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ความรู้ทางคำศัพท์และกลยุทธ์การเรียนรู้คำศัพท์ภาษาอังกฤษของนักศึกษาไทย

หลักสูตรวิทยาศาสตรบัณฑิต

**English Vocabulary Knowledge and Vocabulary Learning Strategies
of Thai Undergraduate Students in Science Program**

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Abstract

Considering the importance of vocabulary knowledge and the significant contributions of vocabulary learning strategy to vocabulary acquisition, the purposes of the present study are 1) to find out the average size of general and academic English vocabulary knowledge of Thai science undergraduate students and 2) to explore vocabulary learning strategies employed by Thai science undergraduate students. The participants of this study were 165 undergraduate students studying in science program at a provincial campus of a leading research-based university in Thailand. The research findings were obtained from the Vocabulary Levels Test (VLT) by Schmitt et al, (2001), questionnaires based on Schmitt's (1997) taxonomy of vocabulary learning strategies, and focus group interviews. Statistical analysis revealed that the participants' vocabulary size is below 2,000 words. The questionnaires and the interviews revealed that the most frequently employed vocabulary learning strategy was determination strategy. Social strategy, memory strategy, cognitive strategy, and metacognitive strategy were employed moderately. Cognitive strategy was the least employed strategy group. In conclusion, the students' vocabulary size and vocabulary learning strategies indicate that the importance of vocabulary knowledge and vocabulary learning strategy as well as the benefits of employing vocabulary strategy should be emphasized. In order to encourage the students to be independent and self-regulated learners, pedagogical implications are proposed that vocabulary learning strategy instruction can be potentially worthwhile.

Key words: Vocabulary knowledge, Vocabulary learning strategy, English language teaching, Thai undergraduate students, Science program

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การประชุมเสนอผลงานวิจัยระดับบัณฑิตศึกษา มสธ. ครั้งที่ 3
The 3rd STOU Graduate Research Conference

1. Introduction

Vocabulary is the important fundamental component of foreign language acquisition as it is regarded as the core of a language. Vocabulary knowledge is related to foreign language proficiency (Read, 2000). In order to acquire foreign language effectively, a large amount of vocabulary knowledge is desirable. However, recent frequency-based studies reveal that some English vocabulary is found to appear more frequently and more useful than others. Consequently, it might not be necessary for learners who learn English as a foreign language (EFL learners) to know every word in order to use the language effectively (Nation, 2001). In fact, EFL learners should learn certain words that would help them achieve their language learning goals. In case of EFL undergraduate students, the knowledge of high frequency vocabulary and academic vocabulary would facilitate a broad range of academic study (Nation, 2001).

Although acquiring vocabulary knowledge is an effort demanding and time consuming process for non-native language learners, it was found that vocabulary learning strategy is an important factor contributing to successful vocabulary acquisition. For non-native learners, learning vocabulary in a foreign language requires strategic processes to find the meaning of new words such as studying word forms, finding the word meanings from a dictionary, and connecting word forms with meanings (Ellis, 1997). Recent studies of language learning strategies and vocabulary learning strategies in Thai EFL context focusing on the relationship between vocabulary learning strategies and language proficiency reveal that vocabulary learning strategies and vocabulary knowledge are related. Additionally, different groups of students employed different vocabulary learning strategies and the extent to which vocabulary learning strategies employed also varied (Komol & Sripetpun, 2011). Moreover, a recent study concerning vocabulary size and reading comprehension ability of Thai university students reveals that Thai students' vocabulary knowledge is insufficient indicating potential shortcomings in academic studies (Pringprom & Obchua, 2011).

Due to the significance contributions of vocabulary learning strategy to vocabulary acquisition, this study investigates Thai science undergraduate students' vocabulary size and their vocabulary learning strategies. The results of this study can be beneficial for EFL teachers and learners in terms of identifying Thai science undergraduate students' vocabulary status, their potential insufficiency in vocabulary knowledge, vocabulary learning strategies used, and language pedagogical development.

Objective of the Study

- 1) To find out the average size of general and academic English vocabulary knowledge of Thai science undergraduate students
- 2) To explore vocabulary learning strategies employed by Thai science undergraduate students

2. Literature Review

This section discusses vocabulary knowledge and vocabulary learning strategy.

