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Development of the Engineering Technology Word List for Vocational Schools in Malaysia

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Abstract: The increasing demand for specialised instruction or lexis for Non-Native English Speakers (NNES) in various disciplines has brought about extensive research of specialized vocabulary in academic texts which help learners to make acquainted with their discourse communities. The word list which consists of the most essential words or known as "building blocks" in the specialized field is regarded as one of the most significant prerequisites in terms of curriculum development. This research emphasizes on the most frequently used engineering academic vocabulary in the form of an engineering technology word list developed using locally written Malaysian engineering technology textbooks for vocational programmes in upper secondary education. The frequently used engineering technology words are selected from the vocational-programme engineering corpus (VPEC) to enhance English for Engineering Purposes (EEP) learning. A word list named Engineering Technology Word List (ETWL) is developed and it is a valuable resource to English for Engineering Purposes (EEP) in Malaysia. The introduction of this word list can be a source of reference where key vocabulary can be accessed for curriculum development in vocational programmes. Besides that, in order for the publishers and EEP textbook writers to further advance the arrangement of vocabulary in developing EEP material, the ETWL should be the key reference.

Keywords: English for Engineering Purposes (EEP), engineering English curriculum development, Engineering Technology Word List (ETWL), vocational-programme engineering corpus (VPEC).

1. Introduction

The trend of education has revolved from teacher-centred or long-established systems found in schools to learner-centred, which focuses on the needs of the students (Nunan, 1996; Cheng, 2000; O'Sullivan, 2004). Due to this, courses and teaching materials are designed with specific group of learners in mind (Moir & Nation, 2002). In response to recognizing learners' needs, extensive research has been conducted on specialised vocabulary in academic texts which helps to socialize learners into their discourse communities (see Mukundan & Ng, 2012; Wang, Liang & Ge, 2008). Researchers have generated word lists which comprise the most important words or "building blocks" for specialised fields in assisting students' curriculum development.

According to Nation (2001), there are four types of vocabulary with majority of the academic words fall under the category of frequently used English words, followed by the academic, technical and low-frequency words. High frequency words are those which are covered by every discipline,

occurring in different kinds of materials and topics with significant coverage. The classic example of high frequency word list is the one introduced by Michael West in 1953 (Coxhead, 2000; Nation, 2001), which until now still provides significant coverage of running words in academic texts. Followed by high frequency words is the academic vocabulary which words that are worth focusing on, during indispensable classes and self-learning time (Coxhead, 2000). The list is made up of words that are supportive of a topic, covering 28 subject areas across the field of Commerce, Law, Science and Arts (Coxhead, 2000).

On the other hand, academic vocabulary, according to Nation (2001), is sometimes called sub-technical vocabulary because it includes not technical but formal words. Sub-technical words can be defined as "context independent words which occur with high frequency across disciplines" (Cowan, 1974, p.391). Trimble (1985, p.130) mentioned that "it refers to those words that have one or more 'general' English meanings and which in technical contexts take on extended meanings (technical, or specialised in some fashion)". Sub-technical or academic (any fields) vocabulary actually pose great difficulties to learners (Cowan, 1974; Trimble, 1985; Fox 1998; Mudraya, 2006; Wang, Liang & Ge, 2008; Ward, 2009), besides the technical words that become major concern and interest of students with special purposes in language learning in specific fields.

The third type of vocabulary is the technical vocabulary, which is designed specifically for learners with special purposes. Words from this category are related closely to a subject matter and they are specialised knowledge in a particular field (Chung & Nation, 2003; 2004). Vocabulary learning, particularly in the acquirement of technical terms of a specialised discipline, is important in students' comprehension in their studies in specialised fields. There is little consensus on what technical vocabulary is. This is due to no distinguished approaches are being employed in determining which words are technical enough to be categorized under this grouping, and no studies can be recognized that measure up the efficacy of various approaches (Chung & Nation, 2003; 2004).Lastly, low frequency words are infrequently used words with wide range which have poor coverage in academic texts (Chen & Ge, 2007). Low frequency words can be described as "words of moderate frequency that did not manage to get into the high-frequency list, proper nouns and words rarely used" (Nation, 2001, p.11). This research aims at developing an engineering technology corpus in Malaysia and the creation of an essential word list, consisting technical and semi-technical engineering words for the field of engineering at vocational school or pre-university level. Therefore, the development of a word list named Engineering Technology Word List (ETWL) will be an asset to English for Engineering Purposes (EEP) in Malaysia, which will be the basis of key vocabulary identified for curriculum development in vocational school programmes. The publishers and EEP textbook writers should make ETWL as the key reference for textbooks produced for secondary, pre-university or university levels. The following sections discuss about the properties of specialised vocabulary and its methodology adopted for the selection of essential words which compose of the ETWL. Section 3 will present the results and discussion in detail about this study whereas section 4 and 5 elaborate on the implication and limitation and future research respectively. In the final section, the researchers would sum up the research, reiterating the value of this ETWL.

