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Generating the Specialized Engineering Word List for Students at Tertiary Level Education

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ABSTRACT

Background: Research findings provide evidence that the use of word list may assist students in learning selected words which they may need to know for the purpose of reading and understanding a technical text. Objective: The objectives of the paper are to determine the specialised engineering word contained in the engineering textbooks as well as to identify the percentage of words contain in Specialised Engineering Word List (SEWL) as it is compared to AWL. Results: This study has found that there are 66 words in SEWL and less than 20% of the words listed in SEWL are available in AWL. Conclusion: The findings enhance our understanding that developing a specialised word list requires a systematic process. And the use of corpora instead of dictionary is more appropriate for researchers attempting to generate a word list.

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INTRODUCTION

One of the most significant current discussions in learning vocabulary concerns with the use of the word list for specialised fields in assisting students' curriculum development (Jin, Ling, Tong, Sahiddan, Philip, Azmi and Tarmizi, 2012). The specialised vocabulary is recognisably specific to a particular topic, field, or discipline (Nation, 2001). Looking back at the history of its compilation, its process of compilation has been made as early as the first half of the 20th century. Nation and Waring (1997) argues that mainly the word list compiled basic and high-frequency vocabulary for learners of English. Several word lists that have been made earlier are The Teachers Word Book of 3,000 Words (Thorndike and Lorge, 1944), The American Heritage Word Frequency Book (Carroll, Davies and Richman, 1971) and The General Service List (West, 1953). In spite of the criticisms the latter received on its size (Engels, 1968) and age (Richards, 1974), General Service List (GSL) has been reviewed and referred to by many researchers (e.g. Coxhead, 2000; Li and Qian, 2010; Wand *et al*, 2008). Also, the evidence for this came from the very high coverage that the GSL provides a wide range of texts (Hwang and Nation, 1989; Hirsh and Nation, 1992).

In a further research, Nation and Waring (1997) claimed that vocabulary frequency lists had an important role to play in curriculum design and in setting learning goals. In terms of conducting instructional activity in the classroom, teachers needed to have a reference list to judge whether a particular word deserved attention or not. Not just that, word list also provided a platform for teachers to determine whether or not certain text is suitable to be used for a lesson.

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On the other hand, Baleghizadeh and Ashoori (2010) claimed that word lists are the words that are learned out of context and the main emphasis is on repetition and memorization, not meaningful learning. Even though word lists are profoundly similar to the direct method, it is very helpful to the learner especially the beginners. The teacher would decide what is important for the students to know and specifically explains or demonstrates a skill, and the student attempts to replicate it (Ebert, Ebert, and Bentley, 2011). Other than that, word lists can help learners to expand their English vocabulary by telling them which word they should learn. Those words are very common in English, but are unlikely to discover in a random or natural manner (Cobb, 2004). It functions as a guideline for teacher and learners during the teaching and learning process. Cobb (2004) explained further saying that like any language, English has the habit of recycling a relatively small number of words repetitively. Therefore, when the learner has identified the word that they need to learn, it will enhance their reading ability.

On the other hand, Brown (2001) in his Affective Principles stressed out that there is a strong connection between language and culture. This complex interconnection of language and culture can definitely impact the learner's process of learning English as A second Language (ESL), especially in the ways of thinking, values, and feeling. Thus, in order for the specific language learners to excel in learning English for Specific Purposes (ESP), they need to understand the register used (Chitravelu, Sithamparam and Choon, 2005) which in this case is the technical vocabulary which also known with several names such as academic vocabulary (Martin, 1976), sub-technical vocabulary (Cowan, 1974) or semi-technical vocabulary (Farrell, 1990).

In understanding technical vocabulary, Chung and Nation (2004) claimed that technical vocabulary is subject related, occurs in a specialist domain and is part of a system of subject knowledge. Though the words listed in the technical vocabulary can be considered as content words, they need to be learned within the context of ESP. This is because each of these features can provide a basis for the deliberate identification of terms. Speaking of which, by using a book; Clinically Oriented Anatomy, Chung and Nation (2004) had listed out four methods of identifying technical vocabulary:

1. Using a rating scale:

This interrater reliability can be used to estimate whether there is a reasonable degree of agreement by different raters as to where a lexical item falls on the scale. While using the rating scale, the researchers agreed that in order for them to fully understand the meaning that the words conveyed, they have to be looked at in context. However, for the rating scale to be used efficiently, it requires good knowledge of the subject area as well as the training of the raters should be done using the same kinds of materials that are used for the research.