2.1 Vocabulary Knowledge

Vocabulary knowledge is an important component of language learning. Vocabulary is related to four language skills as it plays a supportive role in language learning. Firstly, reading skill is regarded as the most fundamental skill of language that can affect learners' academic success. Reading ability is also related to and affected by vocabulary knowledge as sufficient vocabulary knowledge facilitates reading comprehension (Hu & Nation, 2000; Perfetti, 2007). Vocabulary knowledge was found to be the most important factor related to reading comprehension compared with other factors (Laufer, 1997). In support of the idea that vocabulary knowledge is crucial to reading comprehension, Stæhr (2009) indicates that learners' vocabulary size and the quality of their vocabulary knowledge are factors that predict academic reading comprehension. Not only is vocabulary knowledge related to reading comprehension, but it is also strongly related to listening skills. A study of vocabulary knowledge and listening comprehension in EFL learners reveals the association between vocabulary knowledge and listening comprehension. For EFL learners, knowledge of vocabulary is critical to listening comprehension since it is a fundamental factor contributing to correct comprehension (Stæhr, 2009). Moreover, vocabulary knowledge is essential to writing and speaking skills. According to Nation (1990), writing is stated to be the most common way to assess learners' knowledge in academic study, limited vocabulary range is one of the factors that causes difficulties in academic writing for university students (Jordan, 1997; Leki & Carson, 1994).

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The 3rd STOU Graduate Research Conference

For speaking, less vocabulary is required because topics of speaking tend to be less formal than those of writing (Nation, 2001). Yet, learners should be equipped with vocabulary knowledge in order to be able to produce fluent speech. According to Ferris and Tagg (1996), at university level, speaking skills required vary across academic disciplines.

2.2 Vocabulary Learning Strategy

Another important aspect of language learning that should not be overlooked is the knowledge of language learning strategies. In case of vocabulary, there are several ways to acquire new vocabulary through the employment of vocabulary learning strategies. This study is based on the taxonomy of vocabulary learning strategies which involved two main strategy types namely discovery strategies and consolidation strategies (Schmitt, 1997). According to Schmitt (1997), in finding the meaning of newly encountered vocabulary, one could find it by using strategies such as using dictionaries, guessing the meaning from roots and affixes of the word or simply asking other people. Likewise, retaining the meaning of the learned vocabulary could be achieved by using vocabulary consolidation strategies. For example, one could use strategies such as memorizing words with similar meaning in groups, saying the word aloud, writing the words repeatedly, linking the words with the existing knowledge or personal experience, or using word lists (Schmitt, 1997). In conclusion, vocabulary learning strategies are crucial since they assist EFL learners in acquiring meaning of new words and retaining the meanings of encountered vocabulary which can potentially have positive effects on learners' vocabulary knowledge.

3. Research Methodology

Participants of this study were 165 students studying in the 2nd and 3rd year majoring in Food Technology, Conservation Biology, Agricultural Science, and Geosciences in a Bachelor of Science program in the selected provincial campus of the leading research-based university in Thailand. Participants were selected based on the principle of purposive sampling. The data of this study drew upon 3 main research tools: Vocabulary Levels Test (version 2 revised by Schmitt et al. in 2001), 40-item vocabulary learning strategies questionnaire with reliability of 0.95, and focus group interviews.

The data regarding participants' vocabulary knowledge was obtained from the bilingual version of the Vocabulary Levels Test. The test consisted of 120 words of the 2000, 3000, 5000 word level and the Academic Word List.

The questionnaire was adapted from Schmitt's (1997) taxonomy of vocabulary learning strategies. In order to establish the reliability of the questionnaire, a pilot study was conducted with 50 undergraduate students studying in the 2nd and 3rd year in science program at a different university. Reliability coefficient of the questionnaire is 0.95 indicating an acceptable level of reliability. Statistical analysis for the test scores and the questionnaires includes arithmetic means, standard deviation, and percentage.

Following the careful analysis of the test results and the questionnaires, four sessions of focus group interviews were conducted to obtain more detailed information about vocabulary learning strategies. Twenty-one research participants from every major of study were invited to the focus group interviews and separated into four groups according to their major of study. Each interview session was conducted in a room with 4-7 participants. Additionally, the interview sessions were tape-recorded. The interview tapes were immediately transcribed verbatim after the interviews and the tape scripts were reviewed by the participants afterwards. The tape scripts were manually color-coded according to Schmitt's (1997) framework of vocabulary learning strategies for data analysis. The data were categorized and analyzed according to the framework.

4. Results and Discussions

To answer research question 1 which was "What is Thai science undergraduate students' average size of general and academic English vocabulary?", the Vocabulary Levels Test (VLT) was administered and the data from the Vocabulary Levels Test (VLT) were analyzed by using SPSS to find out the participants' test score.