1.1 Specialised Vocabulary

Malaysian students in general have limited exposure to English – a language which is perceived as a foreign language – during their secondary education. Factors such as a lack of competency among English teachers and discrepancy in students' proficiency in the language are also key causes which lead to relapse (Choy & Troudi, 2006). These factors have led to generation after generation of Malaysian students who are poorly equipped with their secondary education and face great difficulties in coping with the English language. According to a local Malaysian newspaper, the English proficiency level of Malaysian undergraduates is not up to the world's standard (The Star,

2011, November 7). To make matters worse, these students not only need to cope with the complexity of the language, as they approach tertiary education, they face more challenges, especially in acquiring essential specialised vocabulary in their respective fields.

Bearing those factors in mind, one of the most common problems in specialised vocabulary acquisition is the incapability in recognising the technical words. Most technical words have Greek or Latin based forms and they occur only within a specialised area (Chung & Nation, 2003; 2004); hence, learners who do not have sufficient exposure have difficulty in identifying and interpreting definitions or meaning of words. There are two major problems for teachers in helping learners deal with technical vocabulary. Firstly, the English teacher does not usually have specialist knowledge of the learners' technical areas. Secondly, technical vocabulary needs to be worked on while getting on top of the specialized field. However, the situation can be improved, if these general English teachers are equipped with a specialised word list for teaching the targeted students.

Technical words or vocabulary are closely associated to a specific subject knowledge, field or area of study which occur in specialist domains only with specialised terms (Nation, 2001; Chung & Nation, 2003; 2004). Specific technical words do not possess direct synonyms, variable semantic and wide range (Mudraya, 2006, p.238). According to Nation (2001), there are degrees of technicality of words based on how limited the words are to a specific field. The degree of technicality has been described thoroughly by Menon & Mukundan (2010, p. 243). Their definition of the level or degree of technicality is discussed below:

1. Highly technical words – these are words which appear rarely outside its particular field such as ‘epithelial’ and ‘chromosome’ in the science and medical fields.
2. Sub-technical words – these are ‘context independent’ words (Cowan, 1974, p. 391) which occur with high frequency across disciplines – academic vocabulary.
3. Semi-technical words – these are words which have one or more general English language meanings and which in technical contexts take on extended meanings.
4. Non-technical words – these are words which are common and have little specialization of meaning, for example ‘hospital’ and ‘judge’.

As explicated earlier, technical vocabulary is part of a system of subject knowledge. It could thus be identified by referring to specialists who have good knowledge of the subject area. This can be done in two ways. The first way is by using a technical dictionary compiled by a subject specialist or group of specialists (Nation, 2001, p.201; Oh et al., 2000, p.304). The other way is by making use of clues that the most relevant specialist, the actual writer of the text, used to mark the words considered to be important for the message of the text, since when new terms are introduced in a text, the writers deliberately provide contextual clues to help readers manage new terminologies (Williams, 1981; Bramki & Williams, 1984; Flowerdew, 1992). Due to the reason that technical vocabulary only occur in a specialist domain, another approach for identifying terms would be to compare the frequency of words occurrence in a particular subject area with their frequency of occurrence or non-occurrence in another area or range of areas. Technical terms should either only occur in a specialist area or occur with much greater frequency in that area as compared to other areas (Becka, 1972; Yang, 1986; Baker, 1988; Farrell, 1990; Sutarsyah, Nation & Kennedy, 1994). This kind of comparison can be done using a computer and any of the various corpora available.

When the range of target topics and languages are systematically limited, specialised vocabularies can be harvested (Nation, 2001). In this study, identifying the specialised engineering technology words are the main foci. What is defined as specialised is that the frequency counts using specialised corpus and gathering relevant feedback from the expert (Nation, 2001); in this case with the help of the technical dictionary (Chung & Nation, 2004) are both implemented in this research. Thus, the specialised engineering word list harvested in this study using academic texts can be

defined as field-related words with significant frequency as compared with a larger reference corpus and it consists of both the technical and semi-technical engineering words. This study adapts and adopts methodologies of the specialist researchers in harvesting technical word lists which are not widely investigated in Malaysia and in the world of ELT. Building a field-specific corpus out of materials gathered from a specific field is most appropriate for students in a discourse community (Mudraya, 2006; Ward, 2009; Martínez, Beck & Panza, 2009). With the creation of custom-developed specialised word list, learners will be able to be associated into their discourse community more holistically.

1.2 Learning Vocabulary from a Word List

Learning from a word list can be beneficial to learners, especially learners of English as a second language (Thornbury, 2004; Nakata, 2008). In this research, the word list created is believed to be put into extensive and beneficial use by students whereby students will actually take the initiatives to find the meanings of these specialised words in their first language. Thus a word list is a presentation of L2 words which are tabulated side-by-side with the L1 translations, terms or definitions (Nation, 2001; Thornbury, 2004; Nakata, 2008).

