอนคอร์แดนซ์ช่วยคุณในการกำหนดกลุ่มคำได้มากน้อยเพียงใด)
   - ☐ Very much (มากๆ)
   - ☐ Much (มาก)
   - ☐ Average (ปานกลาง)
   - ☐ Little (น้อย)
   - ☐ Very little (น้อยมากๆ)
7. Do you think how much a concordance format can help you in identifying recurrent collocations of words? (คุณคิดว่ารูปแบบคอนคอร์แดนซ์ช่วยคุณในการกำหนดกลุ่มคำที่มักเกิดร่วมกัน collocations ได้มากน้อยเพียงใด)
   - ☐ Very much (มากๆ)
   - ☐ Much (มาก)
   - ☐ Average (ปานกลาง)
   - ☐ Little (น้อย)
   - ☐ Very little (น้อยมากๆ)

Part IV: Attitudes towards the concordance-based method (ทัศนคติต่อวิธีเรียนแบบคอนคอร์แดนซ์)

1. Do you think how much a concordance-based method is useful for studying English? (คุณคิดว่าวิธีการเรียนแบบคอนคอร์แดนซ์เป็นประโยชน์ต่อการเรียนภาษาอังกฤษมากน้อยเพียงไร)
   - ☐ Very much (มากๆ)
   - ☐ Much (มาก)
   - ☐ Average (ปานกลาง)
   - ☐ Little (น้อย)
   - ☐ Very little (น้อยมากๆ)
2. Do you think a concordance-based method is easy or difficult to use for studying English? (คุณคิดว่าวิธีการแบบคอนคอร์แดนซ์ใช้ง่ายหรือยากในการเรียนภาษาอังกฤษ)
   - ☐ Very easy (ง่ายมากๆ)
   - ☐ Easy (ง่าย)
   - ☐ Average (ปานกลาง)
   - ☐ Difficult (ยาก)
   - ☐ Very difficult (ยากมากๆ)

3. How much do you like using the concordance-based method? (คุณชอบใช้วิธีการเรียนแบบคอนคอร์แดนซ์มากหรือน้อยเพียงไร)

   ☐ Very much (มากๆ)

   ☐ Much (มาก)

   ☐ Average (ปานกลาง)

   ☐ Little (น้อย)

   ☐ Very little (น้อยมาก)

4. Will you still use a concordancer to study English on your own? (คุณจะยังคงใช้โปรแกรมคอนคอร์แดนซ์เพื่อเรียนภาษาอังกฤษด้วยตนเองอีกต่อไปหรือไม่)

   ☐ Yes (ใช้) Because (เพราะ) ………………………………………………………….

   ☐ No (ไม่ใช้) Because (เพราะ) ………………………………………………………….

   ☐ Unsure (ไม่แน่ใจ) Because (เพราะ) ……………………………………………….

Part V: Comments and Suggestions (ความคิดเห็นและคำแนะนำ)

Please give your opinions, comments or suggestions for improving the concordance-based lessons. (กรุณาให้ความคิดเห็นหรือคำแนะนำเพื่อนำไปปรับปรุงบทเรียนที่ใช้วิธีการเรียนการสอนแบบคอนคอร์แดนซ์)

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Thank you for your cooperation.

Appendix S

Checklists and Results in Validating Questionnaires

……………………………………………………………………………………

I. A checklist for Questionnaire I

This checklist is used for assessing the Questionnaire I. This questionnaire is going to be used at the beginning of the study in order to collect personal data of the students in both experimental and comparison groups. It consists of five parts i.e., general information, English background, reading background, computer skills, and comments and suggestions.

There are three main parts of the checklist.

1. A checklist for assessing each item of the questionnaire.
2. A checklist for assessing the whole questionnaire in overall.
3. An open-ended part for giving other comments or suggestions.