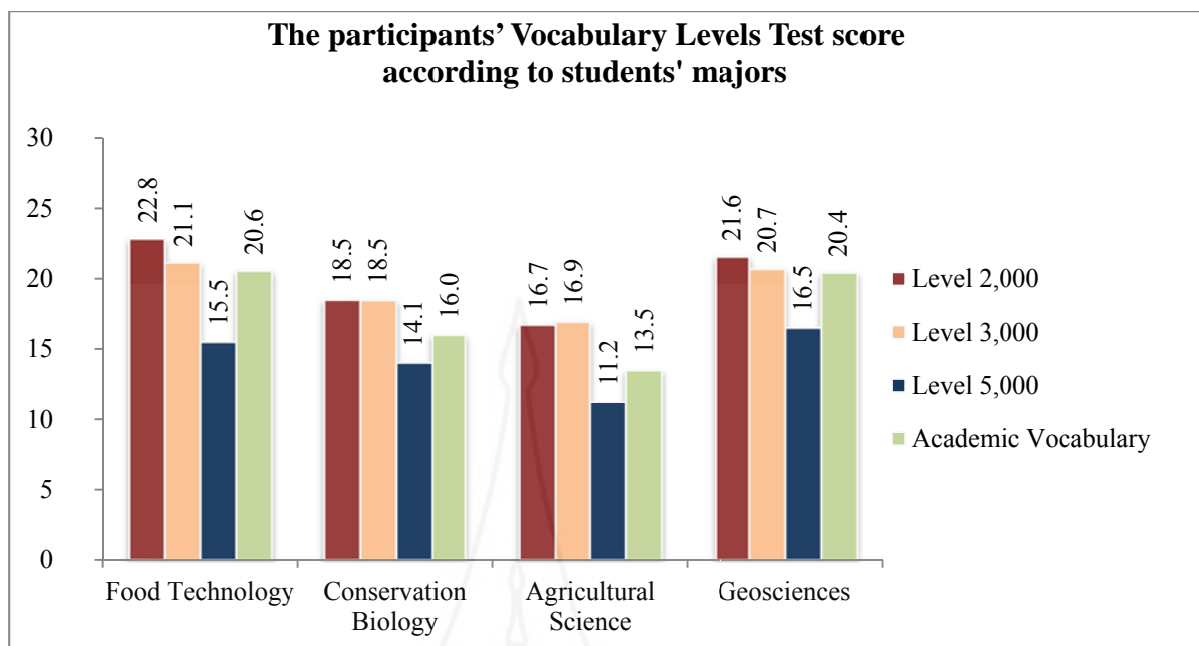


Figure 1: The participants' Vocabulary Levels Test score according to students' majors

The findings displayed in Figure 1 reveal that students from Food Technology major scored the highest in almost every level of the Vocabulary Levels Test. Following the students majoring in Food Technology, the students majoring in Geosciences scored slightly lower in every level except the 5,000 word level which they obtain the highest score compared to other majors of study. The Conservation Biology majored students' mean score ranked the third while the mean score of the students majoring in Agricultural Science is the lowest.

Based on Schmitt et al (2001), the mastery criteria for each level is 26 out of 30 or 80%. The obtained data reveal that most of the participants' test scores, regardless of the majors of study, were below the mastery score for every level. Therefore, it is evident that the participants' vocabulary size of general English vocabulary is below 2,000 words and their knowledge in academic vocabulary is quite limited. The lack of adequate vocabulary knowledge suggests the potential problems in their academic studies.

The participants' limited knowledge of general English vocabulary may lead to problems in their study since they are constantly required to read English textbooks and write in English in their university level science courses. In order to understand English texts, the knowledge of the minimum 2,000 words is required as they are considered very important to academic study (Nation, 2001). The average scores in the three frequency levels represent their vocabulary knowledge insufficiency which can potentially obstruct their academic study. Likewise, the interview data also revealed that the students experienced difficulties when reading and trying to get information from English texts.

The current study's findings also reveal that the participants' academic vocabulary knowledge is quite limited. The low average scores indicate the participants' insufficient academic vocabulary knowledge. The low score might have resulted from the participants' exclusive focus on learning technical vocabulary. The participants stated that they tended to memorize words related directly to their field of study. Although the academic vocabulary provide more coverage in English academic texts than does the technical vocabulary, they were not perceived to be as important.

The test results of the present study suggested that the participants' knowledge of general and academic vocabulary was insufficient considering their academic levels and requirements. The students' limited vocabulary knowledge may be the result of less deliberate vocabulary learning and the lack of effective use of vocabulary learning strategies which will be discussed in the following sections.