According to Nakata (2008), list learning is categorized as a kind of rehearsal where new information is 'over-learned' and encoded into the long-term memory. If only expanded rehearsal can be adopted and practised by learners, learning vocabulary from a word list can be very effectively executed provided that various methodologies and approaches are incorporated while using the word list (Nakata, 2008). Thus, the word list created from this research can serve only as an ultimate guide where teachers and learners should also teach and learn the word in various holistic and creative manners so that the words from the list can be beneficial to all.

Following the research, it is expected that the use of word list for specialised fields will contribute enormously to students' curriculum development. In taking into account the use of word list for specialized fields in assisting students' curriculum development, there are two interrelated features of vocabulary occurrence in texts. These two features can be divided according to their role in encouraging incidental vocabulary acquisition. The first feature is repetition. However, there is no estimated total number of repetitions of a word to secure it to be learnt (Huckin & Coady, 1999). Nonetheless, numerous researches have suggested a target of 10 repetitions in order to learn unknown words (Saragi, Nation, & Meister, 1978; Nation & Wang, 1999; Webb, 2007).

Meanwhile, spaced repetition comes second. Baddeley (1990) whose research in memory revealed that spaced repetition (i.e the distribution or 'spacing' of repetitions of a word across a text) has the ability to aid acquisition of words as opposed to repetition that is massed (i.e., the concentration of repetitions of a word in a particular part of a text). Massed repetition carries the notion that repeated attention to a word over an uninterrupted length of time; for example 6 minutes, in which spaced repetition relate to providing the same amount of attention to a word over a longer period of time, such as two minutes on three occasions over a two-week period.

Hulstijn (2001, p.286) asserted that "several decades of psycholinguistic research have made it clear that lexical information simply must be reactivated regularly" for retention in real time communication. On the other hand, Ranalli (2003) established that the primary principles for word acquisition are to: 1) use distributed rather than massed repetition; 2) strengthen the intervals between repetitions as the items become more preset in memory; and 3) concentrate more on difficult-to-learn items. In fact, Thornbury asserted that in order to acquire a functioning lexicon is "simply a memory task" (2002, p.145). Aiding learners to develop the quality and efficiency of their repetition is not only pedagogically defensible but is warranted.

2. Methodology

This study incorporates only the prescribed Malaysian engineering technology textbooks for Malaysian upper secondary vocational schools for Form 4 and Form 5 levels. It does not include, in any form the language used in the vocational engineering classrooms and in the examination or test papers at Malaysian national levels. These are the books prescribed to vocational students to be used throughout Malaysia. They are the most appropriate materials used to build the corpus as they are exclusive to the field of engineering for pre-university level. The engineering technology textbooks were chosen because the specialised words identified are assumed to be commonly used across all the engineering disciplines. Furthermore, this is the first pilot study on engineering texts done in Malaysia to develop an essential engineering word list. Thus a limited corpus was used for the purpose of this study.

All the related pages of the textbooks were scanned, digitized and converted into the text files for further analysis using the computer-based approach. The selected books are the prescribed texts by the Malaysian Ministry of Education as below:

1. Abd. Samad Hanif, Azmi Basir, Mohd. Saaya Mohd. Adris & Maimunah Husein (2009). Engineering Technology Form 4. Kuala Lumpur, Malaysia: Dewan Bahasa dan Pustaka.
2. Maimunah Husein, Mohd. Saaya Mohd.Adris, Muhammad Razin Ong Abdullah & Abd. Samad Hanif (2006). Engineering Technology Form 5. Kuala Lumpur, Malaysia: Dewan Bahasa dan Pustaka.

2.1 Word List Harvest Process and Word Selection Criteria

The process used in this study looks at the comparison with a larger corpus to determine and identify the highly technical and semi-technical engineering vocabulary, termed as the engineering technology words. As the operational definition of technical words comes in small number, one particular method to determine technical vocabulary is through comparison of frequency of words and range in a specialised text with their frequency in a general or larger corpus (Nation, 2001; Chung & Nation, 2003; 2004). The chosen reference corpus for this research is none other than the British National Corpus (BNC) which was used in several corpus-based related studies (see Al-Marooqi et al. 2011; Mukundan & Ng, 2012). BNC was also used in Menon's (2009) study of lexical patterns in Malaysian upper secondary science subjects' textbooks and English for Science and Technology (EST) textbooks. It was advocated that the BNC was the ideal corpus to be used as a reference corpus as "the acrolectal version of Malaysian English is similar to that of British English" (p.14). BNC is also the most suitable corpus to be used as reference corpus in this research as it consists of 100 million tokens – it is definitely far greater than at least 5 times greater than the target corpus, as advocated by Berber-Sardinha (2002) and McEnery, Xiao, and Tono (2006).