2. Using a technical dictionary:

The technical dictionary chosen for this method is Dorland's Illustrated Medical Dictionary (2000). The dictionary was chosen for three reasons: the content was updated, large and has been created over 100 years ago.

3. Using clues provided in the text:

For this method, three major clues were included such as definitions, typographical clues like bolding, italics, and brackets and labels in diagrams or illustration.

4. Using a computer-based approach:

By employing RANGE – software which could calculate how often a word occurred (its frequency) and in how many different texts in the corpus it occurred (its range) as a tool to extract terms from the sample text together with a spreadsheet program like Excel, it requires a minimal amount of skill in using both of the programs.

In view of the previous studies conducted on word list, it was found that the recent attention has focused on several aspects of using it in the classroom. One aspect concerns with comparing the use of the word list with other methods of learning vocabulary. Kuo and Ho (2012) conducted a study in a public junior high school in which four intact classes of ninth graders were chosen randomly. Each of the classes was also randomly assigned to four groups which were card-spaced, card-massed, list-spaced and list-massed. All of the students whom average age was 15 were taught by the same instructor/researcher equally. The students were asked to study 120 target words that were selected from the "Basic Word 2000" that was prepared by Taiwan's Ministry of Education (MOE). By employing questionnaire, test and interview, the finding showed that word card strategy left significant effects on vocabulary retention among the students.

Similarly, Baleghizadeh and Ashoori (2010) conducted a study to investigate the effectiveness of using keyword method to teach vocabulary over word list method. The study involved 44 female students at Ansari Junior High School in Astara, Iran. Two intact classes were chosen randomly with an average age of 13.5. Unlike the previous study (Kuo & Ho, 2012), the students did not have any knowledge on the use of keyword method and at the elementary level of English language proficiency. In Baleghizadeh and Ashoori's (2010) study, however, a list of 20 English words with corresponding keyword and their Persian equivalents were randomly selected. In order to make sure that none of the target words have been encountered by the students,

the researcher consulted the teacher in charge for both classes. As a result, Baleghizadeh and Ashoori (2010) confirmed that keyword method has a greater impact on the learner's memory in recalling word definitions.

Another aspect of using word list is to examine its various implementations in classes. Hoshino (2010) determined to prove that word list can be an excellent tool in teaching ESL to the learners. The purpose of his study was to examine which of the five types of word list (antonyms, synonyms, categorical, thematic and arbitrary) assisted L2 vocabulary learning. Conducted the study in Japan, a total of 119 Japanese university students were chosen. In term of the materials, Hoshino (2010) used forty English words for each of the word type. It was evident that among all types of word list, categorical was the most effective list for the L2 vocabulary learning. At the same, the study proved that word list can benefit the learner.

In addition, Jeon and Shin (2011) investigated two different types of vocabulary learning condition; receptive learning and productive learning by using word list. The study that took place in a local private elementary school in Korea. Fifty English as Foreign Language (EFL) learners in the third grade have been selected. All of the students have studied English for at least 3 years and received English lessons five hours per week at school. A vocabulary lesson and tests were administered in an 85 minutes block class. 30 lexical items that were originally selected from the textbook which was used in the school was used for the purpose of this study in which later, it tested to verify that the students were unfamiliar with those items. In between those two learning conditions, the finding proved that productive learning aided learners to retain a substantial amount of vocabulary knowledge.

Foley's (2009) in his study integrated the use of word list in three main reading activities which were pre-reading, while reading and post-reading activities. Such was the implementation of word list in his study due to he argued that teachers need to be creative and inventive in using the resource in teaching English for Academic Purposes (EAP) program. Meanwhile, Wang, Liang and Ge (2008) created the Medical Academic Word List (MAWL) with the intention to help the medical English learners as well as to provide guidelines for the designing and publishing of medical course books. Similar to MAWL, Fraser (2008) has presented the Pharmacology Word List that he claimed can save the learner's time from learning words that would not be used in their pharmacology study. On the other hand, Ward (1999) came up with a vocabulary list specifically designed for the Engineering students. The list contained 2000 word families that covered 95% of the engineering texts. In addition to that, another set of words for the new engineering students was created by Ward (2009). He claimed that these undergraduates needed to be given attention as well since they were new to the world of engineering. In addition, Engineering Technology Word List (ETWL) is developed for English for Engineering Purposes (EEP). The study that was conducted by Jin, Ling, Tong, Sahiddan, Philip, Azmi and Tarmizi (2012) succeeded in developing Engineering Technology Word List (ETWL) consisted of 313 words. The study used corpus namely British National Corpus (BNC) to develop their list.

