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Technical Vocabulary Proficiencies and Vocabulary Learning Strategies of Engineering Students

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Abstract

With the growth of English for Specific Purposes (ESP) in the professional and technical areas of study, vocabulary learning strategies are considered to be one of the most important factors for student success in learning technical English. And when it comes to technical English, the other important factor could be students' background knowledge in the area. The current study aimed to 1) investigate technical vocabulary learning strategies use of engineering students; and 2) determine the differences in technical vocabulary learning strategies used by engineering students whose education backgrounds were on different streams. The questionnaire on technical vocabulary learning strategies was administered to 47 undergraduate engineering students from Udon Thani Rajabhat University selected as samples in the study. The subjects were also asked to complete the technical vocabulary test, and some agreed to participate in semi-structured interviews. The findings revealed that students with the educational backgrounds in vocational stream had higher technical vocabulary proficiencies than students whose educational backgrounds were in the general education stream. Differences in the use of learning strategies were found between students who employed different streams of educational backgrounds (general education stream and vocational stream) at the significant level of .05 in determination, memory, and cognitive strategies.

Keywords: technical vocabulary strategies; vocabulary learning strategies; engineering students; educational background

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1. Introduction

Thailand, as well as other members of ASEAN, is moving towards the ASEAN Community by 2015; therefore, the importance of English as the working language is highlighted. The workforce needs to be equipped with adequate English in order to work and to communicate effectively when the changes arrive, and that becomes the challenge of English language education which will have to put the emphasis on working, not only for communication in the field of English for Specific Purposes (ESP). In the field of English language teaching and learning, vocabulary plays an important role in students learning as knowing adequate vocabulary can facilitate students to convey meaning in communication. The importance of learning vocabulary is also supported by Rivers [1] who noted that sufficient vocabulary acquisition is crucial for the use of second or foreign language because of the lacking of extensive vocabulary, students are prevented to employ the structures and functions they have learned for comprehensible communication. According to Nation [2], there are four kinds of vocabulary in a text. Among all vocabulary types, one is vital for English language learning, especially in ESP classes, called 'technical vocabulary'. Chung and Nation [3] suggested that there are considerable researches about high frequency and academic words, but there has been a few about technical vocabulary. Nevertheless, technical vocabulary is widely used by people working or studying in a specialized field which has been recognized as a pivotal part in ESP learning.

Technical vocabulary is closely associated with learners who have a specific purpose in language learning. [4] It can be an ordinary word which provides a specialized meaning that differs from its common meaning when used in a specific field. [5] It also has its uniqueness to its area. [6] Wignell, Martin, and Eggins [7] noted that technical term use can be overlapped with words from other areas. Consequently, technical vocabulary and general vocabulary have some degrees of overlapping. [8]

In an ESP class, learners have to encounter unavoidably different texts especially texts in specific context. Learners have to construct meaning based on their own previous knowledge they have studied when learning a text. Background knowledge also interacts with the meaning of the text. [9] Making sense of new experience was constructed from learners' previous experience. [10] A learner's background knowledge and prior experiences play a large role in vocabulary development with the more background knowledge they have to support understanding while reading texts. [11] It can be said that specific field knowledge is extremely crucial in learning the technical language of that field for understanding texts. Nevertheless, [4,12] pointed that technical vocabulary may be enormous and cannot be neglected in ESP learning. Learners should be helped to deal with unfamiliar technical vocabulary; though, there are different kinds of help would be required. Nation [2] believes that a large amount of vocabulary could be acquired with the help of vocabulary learning strategies, and the strategies are proved useful for students with different language levels. Vocabulary Learning Strategies (VLSs) enable learners to take more control of their own learning so that students can take more responsibility for their vocabulary learning. [2,13] VLSs develop the autonomy of the students by allowing self-directed involvement and helping them gain control of their learning. [14] Learners were considered to employ different vocabulary learning strategies and enter with different learning schemata. Strategy instruction can be considered as a mean to help learners take charge of their own. [15] Thus, VLSs are a key part of language learning strategies.