The computer-based approach of using WordSmith Tools 5.0 (Scott, 2010) and the RANGE software (Heatley, Nation & Coxhead, 2002) is applied in this study. WordSmith Tools 5.0 and RANGE are both computer software developed for concordance and lexical analysis. Using the 'Keyword' function in the WordSmith 5.0 programme, a word list can be created by comparing the target corpus with a reference corpus with only the words with the positive 'keyness' are included in the lists. Also, the specialised words or the engineering technology words are technical and semi-technical words which do not include English function words, the words from the General Service List (GSL) (West, 1953) and the Academic Word List (AWL) (Coxhead, 2000). These types of words can be removed using the RANGE software and this step was implemented after comparing the corpus with the much larger BNC corpus. At this step, RANGE functions as a filter which can segregate the words those of the function, GSL and AWL lexis. The function words, GSL and AWL files, along with the word families were preloaded by the developers of this software. After

removing the function, GSL and AWL words from the analysed engineering technology corpus, the remaining potential words for the list were compared with the on-line McGraw-Hill Dictionary of Engineering, Version 1.0 (2008). In the creation of the pilot science-specific word list (Coxhead & Hirsh, 2007), the words from the GSL and AWL were also removed to find out to what extent there is a list of words occurring outside the GSL and AWL with reasonable frequency and range.

The dictionary was chosen because of the involvement of McGraw-Hill companies in publishing widely in the field of engineering ranging from industrial engineering to the more specific aerospace engineering. If a word from the list appeared in the on-line dictionary, it was then termed as a technical engineering word. Else, the word is considered as a semi-technical word which is almost equally as important. Two experts from the researchers' university, which is an engineering based university, were consulted for their expertise if some of the technical vocabularies identified were technical or semi-technical. Only after these processes, a word list of essential words in the field of engineering technology were determined and segregated. Recommendation regarding using a four step rating scale by Chung and Nation (2003; 2004) is indeed reliable and valid. However, the computer-based approach was preferred in this study due to its practicality (in terms of time consumption) and this approach is more objective as different raters may have different point of views regarding words which should be included in any technical vocabulary lists. ELT practitioners in Malaysia may not possess the needed field expertise as well as the time to carry out the research using the inter-rater reliability concept of the four-step rating scale.

In short, the criteria set for the inclusion of the words into the specialised Engineering Technology Word List (ETWL) are:

1. The frequency of the words from the engineering technology corpus must be significant enough, according to the Keyword function in the WordSmith Tools 5.0 to be regarded as the specialised engineering vocabulary after a comparative analysis with a larger reference corpus (BNC).
2. The words must be closely related to the engineering field. Thus, the lexical items found must be outside of the GSL and AWL list of words. The general English function words must also be removed.
3. The specialised words identified must match the technical words found in the McGraw-Hill on-line dictionary to be considered as technical words. Else, the particular word should be regarded just as a semi-technical engineering word.
4. The identified technical and semi-technical words must be cross-checked with the two experts in the field of engineering to ensure the appropriate words were regarded as the technical words or the semi-technical words or should be omitted.

3. Results and Discussion

"A corpus needs to be justified in linguistics terms - it is not any large collection of texts and corpus linguistics does not begin by accepting certain rules as given; it defines its own sets of rules before applying" (Menon, 2009, p.7). The target corpus needs not be a very large one; even a small corpus can represent a specific part of the language (Mudraya, 2006; Mukudan & Menon, 2007).

From the analysis, the corpus of engineering technology has the strength of 124,584 words and 7,160 types of words. Both textbooks were also analysed in terms of the consistency ratio (types/tokens ratio) and the density ratio (tokens/types) to find out the difficulty level of the prescribed scientific textbooks. The results are shown in Table 1:

Table 1. Characteristics of the textbooks

Textbook	Consistency Ratio	Density Ratio
Form 4 Engineering Technology	9.0	11.2
Form 5 Engineering Technology	7.3	13.7

From the results shown, it is implied that the upper secondary school students in vocational schools in Malaysia have to deal with books which are crammed with words. A new word is introduced after every 9th word for the Form 4 KBSM Engineering Technology textbook whereas for the Form 5 KBSM Engineering Technology textbook, a new word is introduced after the 7th word. Thus, students need a list of words which can help them to focus and understand the engineering textbooks better. In fact, students should focus more on the engineering technology words which are specialised in nature to facilitate better comprehension at college or university level.

The creation of the corpus is aimed at students who barely know specialist engineering words. This research only focuses on the raw words (regarded as types) appearing in the corpus. The word families of a particular word will be regarded as word types as well. For instance, the word 'circuit' and 'circuits' will be considered as two entries of the word types in the list. The word list generated is a list of word types. The words types found were not categorised according to word families because students should learn every single word individually in a lexico-grammatical or authentic context to promote better understanding in the specialised field (Ward, 2009), since most Malaysian students have not attain mastery command of English. By concentrating on word types rather than families, it facilitates learning of individual word in its common structures in the texts, besides diminishing the additional learning load associated with derived and inflected structures (see Ward, 2009; Mukudan & Ng, 2012). Most of the words that made it to the specialised list of engineering technology almost always have the frequency of appearing seven times in the textbooks or corpus, a suggested figure by Thornbury (2002, p.24) for vocabulary retention.