It can be identified in the literatures that most studies on word list for technical vocabulary were focused mainly on comparing its use with other vocabulary methods. Despite previous researchers' effort in examining the use of technical word lists for EAP, medical and enginering fields, it seems that little is known about developing a word list using engineering online dictionary. Also, no research has been found to compare the word exist in ones word list; in particular engineering word list, with AWL, thus far. Having said this, the purpose of the study, therefore, aim at identifying the specialised engineering word list exist in engineering textbooks. In addition, it compares the word list that is obtained by the current study with AWL. This study, therefore, attempted to answer two research questions:

1. What are the specialised engineering word contained in the engineering textbooks?
2. What is the percentage of words contain in Specialised Engineering Word List (SEWL) as it is compared to AWL?

MATERIALS AND METHODS

Content analysis was used as the method to collect the data for the study. It is a technique that enables researchers to obtain written contents of a communication from newspaper editorials, graffiti, musical compositions, magazine, articles, advertisements and films (Fraenkel and Wallen, 2009). In the present study, content analysis was used to determine the words printed in two (2) textbooks namely AutoCAD and Circuit Analysis I. These books are used by the undergraduate students in Universiti Malaysia Pahang (UMP). The former books are used by the majority of students in all the faculties in the university while the latter is a course book that is used by the students in Electrical and Electronics Engineering Faculty. Figure 1 illustrates the procedures of conducting the content analysis in the study that was adapted from Fraenkel and Wallen (2009).

The first process of collecting data required the researchers to identify the objective of conducting the content analysis. In the study, the aim of using the method is to obtain specialised engineering words printed in the textbooks. The process also involved defining term to be analyzed for the study. As far as this is concerned, the term in the current study referred to the engineering words itself. Also, they were the units or elements that were analysed in the study. The second process involved locating relevant data for the study. In this process, two engineering textbooks were selected and their pages were scanned. Since the objective of the study is to identify

the specialised engineering words contained in the engineering textbooks, all words are considered important. The final stage involved developing a sampling plan that took several phases. In this process, the contents of the pages that were scanned were imported to Notepad. This is to ensure that the contents of the books could be seen and read in the standard Windows format. Later, WordsSmith Version 6 was used to create the preliminary word list. Choosing the command 'WordList' in the program enables one to create a Windows showing the words from the text file in alphabetical order according to frequency order, statistics, filenames and notes. However, some words were discarded due to they were meaningless. To illustrate, the word *clre*, *nzle*, *obser*, *prb*, *prjc* and others were withdrawn from inclusion since they were absent from having definite meanings. From the processes, 1,044 words were initially generated. At this phase also, words contain in SEWL was compared to AWL to obtain its difference in percentage. Later, a non-random sampling method specifically purposive sampling was conducted. Such sampling was employed since it could generate words that were representative in specialised engineering texts. Moreover, the sampling is the most common one in conducting a content analysis (Fraenkel and Wallen, 2009; Leedy and Ormrod, 2005). In the final phase, all 1,044 words were determined by checking its occurrence in online engineering dictionary (http://www.engineering-dictionary.org/Dictionary-of-Technical-English/). This is to ensure that only words exist in the online dictionary would be selected as the final word list, and therefore, representing the specialised engineering words. Concerning reliability and validity of using content analysis to determine SEWL, the former was conducted by acquiring confirmation on the usefulness of the words from academicians teaching engineering courses in UMP. Whereas triangulation was used for the latter in that online engineering dictionary was employed to triangulate that the words in SEWL confirm to be the words used in engineering field.

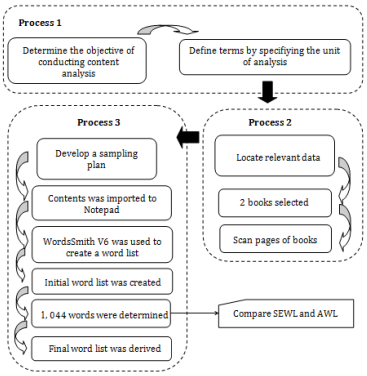

Fig. 1: Procedures of conducting content analysis.