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The 3rd STOU Graduate Research Conference

4.1 Vocabulary Learning Strategies employed by Thai science undergraduate students

Research question 2 was “What kinds of vocabulary learning strategies are employed by Thai science undergraduate students?” To find out what kinds of strategies the participants used to learn English vocabulary, the 40-item questionnaires were administered following the Vocabulary Levels Test. The questionnaire data revealed that the participants used various kinds of vocabulary learning strategies to learn new words and to remember learned words. Yet, the frequency of employing each strategy varied. Key findings are presented in table 1.

Table 1 *The Participants' Vocabulary Learning Strategies*

Vocabulary Learning Strategies	Mean	SD	Frequency of use
Determination Strategies	3.60	0.54	Frequently used
- Use an English-Thai dictionary	4.34	0.81	Frequently used
- Use any pictures or gestures to guess	3.88	0.81	Frequently used
- Use an English-English dictionary	2.71	1.11	Moderately used
Social Strategies	3.11	0.64	Moderately used
- Ask your classmates for the meaning	3.75	0.90	Frequently used
- Ask the teacher to give you the definition	3.47	0.93	Moderately used
- Talk with native speakers	2.45	0.94	Slightly used
Memory Strategies	3.11	0.57	Moderately used
- Say the new word aloud when studying	3.54	0.97	Frequently used
- Connect the word to personal experience	3.44	1.03	Moderately used
- Draw a picture of the word to help remember it	2.19	0.93	Moderately used
Metacognitive Strategies	2.99	0.75	Moderately used
- Use English-language media	3.98	0.98	Frequently used
- Play English vocabulary games	2.99	1.12	Moderately used
- Study new words continuously	2.41	0.92	Slightly used
Cognitive Strategies	2.79	0.70	Moderately used
- Take notes or highlight new words in class	3.55	1.07	Frequently used
- Repeat the words aloud many times	3.45	1.05	Moderately used
- Use flash cards to record new words	2.12	0.92	Slightly used

The descriptive statistics for vocabulary learning strategies used by Thai science undergraduate students is presented in Table 1. The reliability for the questionnaire was 0.95 indicating that the questionnaires were exceptionally reliable.

According to table 1, the most frequently employed vocabulary learning strategy type is determination strategies (M=3.60) followed by social strategies (M=3.11), memory strategies (M=3.11), metacognitive strategies (M=2.99), and cognitive strategies (M=2.79) respectively.

4.1.1 Determination Strategy

Determination strategy is the most frequently employed vocabulary learning strategy group compared to other vocabulary strategies. This group of strategies consists of strategies of finding vocabulary meaning without seeking help from others (Schmitt, 1997). The most frequently used strategy to discover vocabulary meaning was to use English-Thai dictionaries. The main reason to this might be that bilingual dictionaries can be easily accessed and the definitions provided in the participants' native language were easier to understand compared to English-English dictionaries. The interviews revealed that besides printed version, English-Thai dictionaries can be immediately accessed

การประชุมเสนอผลงานวิจัยระดับบัณฑิตศึกษา มสธ. ครั้งที่ 3
The 3rd STOU Graduate Research Conference

through participants' mobile phones and computers whenever they wanted to learn new vocabulary. English-Thai dictionaries, both printed and electronic versions, were the common reference material for vocabulary learning among this group of students. Although using English-Thai dictionaries is the most frequently employed determination strategy, the use of English-Thai dictionaries alone may not benefit vocabulary learning and long term vocabulary retention. Relying mainly on the use of bilingual dictionaries may limit vocabulary learning as bilingual dictionaries often contain fewer examples of alternative meanings and word use compared to monolingual dictionaries.

Another frequently used determination strategy is guessing from available pictures or gestures ($M=3.88$). The participants considered available pictures in the text and the interlocutors' gestures helpful when trying to discover meanings of new words while reading or conversing. The use of contextual clues to discover the meaning of words may function as the compensation for the lack of reference materials.

The least frequently employed determination strategy was using English-English dictionaries. The reason why students did not prefer using monolingual dictionaries to discover words meanings might be that using English-English dictionary caused confusion to them. The interviews revealed that some students could not understand the words definition provided in the English-English dictionaries, so they preferred using an English-Thai dictionary. In fact, the reason why the students preferred English-Thai dictionary was quite predictable. The average Vocabulary Levels Test scores indicated that the students' vocabulary knowledge did not reach the 2,000 words level. Nation (2001) states that the knowledge of 2,000 words or more is required for the effective use of monolingual dictionaries. Thus, the participants' insufficient vocabulary knowledge did not allow them to use English-English dictionary effectively.