2. Types of vocabulary learning strategies

There is a wide range of vocabulary learning strategies as shown by classifications of vocabulary learning strategies that have been variously proposed by different researches. [16-22] Although there are definitions of vocabulary learning strategies that have been stated, this study has adapted Schmitt [20] to investigate the vocabulary learning strategies use of students. Schmitt distinguished two broad types: discovery strategies and consideration strategies; although some VLSs may of course be used for both. Then, he further divided the strategies in his taxonomy into Determination Strategies (DET) containing strategies used by an individual when

faced with discovering new word's meanings without recourse to another person's expertise (p. 205). Social strategies (SOC) are ways to interact with other people to improve language learning (p. 210). Memory Strategies (MEM) involve recalling meaning of a word based on its decoding and connection with formerly learned knowledge's students. Cognitive Strategies (COG) are similar to memory strategies in some cases (p.215), but are not focused so specifically on manipulative mental processing. For Metacognitive Strategies (MET), learners can utilise these strategies to control and evaluate their own learning by having an overview of the learning process. 600 Japanese EFL learners were asked to complete a survey to rate their different VLSs use, their perception of useful strategies, and the most helpful ones. The result revealed there are six most used and most helpful which are using a bilingual dictionary, written repetition, verbal repetition, saying a new word loudly, studying a word's spelling, and taking notes in class. Nevertheless, various studies were recently conducted in this field. Some of them are presented as follows.

Gu [23] explored the major factors which are gender and academic major influence language learning. The study based on specific tasks and contexts of learning that may confound the relationship among gender, academic major, learning strategies and learning outcomes using a large-scale survey with a group of adult Chinese EFL learners on their vocabulary learning strategies. The findings revealed that female students significantly outperformed their male counterparts in both the vocabulary size test and the general proficiency test. Also, females reported significantly more use of almost all vocabulary learning strategies that were found to be correlated with success in EFL learning. Conversely, academic major was found to be a less potent background factor. Science students slightly outperformed arts students in vocabulary size, but arts students significantly outperformed science students on the general proficiency test. Moreover, strategy differences were also found between arts and science majors, but differences on most strategy categories were less clear-cut than were those between male and female participants.

Arani [24] explored the strategies used most and least frequently by Iranian medicine students and compared high and low level students. 46 students were required to fill the medical terminology learning strategies questionnaire based on Schmitt's taxonomy. In general, the results showed that they preferred to use written repetition, verbal repetition, and bilingual strategies. In addition, the most proficiency students in medical terminology used various types of strategies more often than the less proficiency students. It was also found significantly that greater learning strategies are used among more successful learners, and there were significant differences by proficiency level in students' use of four strategy categories: determination, memory, cognitive, and metacognitive.

Wen [25] found out and compared the differences of strategy use between academic-oriented and vocational-oriented students. A total of 186 third-grade comprehensive high school students in a private and a public school, including an academic-oriented (AO) class and a vocational-oriented (VO) class, participated in the study. The results were found that AO students employed more learning strategies than VO students for knowing an English word's meaning; in particular, AO students used more determination and more memory that VO students. There were also no significant differences in social, cognitive, and metacognitive strategies. In addition, there were significant differences in overall and each strategy category. Poor vocabulary learners significantly used less learning strategies than good vocabulary learners in learning vocabulary.

Atay and Ozbulgan [26] investigated vocabulary learning strategies use of 50 military ESP learners in Turkey. A multiple-choice vocabulary test and a strategies questionnaire were instruments in order to compare Air Traffic Terminology of two classes. A controlled group had no special training. On the other hand, an experimental group who was presented with VLS also spent six hours each day in class to focus on memory strategy instruction. According to the knowledge of vocabulary post-test, the experimental group showed a significant gain in test's scores compared to the controlled group. The result from the questionnaire was also found that learners in the experimental group indicated a major increase in the use percentage and strategy variety in the post-test.