The corpus was cross-checked with the harvested word list as well as those lists of the GSL and AWL to determine the word coverage of the engineering technology texts accordingly. According to Nation (2001), almost 80% of all academic texts consist of high frequency words, with 5% of technical words and low frequency words respectively. Also, the AWL should provide coverage of 10% in any academic texts. However, in this study, that would not be the case except for the AWL coverage in the texts. Table 2 indicates the word coverage of the texts according to the characteristics of vocabulary that of the high frequency words (the GSL), the academic words (the AWL), the technical words and the low-frequency words.

Table 2. The coverage by the different kinds of vocabulary in the target corpus

Coverage of words in:	In any Academic Texts* (%)	In the Target Corpus (%)
GSL	80	69.4
AWL	10	10.4
Technical/Specialised	5	8.7**
Low-frequency	5	11.5
Total	100	100

Denotes:

*Approximation according to Nation (2001) findings.

** Percentage of coverage provided by the ETWL (313 word types). The list of words of the ETWL is attached in Appendix A.

The results indicated that the harvested list actually can provide up to 8.7% of the coverage of the texts despite the small number of words attained from the analysis. It is definitely obvious that the need for the specialised list is significant for the field of engineering, as the percentage of the GSL coverage is not as advocated by Nation (2001) and Coxhead (2000) that the coverage of the GSL words should be around 80% in any academic texts.

Then, two engineering experts from the researchers' university were consulted regarding the doubtful words which were supposed to be part of the list. They were the words that may have fulfilled all the conditions at the marginal border-line or they were considered as neither technical nor semi-technical words. There were 179 words that were considered doubtful for the inclusion into the list and eventually they were rejected (as appended in Appendix B). With a list of 313 word types, learning of engineering words can be better facilitated. Learning from a list can be fruitful if the words are taught systematically and holistically in the classroom environment. The value of learning via a word list perhaps has been underestimated. No doubt students need to have the inner drive and take the initiatives to search for the definition of words and the translations into their first language of the essential word list. It is apparent that searching for technical terms in engineering can be made easier with the use of on-line dictionary. 20 samples of the words definition from the ETWL are shown in Appendix C, using the on-line McGraw-Hill Dictionary of Engineering (2008). Learners should learn the essential word list and the definition in order to understand the subject matter better. Some reasons behind the benefits of list learning would include large numbers of vocabulary can be acquired by students in a considerably short time, perhaps an estimation of thirty words an hour if they are well-rehearsed (Thornbury, 2002). Repetition and recycling of these words are important so that students can learn the vocabulary much more effectively (Mukundan, 2007; 2009).

4. Implications for Teaching and Learning of Vocabulary Using a Word List

As a result of this research, a specialised engineering word list of 313 words is now available for future use in the field of English for Engineering Purposes (EEP), focusing on engineering technology. Learners and instructors alike will appreciate this list as a valuable tool as the words found are closely related specifically to engineering technology. The word list will be an asset to EEP as this will be the first time a word list can be the basis from which vocabulary is identified for EEP curriculum development. Like the Medical Academic Word List, MAWL (Wang, Liang & Ge, 2008), the ETWL aids students and instructors to focus on specific vocabulary in a more vivid and systematic way that facilitates pedagogy. If only the list learning method can be taken care of by learners and educators alike holistically, the specialised word list harvested from this study can prove to be ground-breaking for learners or student engineers who need their instant fix of engineering vocabulary dosage for academic purposes. Students need wide contact to the words right through the texts to encourage learning and acquisition of the vocabulary (Tomlinson, 1998; Nation, 2001; Coxhead and Byrd, 2007). The ETWL is a must-have reference for publishers and engineering textbook writers to enhance or to improve the presentation of vocabulary in EEP materials.

With specialised word lists, learners will be better guided in their vocabulary learning needs, as compared to decades ago. In order to encourage vocabulary acquisition, creative activities for students to explore the essential vocabulary are needed such as the split information, whereby ranking and sharing of information is required (Nation, 2008). Teachers can also introduce fun vocabulary-focused activities for learners to facilitate better learning of the words like in the game of 'Bingo', story constructions and random words connection activities from the list (Thornbury, 2002).Hirsh and Coxhead (2009) also have 10 suggestions to be shared on learning science-related

vocabulary, using Nation's (2007) four strands as a framework, namely the meaning-focused input; meaning-focused output; language-focused learning and fluency. Multimedia can also be used as interactive tools to incorporate and facilitate the teaching of technical vocabulary, like in a research done in Rwanda (see Rusanganwa, 2013) and interdisciplinary approach has also been incorporated in vocabulary learning or awareness in text features (see Stoller & Robinson, 2013).