Results:

1. What are the specialised engineering word contained in the engineering textbooks?

To obtain the answer for the first research question, the 1,044 words were mapped with words exist in the online engineering dictionary. This was done by copying and pasting every word that was saved earlier in Excel programme to the online engineering dictionary. Figure 2 shows the word 'condensation' that was copied to the online engineering dictionary to acquire whether or not the word existed in the resource. Upon hitting the "go" button, the definition of the entry returned the explanation of the word.

Fig. 2: Mapping of words.

Having done the process, it can be seen from the data in Table 1 that there are 66 words from SEWL that match with the words in the online engineering dictionary. These words range from one syllable to six syllables words. Table 1 shows the specialised engineering word contained in the engineering textbooks.

2. What is the percentage of words contain in Specialised Engineering Word List (SEWL) as it is compared to AWL?

Descriptive statistics in the form of percentage is used to simplify and summarise the basic information to answer the above research question (Pallant, 2007). As such a simple calculation was formulated to obtain the

percentage of words that exists in SEWL with AWL. Figure 2 presents the formula that is used to calculate the percentage of words that exists in SEWL compared to AWL.

Table 1: Specialised engineering word after mapping.

application	condensation	celsius	toolbar	refrigerator
axis	compound	demonstrate	force	composition
capacitor	connection	pin	plug	steam
carbon	charge	electromagnetic	drop	cursor
component	computer	electron	tab	propane
convection	cover	platinum	moment	side
edge	common	decimal	power	car
environment	course	plates	metal	well
ground	century	cycle	trim	tool
kelvin	chamfer	elastic	right	left
port	compare	degree	current	base
rotation	concrete	element	template	motor
shaft	cold	dashboard	acceleration	velocity
ozone				

Figure 2: Calculation to determine word percentage in SEWL compared to AWL.

$$\frac{x}{1044} X\ 100$$

In comparing the words that exist in SEWL and AWL, the use of Excel programme enabled the SEWL to be inserted in one column. Another column was prepared to tick (√) the word that exists in AWL. In doing this, manual checking of the words was done in that every single word that exists in SEWL is ticked in the AWL column. After comparison was conducted, it is identified that there are 199 words that exist in SEWL are found in AWL. This means only 19% of words from SEWL exist in AWL.

Discussion:

The current study found that there are 66 words under SEWL that may facilitate students in reading engineering materials. The words receive priority in engineering field because of their importance and usefulness as they were checked using the online engineering dictionary. It is encouraging to compare this finding with that of Jin, Ling, Tong, Sahiddan, Philip, Azmi and Tarmizi (2012) in terms of determining words to develop a word list using corpus and dictionary. Their study that used BNC generated 313 words wheras the use of dictionary could produce only 66 words. As advocated by Bian (2006) the larger use of ones resource; in this case a corpus, produces greater number of words to be compiled in preparing a word list. It seems that the use of corpus is more helpful for researchers who attempt to generate a specialised word list. Since the development of word list requires a large corpus, Lee and Low (2014) suggested that the use of corpus-based lexical database is more appropriate. They posited that its use is more supported and reachable to researchers as it is available at any time and place.

Another important finding was that there was less than 20% of the words available in SEWL contained in AWL. This finding, however, could not be generalized. This is because the use of only two engineering course books to generate the word list may not be sufficient. Moreover, their uses may not correspond to other engineering materials. Nevertheless, an issue that emerges from this finding signifies that engineering students are required to know words beyond the AWL to understand engineering resources. Failure to grasp specialised engineering words may result in passive reading among students as they would not be able to understand the materials they are reading. In commenting on this finding, a study conducted by Shafie and Nayan (2011) is worth discussing. Their study reported that many of the university students in Malaysia were struggling readers as they failed to monitor meaning of texts. As a result to passive reading, their academic success may be hindered.

Conclusion:

The present study was designed to identify the specialized engineering words contained in the engineering textbooks as well as to determine the percentage of words contain in SEWL as it is compared to AWL. This study has found that there are 66 words listed in SEWL. The second finding was that there are less than a quarter of words in SEWL are found in AWL. Taken together, these results suggest that developing a specialised word list; in this case engineering word list, requires a systematic process. Although Chung and Nation (2004) argue that using dictionary can be one of the methods to identify technical vocabulary, it seems that its use limits the number of words that may be generated using the resource. As such, further study may compare the use of dictionary and corpus in generating specialised engineering word list.

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