Akbari and Tahririan [27] examined the extent of Schmitt's taxonomy keeping its relevance in ESP contexts. To elicit VLS, observation, interview, and questionnaire were instruments to collect data with 137 medical and paramedical students. The finding of the questionnaire revealed the major strategies for learning specialized and non-specialized vocabulary did not differ in general among ESP students in different fields of study. The most frequent comprehension strategy was using bilingual dictionary and the most commonly used learning strategy was oral and written repetition. Besides, three main VLSs were elicited from observation and interview, and the rationale for using these strategies were explained according to some underlying factors such as person-related factors (i.e., motivation and learning style), task- related factors (i.e., materials and field variables), and context-related strategies (i.e., educational background and curriculum requirements).

Seddigh and Shokrpur [28] studied vocabulary learning strategies use among medical students at Shiraz University of Medical Sciences in Iran using a questionnaire. The results revealed that guessing and dictionary strategies were the most frequently used VLSs while study preference strategies were the least used ones. The findings of ANOVA found that there were statistically significant differences in the mean scores of the eight strategies: guessing, dictionary, memory, note-taking, selective attention, autonomy, social, and study preference. Besides, they investigated VLSs use based on gender and found that females employed more VLSs than males especially in the case of guessing and note-taking strategies. The statistical analysis indicated that there was a significant difference between the students' gender and their choice of VLSs.

In Thailand, tertiary engineering courses normally include a specialized English course for engineering students which aims to prepare learners with working English in different engineering contexts. Therefore, technical vocabulary is emphasized throughout the teaching and learning. In this study, the context was the technical vocabulary learning of undergraduate engineering students in a tertiary institute in the northeast of Thailand. The students enrolled for engineering courses were required to undertake the English for Engineers Course as a compulsory subject which focused on technical English in a specific engineering field. The purpose is to reinforce students' language ability and skills so that they can apply knowledge of language and technical skills in their field of study and their future careers. The VLSs of technical vocabulary, which is referred to in this paper as the Technical Vocabulary Learning Strategies (TVLSs), could be an important part of the learning in this context. Regarding EFL in the Thai context, there are many studies about vocabulary learning strategies that investigate vocabulary learning strategies use of Thai students. [29-35] However, there are a few studies to examine learning strategies of technical vocabulary. The study, therefore, was conducted with an attempt to discover the Technical Vocabulary Learning Strategies (TVLSs) employed by engineering students based on Schmitt's taxonomy. The present investigation is designed to answer the following questions:

1. What is the technical vocabulary proficiency of engineering students with different streams?

2. What TVLSs do students with educational backgrounds in general education and vocational stream frequently employ?

3. Are there any significant differences in the use of TVLSs between students whose educational backgrounds were on different streams?

3. Research Methodology

3.1 Samples

47 undergraduate Engineering students were selected to be samples by using selective sampling undertaking English for Engineers Course at Udon Thani Rajabhat University. The students were from different educational backgrounds including 25 students who graduated in general education stream from high schools, whereas 22 students were from the vocational stream. All of them were third-year students when the researcher gathered

information. The reason for choosing the students was they were a group of students who enrolled this course in the process.

3.2 Instruments

There were three kinds of research instrument that were utilized in the study. Firstly, this study utilized a 30-item technical vocabulary test including three parts: (a) 10 items was matching electronic devices with their functions, (b) 10 items was completion the blanks by using suitable words, and (c) 10 items was answering multiple choices questions after seeing pictures or circuit symbols. It showed the reliability of 0.91 after the test was piloted. Another one was TVLSs questionnaire adapted from Schmitt's vocabulary learning strategies. The 56-item questionnaire was divided into five categories: determination strategies (item 1-8), social strategies (item 9-16), memory strategies (item 17-42), cognitive strategies (item 43-51), and metacognitive strategies (item 52-56). All of these item were 6-point-rating scale where samples were asked to express their frequently use of strategies with a provided statement. The questionnaire was tried out with 30 students who were not the samples. The result from the piloting shown that the reliability was 0.98 calculated through Alpha Coefficient. Finally, the semi-structured interview was employed to gather additional information about using the strategies of learning technical vocabulary. The content was examined by three experts before the interview took place.