5. Limitations and Future Research

One of the limitations of the study is that there will be an abundance of information due to the thorough analyses of various features such as the syntactic, pragmatic and phonological elements of each word. This may require more effort and time for information processing in the long run. However, this study only focuses on the lexical aspect in the development of an essential word list. The word list developed is as up-to-date as the current upper secondary Malaysian engineering textbooks of Form 4 and 5. Should the textbooks were rewritten, another analysis must be carried out. Also, in the Malaysian upper secondary textbooks series, there are civil, mechanical and electrical and electronics textbooks. These texts should be included in building a larger corpus to find out more about the engineering vocabulary needed for upper secondary or pre-university education in Malaysia. This study is more like a pilot study of developing engineering-based word list for Malaysian students and the other engineering texts were not included. It was assumed that the engineering technology texts best represent the entire engineering education of upper secondary education as they are not related specifically to an engineering discipline. If possible, electronic version of the texts should be used in a study like this to avoid human errors, difficulties in scanning and save more time. Research can also be carried out comparing the Malaysian upper secondary engineering texts with the pure science texts, such as physics, chemistry and biology to identify the variant properties of the respective texts.

6. Conclusion

The subjects in engineering can be a tough field to study especially when English is not the first language for the learners. Without a comprehensive word list in the field of engineering education, in particular one that is pedagogic in orientation, pedagogy in the definite field can be tricky as learning a language for specific purposes can be a daunting task if the learners are not well guided. It is not an easy task to guess technical or semi-technical engineering technology words from context as student engineers are yet to be expert practitioners while studying in colleges. With lack of adequate background in that technical area (learning technical words is closely related with learning the subject), these technical words are hard to comprehend or guess, especially the terminological words which have very narrow range (Nation, 2001). With the harvested word list, it can be a 'quick fix' for both the students and teachers who are in need of essential engineering vocabularies to function better in the ESP or EAP classrooms. Knowledge of these vocabularies is important for the academic path of learners in becoming professional practitioners or furthering studies in the field of engineering.

Without a word list, material developers might not be able to develop books in more holistic and thorough approach. They will solely base on intuitions and this can lead to the use of vast varieties of words which are not significant and exclusive to engineering education. The ETWL is able to enhance vocabulary learning within the engineering technology context with a word list of 313 specialised engineering technology words selected from a corpus of 124,584 words which serves as a suitable guide for the learners in the field of engineering. Therefore, the study is hoped to supply more knowledge in students' curriculum development especially in the use of word list in the field being discussed. Like in most cases of learning vocabulary, especially in the learning of low-

frequency words, memorization is needed to enable students to master the vocabulary. Explicit learning of vocabulary can be effective if intentional and constant attention is given by learners (Nation, 2001). Thus, using a word list, the intensive and extensive exposure to the essential specialised words can assist students who have specific field-related needs in using English to perform better academically besides socialization into the engineering 'exclusive club'.

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Appendices

Appendix A_1. Engineering Technology Word List (ETWL)
Semi-Technical Words of ETWL

ACTUATOR	BREAKER	COUPLER	ELECTRON
ACTUATORS	BULLDOZER	CRANE	ELECTRONIC
ADHESIVE	CABLE	CRANK	ELECTRONS
ADHESIVES	CABLES	CRANKSHAFT	EMISSION
ADJUSTABLE	CARBON	CROSSCUT	EMITS
ALLOY	CARRIER	DATUM	EMITTER
ALTERNATOR	CAST	DEFORMATION	ERGONOMIC
AMPERE	CASTING	DEMODULATION	EXCAVATING
ANALOG	CEMENT	DEMODULATOR	EXCAVATION
ANALOGUE	CERAMIC	DEMOLITION	EXHAUST
ANTENNA	CIRCUIT	DEPLETING	EXTRUSION
ANVIL	CIRCUITS	DESULPHURIZATION	FEASIBILITY
ANVILS	CLAMP	DIAC	FERROUS
ARC	CLAMPING	DIELECTRIC	FLUX
ARCHITECT	COIL	DIODE	FOOTING
ARCHITECTURAL	COILS	DIODES	FRICTION
ARMATURE	COLUMN	DIOXIDE	FUSE
ASBESTOS	COLUMNS	DISCHARGING	GALVANIZED
AUDIO	COMBINER	DISC	GANTT
AUTOMOTIVE	COMBUSTION	DIVERTING	GAUGE
AUXILIARY	COMMUTATOR	DIVIDER	GENERATOR
BACKHOE	COMPACTION	DOPED	GENERATORS
BANDWIDTH	COMPRESSED	DOWNLINK	GEOSTATIONARY
BASEBAND	COMPRESSION	DUCTILE	GERMANIUM
BATTEN	COMPRESSIVE	DUCTILITY	GUNITING
BATTENS	COMPRESSOR	DUPLEX	HYBRID
BITUMEN	CONDENSER	DUPLEXER	HYDRO
BLANKING	CONDITIONER	EJECTOR	IGNITION
BOLT	CONDUCTOR	ELECTRODE	ILLUMINANCE
BOLTS	CONTAMINANTS	ELECTROLYTIC	IMPELLER
BRAINSTORMING	CONVEYER	ELECTROMAGNET	INDIUM
BRAKE	CONVEYOR	ELECTROMAGNETIC	INDUCTANCE
BRAZING	CORBEL	ELECTROMOTIVE	INDUCTOR