PART I: For assessing each item of the questionnaire

1. In the following table, please give comments on the following topics.
   - Each item is justified for obtaining necessary data or not.
   - Each question is clear or not.
2. Please use the following symbols for giving comments in the checklists.
   ✓ = Yes
   X = No
   ? = Unsure
3. If needed, please give comments in the available column, write directly in the questionnaires, or use a separate piece of paper.

Part	Items	Justified	Clear Question	Comments / Suggestions
I	1			
	2			
	3			
	4			
II	1			
	2			
	3			
	4			
	5			
	6			
	7			
	8			
	9			
III	1			
	2			
	3			
	4			
	5			
	6			
	7			

	8			
	9			
	10			
IV	1			
	2			
	3			
	4			
	5			
	6			
	7			
	8			
	9			
	10			
	11			
	12			
V	-			

PART II: For assessing the whole questionnaire in overall

1. In the following tables, please give comments whether the given issues are justified.
2. Please use the following symbols for giving comments in the checklists.

✓	=	Yes
X	=	No
?	=	Unsure

3. If needed, please give comments in the available column, or write in a separate piece of paper.

Please give comments whether the given issues are justified or not for serving the objectives of the study.

Issues	Yes / No / Unsure	Comments or Suggestions
1. Design format		
2. Contents		
3. Clear Instruction		
4. Coverage or sufficiency		
5. Others. If any.		

PART III: Please give comments or suggestions for improving Questionnaire I.

Thank you very much for your assistance.

II. A Checklist of Questionnaire II

This checklist is used for assessing the Questionnaire II. This questionnaire is going to be used at the end of the study in order to explore students' learning processes while dealing with the concordance-based method as well as to explore their attitudes towards the method. It consists of five parts i.e., studying performance, computer skills, concordancing skills, attitudes towards the method, and comments and suggestions.

There are three main parts of the checklist.

1. A checklist for assessing each item of the questionnaire.
2. A checklist for assessing the whole questionnaire in overall.
3. An open-ended part for giving other comments or suggestions.

PART I: For assessing each item of the questionnaire

1. In the following table, please give comments on the following topics.
   - Each item is justified for obtaining necessary data or not.
   - Each question is clear or not.
2. Please use the following symbols for giving comments in the checklists.

   ✓ = Yes

   X = No

   ? = Unsure
3. If needed, please give comments in the available column, write directly in the questionnaires, or use a separate piece of paper.

Part	Items	Justified	Clear Question	Comments / Suggestions
I	1			
	2			
	3			
	4			
	5			
	6			
	7			
II	1			
	2			
	3			
	4			
	5			
	6			
	7			
	8			
III	1			
	2			
	3			
	4			
	5			
	6			
	7			
IV	1			
	2			
	3			
	4			
V	-			

PART II: For assessing the whole questionnaire in overall

1. In the following tables, please give comments whether the given issues are justified.
2. Please use the following symbols for giving comments in the checklists.

✓	=	Yes
X	=	No
?	=	Unsure

3. If needed, please give comments in the available column, or write in a separate piece of paper.

Please give comments whether the given issues are justified or not for serving the objectives of the study.

Issues	Yes / No / Unsure	Comments or Suggestions
1. Design format		
2. Contents		
3. Clear Instruction		
4. Coverage or sufficiency		
5. Others. If any.		

PART III: Please give comments or suggestions for improving Questionnaire II.

Thank you very much for your assistance.

III. The results on validity and reliability of the questionnaires

A. Calculation for validity of the questionnaires

To validate the questionnaire, three experts were consulted and they gave their opinions in the checklists on the justification of each questionnaire item. To calculate the data from the checklists, the items marked with agreement on justification is rated 1, those with disagreement is -1, and those with unsure is 0. Then, these results are calculated for means and the overall results were shown in the following table. The issues are considered justified if the mean values are over 0.5.