3.3 Data collection and data analysis

Prior to the administration of the survey for accomplishment of the test and questionnaire, participating students were informed about the purposes of the study and the confidentiality of the results. Respondents took 30 minutes to personally answer the test. Then, the questionnaire was distributed to them. They were allowed to ask questions according to the questionnaire items at any time during the process. After that, some agreed to participate in the interview. The data obtained were analyzed by using SPSS. The descriptive statistics were used to describe TVLSs use, and the Independent Samples T-Test was carried out to check whether the differences in TVLSs use between students whose education background were on different streams were statistically significant or not.

4. Results and Discussions

To respond to the first research question, what technical vocabulary proficiency of engineering students with different streams is, the descriptive statistics related to technical vocabulary proficiency of samples were shown in Table 1.

Table 1. The technical vocabulary proficiencies of students with different education stream

Technical Vocabulary Proficiency	General Education Stream				Vocational Stream			
	N	Mean Scores	S.D.	Range of Scores	N	Mean Scores	S.D.	Range of Scores
High	3	20.33	0.58	20-21	9	23.22	2.86	20-28
Moderate	12	13.17	2.66	10-18	9	15.44	3.00	11-19
Low	10	7.30	1.49	5-9	4	7.25	1.26	6-9
Overall	25	11.68	4.75	5-21	22	17.14	6.52	6-28

From the table above, the result of the data analysis revealed that the samples with the educational backgrounds in vocational stream had higher technical vocabulary proficiencies than students whose educational backgrounds

were in general education stream**.** The students from vocational stream also had higher range of scores than students from general education stream. This result may be explained by the fact that students were from different institutions that provides differently curriculum and courses. The students in vocational stream were provided courses of English for specific purposes that prepare learners with working English in engineering contexts. Because it took years to study English in their context, they had sufficient experiences to construct the meaning of words when learning technical vocabulary. It can be assumed that the students had adequate background knowledge of technical vocabulary.

To answer the second research question, what TVLSs students with educational backgrounds in vocational and general education stream frequently employ, the descriptive statistics related to learning strategies of technical were shown in Table 2.

Table 2. Means of five TVLSs used by students with general education and vocational streams
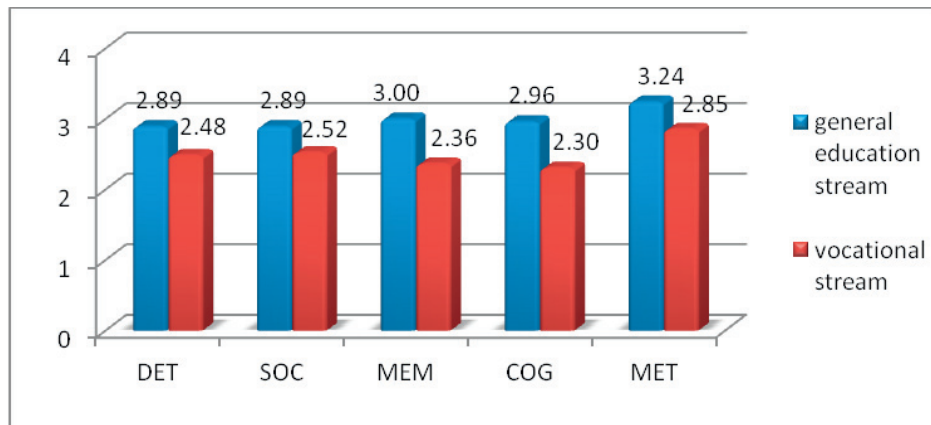
As evidence, the result of the data analysis revealed that the students in general education reported a medium frequency while students in vocational stream reported a less frequency of the mean strategy use on the five categories of the TVLSs. (see table 2). All of the samples stated used metacognitive strategies most frequently. It is remarkable that using metacognitive strategies such as using the English-language media, skipping or passing new word, testing oneself with word tests, and continuing to study word over time, are the high frequency strategies used by all students. A possible explanation is that they were aware of the ways of developing technical vocabulary by using them frequently. In addition, it seems metacognitive strategies especially using the English-language media are popular strategies. This result may be explained by the fact that students are able to access easily materials in their everyday life such as televisions programmes, international films, newspapers, and the Internet. Besides, the findings show that students with general education stream employed determination, social, cognitive, and memory strategies least frequently respectively whereas students with vocational stream preferred social, determination, and memory strategies to cognitive strategies.