(Continues…)

Appendix A_1. Engineering Technology Word List (ETWL)
Semi-Technical Words of ETWL **(Continues…)**

INDUCTORS	PERPENDICULAR	RISER	SUPERPLASTICIZER
INSTILL	PHOTODIODE	RIVET	SUPERSTRUCTURE
INSULATOR	PIPING	RIVETS	SURVEYOR
INVERTING	PISTON	ROM	SYNCHRONOUS
ISOMETRIC	PLOTTING	ROTATE	SYNTHETIC
JOIST	PLUG	ROTATES	TAMPING
LATHE	PLUGGING	ROTATING	TANK
LEVER	PLUMB	ROTATION	THERMAL
LEVITATION	PLUNGER	ROTOR	THERMOPLASTIC
LIMITER	POLE	RYTHMIC	THERMOSETTING
LINEAR	POLYMER	SCORIA	THROTTLE
LITER	PORT	SEMICONDUCTOR	TRAMMEL
MACHINING	PROPULSION	SEPARATOR	TRANSDUCER
MAGLEV	PROTOTYPE	SHUNT	TRANSFORMER
MAGNET	PULSE	SILICON	TRANSFORMERS
MAGNETIC	PULSED	SILL	TRANSISTOR
MANIFOLD	PUNCH	SLUMP	TRANSISTORS
MONOMERS	PUNCHER	SOLAR	TRANSMITTER
MORTAR	RADAR	SOLDER	TRANSPONDER
MORTICE	RADIOACTIVE	SOLDERED	TRIAC
MORTISE	RADIONUCLIDE	SOLDERING	TURBINE
MULTIPLEXING	RAFT	SOLIDIFICATION	TYRISTOR
MULTIPLIER	RAFTER	SOLIDIFIES	VACUUM
NEUTRON	REAMING	SPARK	VALVE
NEWTON	REBAR	SPINDLE	VALVES
NONFERROUS	RECTIFIER	SPRUE	VERNIER
OHM	RELAY	STATIONARY	VIBRATOR
OPTIC	RELAYS	STATOR	VIDICON
OPTICAL	RENEWABLE	STRUTTING	VOLTAGE
ORTHOGRAPHIC	RESISTANT	SUBCONTRACTOR	WATT
OSCILLOSCOPE	RESISTOR	SUBSTATION	WORKPIECE
OXIDE	RESISTORS	SUBSTRUCTURE	WORKPIECES
PAPERCRETE	REPEATER	SUBSYSTEM	WRENCH
PARABOLIC	RESERVOIR	SUBSYSTEMS	
PENSTOCK	RIDGE	SUPERHET	

Appendix A_2. Engineering Technology Word List (ETWL)
Highly Technical Words of ETWL

ACETYLENE	CALIPERS	CONTACTORS	SOLENOID
AMPLIFIER	CAPACITOR	CONVERTER	SHAFT
AMPLIFIES	CAPACITORS	HETERODYNE	SHEARING
AMPLIFY	CARBURETTOR	HYDRAULIC	SIEVE
AMPLITUDE	CATHODE	HYDROELECTRIC	SIEVES
ANODE	CAVITY	HYDROSEEDING	SILICATE
BEVEL	CHISEL	MODULATED	TELESCOPIC
BIMETALLIC	CHISELS	MODULATION	TENSILE
BINARY	COAXIAL	MODULATOR	TORQUE
BRITTLE	COLLIMATION	OSCILLATOR	TORSION
CALIPER	CONTACTOR	PNEUMATIC	

Appendix B. Rejected Words from the ETWL

AESTHETIC	DIGITAL	FLOWCHART	INSTALLATION
ALUMINIUM	DIRECTIONAL	FLUID	INSTALLED
BATTERY	DISABLE	FOLDABLE	INTAKE
CALLER	DRAIN	FORGING	INTERCOM
CHAINAGE	DRAWINGS	FORMWORK	INTERFACE
CLIENT	DRILL	FUEL	INTERLACING
COMPACTED	DRILLING	FULFIL	INTERLOCKING
COMPACTING	DURABILITY	FULFILL	INTERNET
CONCRETE	DURABLE	GRADUATION	INTRODUCTLON
CONGESTION	EARTHWORK	GRADUATIONS	JEWELRY
CONNECTOR	EQUIPMENTS	GRAPH	JOGGING
CONSTRUCTIONAL	FACSIMILE	GRAPHICS	JOGGLE
CUTLERIES	FASCIA	GROOVED	JUNCTION
CUTTER	FEEDBACK	GROOVES	KEYBOARD
CYLINDER	FIBRE	HACKSAW	LAMINATED
CYLINDRICAL	FILLER	HANDPHONE	LANDFILL
DAM	FILTER	HEIGHT	LANDFORM
DIAGRAM	FIREWIRE	HORIZONTAL	LEAKAGE
DIAMETER	FLATNESS	HOSE	LEGISLATIONS
DIESEL	FLOPPY	INJECTION	LOOSENING