Results from the checklist for assessing the overall aspects of both questionnaires

	N	Minimum	Maximum	Mean	Std. Deviation
Design format	3	1	1	1.00	.000
Contents	3	1	1	1.00	.000
Clear Instruction	3	1	1	1.00	.000
Coverage or Sufficiency	3	1	1	1.00	.000

B. Calculation for reliability of the questionnaires

After these questionnaires were tried out, only the items in the form of a 5-point rating scale were calculated for the reliability value by using the method of an *alpha coefficient* or *Cronbach's Alpha* at the set point of 0.75.

Alpha value of Questionnaire I

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Alpha if Item Deleted
P2I6	60.0000	86.1000	.3113	.8573
P2I81	58.7619	88.0905	.1577	.8618
P2I82	59.5714	82.1571	.5017	.8511
P2I83	60.7143	88.4143	.1830	.8602
P2I84	60.5714	88.5571	.1220	.8629
P2I85	59.0476	87.1476	.1741	.8627
P2I86	61.5714	81.5571	.5032	.8509
P2I87	60.8095	79.0619	.6306	.8457
P2I88	61.2857	74.5143	.8730	.8347
P2I89	61.3333	79.0333	.6212	.8460
P2I810	61.8095	83.2619	.5938	.8496
P2I811	61.4762	82.0619	.5178	.8505
P2I812	60.1429	74.8286	.7809	.8380
P2I813	61.3333	78.0333	.6109	.8461
P2I91	60.7143	83.9143	.4649	.8527
P2I92	60.6190	85.6476	.4328	.8542
P2I93	60.1905	82.3619	.5353	.8502
P2I94	60.4762	81.9619	.7075	.8465
P3I2	59.3810	91.2476	-.0757	.8745
P3I4	60.1905	86.7619	.3386	.8566
P4I2	59.2857	85.6143	.2604	.8599
P4I5	60.1429	86.1286	.5421	.8534
P3I8	59.7143	87.1143	.1653	.8635
(Note: P = Part, I = Item: For example: P216 = Part 2 Item 1 sub-item 6)				
Reliability Coefficients				
N of Cases = 21.0		N of Items = 23		
Alpha = .8593				

Alpha value of Questionnaire II

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Alpha if Item Deleted
P1I3	149.8571	245.3286	-.0302	.9143
P1I4	150.4286	233.5571	.5449	.9087
P1I6	151.0000	238.0000	.3738	.9104
P1I7	150.0476	244.6476	.0051	.9137
P2I1	150.3333	235.5333	.5405	.9091
P2I2	150.3810	234.2476	.5194	.9089
P2I41	150.6190	234.7476	.3922	.9102
P2I42	150.2857	239.5143	.1922	.9126
P2I43	150.2381	229.6905	.6000	.9077
P2I44	149.7143	235.0143	.4806	.9093
P2I45	149.5238	243.3619	.0954	.9125
P2I46	150.6667	228.9333	.5516	.9081
P2I47	150.4286	237.9571	.1945	.9134
P2I48	149.5238	232.0619	.5484	.9084
P2I49	149.9048	234.6905	.4046	.9100
P2I410	150.4286	234.0571	.3909	.9102
P2I411	150.7619	238.2905	.1406	.9155
P2I51	150.5238	238.0619	.3158	.9109
P2I52	150.3333	236.4333	.4193	.9099
P2I53	150.2381	227.8905	.6756	.9068
P2I54	150.1905	224.3619	.6879	.9061
P2I55	150.0000	227.6000	.6960	.9066
P2I56	150.7619	222.6905	.7134	.9057
P2I57	150.6667	227.0333	.5533	.9081
P2I58	149.9048	226.8905	.5639	.9079
P2I59	150.5714	225.2571	.5525	.9081
P2I510	150.6667	223.2333	.7208	.9056
P2I511	150.8571	231.5286	.3798	.9108
P2I6	151.7143	228.9143	.5982	.9076
P2I7	150.6667	241.3333	.1892	.9120
P2I8	150.4762	237.6619	.3011	.9111
P3I31	151.0476	236.3476	.3818	.9103
P3I32	151.0476	236.8476	.4058	.9101
P3I33	151.0476	234.8476	.4086	.9100
P3I34	150.8095	239.7619	.2257	.9118
P3I35	150.9524	237.2476	.3901	.9102
P3I36	151.0476	232.7476	.4993	.9089
P3I4	151.0952	235.5905	.4435	.9097
P3I5	152.5714	237.0571	.4968	.9096
P3I6	150.3810	239.4476	.3657	.9106
P3I7	150.5714	238.4571	.4067	.9102
P4I1	150.5238	238.3619	.4128	.9102
P4I2	150.7143	240.3143	.3071	.9110
P4I3	150.5238	237.3619	.4005	.9101
(Note: P = Part, I = Item: For example: P113 = Part 1 Item 1 sub-item 3)				
Reliability Coefficients				
N of Cases = 21.0		N of Items = 44		
Alpha = .9117				