The third research question sought to look if there are differences in the use of vocabulary learning strategies according to technical vocabulary. To answer this question, the Independent Samples T-Test was performed on the data as demonstrated in Table 3.

Table 3. The differences of five strategies use by students with different education streams

Category	General Education Stream		Vocational Stream		F
	$\overline{\text{X}}$	S.D.	$\overline{\text{X}}$	S.D.	
Determination Strategies	2.89	0.60	2.48	0.98	*5.42
Social Strategies	2.89	0.74	2.52	1.07	2.50
Memory Strategies	3.00	0.65	2.36	1.05	*4.90
Cognitive Strategies	2.96	0.64	2.30	1.18	*11.14
Metacognitive Strategies	3.24	0.73	2.85	1.00	3.85
Overall	3.00	0.53	2.50	0.98	*7.77

*Note: *$p < .05$*

   As presented in Table 3, for both education streams, this indicated that the most used strategy was metacognitive. The students in general education stream preferred memory and cognitive to determination and social strategies while the students in vocational stream frequently used social and determination strategies more than memory and cognitive strategies.
   In table 3, the Independent Samples T-Test showed there were significant differences in term of frequent use of technical vocabulary learning strategies among the students with general education and vocational stream at the significant level of .05. In addition, the students in vocational stream employed TVLSs less frequently than the students in general education stream. It is interesting to note that the students in vocational stream rarely used TVLSs for learning of technical vocabulary. This is probably because the students have sufficient background knowledge in specific context; therefore, they could understand technical vocabulary without using these strategies which is consistent with Carrell and Eisterhold (1988), who stated that students have to construct meaning based on their own previous knowledge when learning a text. Their background interacts with the meaning of technical vocabulary. However, it is obvious that using high strategies more frequently might not guarantee success in technical vocabulary proficiency. Moreover, the results also found that for determination, memory, and cognitive strategies, students in general education stream used these strategies significantly more often than students in vocational stream. Moreover, there were no significant differences occurred between two groups of students on social and metacognitive strategies.

5. Conclusion

   Based on the results of the study, engineering students with educational backgrounds in vocational stream had higher technical vocabulary proficiencies than students whose educational backgrounds were in general education stream**.** The students in general education also reported a medium frequency while students in vocational stream reported a less frequency of the mean strategy use on the five categories of the technical vocabulary learning strategies. The findings indicated the most frequently used strategies by engineering students in two groups were metacognitive strategies. Besides, the results revealed differences in the use of learning strategies were also found between students with different educational background for each strategy, except for the social and metacognitive strategies, at the significant level of .05. Furthermore, the students in vocational stream employed TVLSs less frequently than the students in general education stream.
   From the results of this study, this would be to develop additional categories of TVLSs to be suitable for the next researcher's situation. This should also be extended to further research about TVLSs that should examine other fileds such as biology, medicine, law, and so on. Besides, this study would be especially fruitful for lecturers in specific purposes. English teachers should raise learners' awareness, recognize the appropriate strategies for the context and suggest them various strategies while the lack of strategies knowledge has

prevented students from employing actively. In order to decide the appropriate kind of TVLSs, they should be trained a variety of strategies in order to adapt for the great benefit they could gain from it.

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