(Continues…)

Appendix B. Rejected Words from the ETWL **(Continues…)**

LOOSING	OBJECTIVES	SECTIONAL	TORCH
LORRY	OVERLOAD	SHRINKAGE	TRAFFIC
LUBRICATED	OVERLOADING	SIGNBOARD	TRISHAW
LUBRICATION	PACKAGING	SILT	TYRE
LUBRICATOR	PESTICIDES	SKETCH	UNEVEN
MACHINERIES	PETROL	SKETCHES	UPLINK
MANIPULATOR	PETROLEUM	SLOTS	USAGE
MATERIAL	PLANK	SPANNER	USERS
METALLIC	PLASTIC	SPANNERS	VERTICAL
METER	PLYWOOD	SQUIRREL	VERTICALLY
MICA	POLARITY	STARTER	VICE
MICROMETER	POLLUTION	STORAGE	VIDEO
MICROPHONE	POLLUTIONS	STOREY	WAIL
MIXER	PORTLAND	SWITCH	WALKIE
MODEM	PORTS	SWITCHES	WALLBOARD
MOISTURE	RECREATION	TAPER	WASHERS
MOLTEN	RECYCLE	TAR	WASTAGE
MOSQUE	RECYCLED	TENON	WEB
MOULD	RECYCLING	TEXTURE	WEBSITE
MOULDING	RENOVATION	THIMBLE	WEBSITES
MOVABLE	SATELLITE	THROATING	WELDING
MULTIMEDIA	SCANNER	TILE	WINDINGS
MULTIPURPOSE	SCANNING	TILES	WORKABILITY
NEWSGROUP	SCREWDRIVER	TIMBER	ZINC
NONLOAD	SCRIBER	TOOTHBRUSH	

Appendix C. 20 Samples of Technical and Semi-Technical Words from McGraw-Hill Online Engineering Dictionary

No.	Word	Definition
1.	Ampere	The unit of electric current in the rationalized meter-kilogram-second system of units, defined in terms of the force of attraction between two parallel current-carrying conductors. Abbreviated a, A, amp.
2.	Amplifier	A device capable of increasing the magnitude or power level of a physical quantity, such as an electric current or a hydraulic mechanical force, that is varying with time, without distorting the wave shape of the quantity.
3.	Amplify	To strengthen a signal by increasing its amplitude or by raising its level.

(Continues…)

Appendix C. 20 Samples of Technical and Semi-Technical Words from McGraw-Hill Online Engineering Dictionary **(Continues…)**

4.	Backhoe	An excavator fitted with a hinged arm to which is rigidly attached a bucket that is drawn toward the machine in operation. Also known as backacter, backdigger, dragshovel, pullshovel.
5.	Caliper	An instrument with two legs or jaws that can be adjusted for measuring linear dimensions, thickness, or diameter.
6.	Capacitor	A device which consists essentially of two conductors (such as parallel metal plates) insulated from each other by a dielectric and which introduces capacitance into a circuit, stores electrical energy, blocks the flow of direct current, and permits the flow of alternating current to a degree dependent on the capacitor's capacitance and the current frequency. Symbolized C. Also known as condenser, electric condenser.
7.	Chisel	A tool for working the surface of various materials, consisting of a metal bar with a sharp edge at one end and often driven by a mallet.
8.	Deformation	Any alteration of shape or dimensions of a body caused by stresses, thermal expansion or contraction, chemical or metallurgical transformations, or shrinkage and expansions due to moisture change.
9.	Linear	Having an output that varies in direct proportion to the input.
10.	Manifold	The branch pipe arrangement which connects the valve parts of a multicylinder engine to a single carburetor or to a muffler.
11.	Modulation	Regulation of the fuel-air mixture to a burner in response to fluctuations of load on a boiler.
12.	Pneumatic	Pertaining to or operated by air or other gas.
13.	Relay	A device that is operated by a variation in the conditions in one electric circuit and serves to make or break one or more connections in the same or another electric circuit. Also known as electric relay.
14.	Shaft	A cylindrical piece of metal used to carry rotating machine parts, such as pulleys and gears, to transmit power or motion.
15.	Shearing	A cylindrical piece of metal used to carry rotating machine parts, such as pulleys and gears, to transmit power or motion.
16.	Spark	A short-duration electric discharge due to a sudden breakdown of air or some other dielectric material separating two terminals, accompanied by a momentary flash of light. Also known as electric spark, spark discharge, sparkover.
17.	Substructure	The part of a structure which is below ground.
18.	Subsystem	A major part of a system which itself has the characteristics of a system, usually consisting of several components.
19.	Torsion	A twisting deformation of a solid body about an axis in which lines that were initially parallel to the axis become helices.
20.	Vernier	A short, auxiliary scale which slides along the main instrument scale to permit accurate fractional reading of the least main division of the main scale.