Appendix T

Semi-structured Interview

……………………………………………………………………………………………

I. <u>Computer concordancing skills</u>

- Can you use the concordancer well?
- Can you tell in what ways the concordancer can be used?
- Which functions of the concordancer do you use?
- Do you think its use is easy or difficult?
- Do you like using it?
- Suppose that we are going to study a word such as '*depend'* and we would like to know how often this word occurred in our Engineering Corpus. Do you know how to find this information?
- And if we would like to learn more about '*depend*', for example, words in the same family with it, how can we find this information?
- And if we want to know which words often come after '*depend*', how can we do that?
- In this illustration, (either concordances of '*depend'* or '*referred*' were provided), can you specify how many word types of keywords appear?
- What preposition often comes after '*depend/refer*'?
- If too much information appears on the screen after searching a word, what should you do?
- How do you observe which word is a noun, a verb or an adjective?

II. <u>Skills in dealing with concordances</u>

- When you read concordances, which parts do you look at first?
- Do you observe the immediate left and right contexts of the keywords?
- Do you mostly read in concordance lines or find a full sentence at the top?
- Do you read words by words or in chunks of words?

III. <u>Attitudes and opinions</u>

- Do you think the concordance format is helpful for observing the contexts? Why?
- Do you think dealing with the concordancing method helps you memorize the studied words more than usual? Why?
- Do you like using it or not? Why?
- Do you think the method is useful for studying English?
- Can you specify the usefulness of the method?
- How do you feel about using the method?
- Do you have any problems in using the method? If yes, what are they?
- Do you continue to use the method for your own study?
- Would you give comments or suggestions for improving vocabulary learning with the concordancing method?

BIOGRAPHY

Mrs. Pisamai Supatranont was born on September 24th, 1959 in Bangkok. She graduated with an M.A. in Applied Linguistics (English for Science and Technology) from King Mongkut's University of Technology Thonburi in 1993. She also received a scholarship from the Australian Government to further her M.Ed. study in Applied Linguistics at the University of Western Australia in 1997. In 2001, she received a grant from Cambridge University Press in Singapore to join an intensive course for a Specialist Certificate in Language Curriculum and Materials Development from RELC, Singapore. In 2004, she joined an extra-curricular activity of the EIL program to embark on educational visits to different universities in California in the United States of America. Based on her present dissertation, she was awarded a grant for research promotion from the committee of the 2005 KOTESOL conference in Korea. Accordingly, she presented her research study in Seoul, Korea in October 2005 and her paper concerned with this research was accepted for publication in *Korea TESOL 2005 Proceedings*, published in May, 2006.

Currently, she works for Rajamangala University of Technology Lanna, Tak Campus. Her fields of interest are ESP, Materials Designs and Classroom concordancing. She has taught ESP to engineering and business students for 24 years and has developed ESP materials for teaching these students including textbooks for Foundation English and Technical English courses. Her translated works published by Se-Education Public Company Limited include '*Time Management for Teams*', '*Electrical and Electronic Measurement and Testing*' and '*Op Amps & Linear Integrated Circuits for Technicians*'.