4.1.2 Social Strategy

Social strategy is another vocabulary learning strategy group used moderately by the science undergraduate students. When discovering the meanings of new words, the participants often consulted friends, teachers, and other people. According to the data obtained, the participants asked their classmates for two purposes. They asked for the meanings of new words and meaning confirmation mainly because they could learn the new words more conveniently. However, if the participants could choose people to ask, they would prefer asking classmates who seemed knowledgeable enough to provide them with the correct word meanings. Apart from classmates, teachers were also considered reliable to provide them with both the correct vocabulary meanings and word uses.

According to data analysis, asking classmates is the most frequently used social strategy possibly because the participants feel more comfortable asking their friends than asking teachers or native speakers. Additionally, asking classmates might be preferable and considered helpful because the participants shared some background knowledge with their friends. The shared background knowledge might facilitate vocabulary learning. Unlike asking classmates, asking native speakers was the least used social strategy. The possible reason might be the participants lacked the opportunity to socialize and interact with native speakers. Since there are only a limited number of foreign teachers in the campus, the participants would have fewer opportunities to converse in English. Although the opportunity to talk to native speakers in their campus was scarce, the participants still sought opportunity to talk with foreigners and practiced their foreign language skills by other means such as using online live chat service and email. It can be interpreted that the participants' limited vocabulary knowledge did not prevent them from using English with English speakers. In addition, the participants' attempts to use English with foreigners showed that they seemed to be aware of the benefits of using social strategies to enhance vocabulary learning.

When consolidating their vocabulary knowledge, the participants often studied vocabulary with their friends. It is evident that group study not only provides the opportunity to share vocabulary learning skills but also creates the challenging atmosphere for vocabulary studying. Hurd (2003) indicates that the opportunity to practice and share learning experience with friends can affect vocabulary learning motivation. Thus, the challenging atmosphere experienced during group studies may function as the vocabulary learning motivation for the students.

4.1.3 Memory Strategy

The findings reveal that all kinds of memory strategy are moderately employed by the students in order to consolidate vocabulary meanings. The students reported connecting new words to their existing vocabulary knowledge and personal experience. They also create mental images of words and their spellings. Saying new words aloud when studying is also found to be the most

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The 3rd STOU Graduate Research Conference

frequently used memory strategy. Convenience might be the possible reason for the students to use this strategy when trying to study vocabulary. Saying the words aloud can be practiced independently. Hence, the students can consolidate vocabulary knowledge on their own in their favorable learning situations.

As memory strategy involves connecting the newly acquired knowledge to the learners' existing knowledge, the two equally employed memory strategies are connecting words to personal experience and connecting words to other words with similar or opposite meaning. Takač (2008) states that relating vocabulary to personal experience, in fact, can be beneficial to vocabulary knowledge development as the vocabulary become more psychologically tangible to learners. Similarly, connecting words with personal experience, according to the participants, helps strengthen their memory of the words meaning and facilitate subsequent words recall.

Additionally, Nation (2001) suggests that elaborative memorization could improve long-term vocabulary retention. However, in the current study, the participants claimed that they only elaborately memorized vocabulary before examinations. Furthermore, they stated that most of the focused words were technical vocabulary related to their major of study. The students' focus on technical terms was likely to be responsible for their experience of the decline in vocabulary knowledge since this category of vocabulary provide roughly 5% coverage in all kinds of written texts (Nation, 2001). The low scores on the Vocabulary Levels Tests might have resulted from the students' focus on memorizing technical vocabulary as well. It is possible that the students could not reach the mastery criteria for each level of the test mainly because the test focused exclusively on high frequency vocabulary and academic vocabulary rather than technical terms.

The least frequently used memory strategy is to draw a picture of a word to help memorization ($M=2.19$). The participants reported using this strategy less because drawing pictures could not represent the meanings of words referring to abstract ideas which they frequently encounter in their studies. This strategy might not be suitable for the level of vocabulary they learn.

4.1.4 Metacognitive Strategy

Metacognitive strategy is moderately employed by the participants. In order to monitor, evaluate, and expand their vocabulary learning progress, the students reported using English-language media and play English vocabulary games as the two most frequently employed strategies to test their understandings of English vocabulary. The students often watch movies, listen to English language music, browse English language websites, and play English vocabulary games in their free time. According to the students, watching movies, listening to English language music, and playing vocabulary games are enjoyable ways to consolidate and expand their vocabulary knowledge. English language media and games are considered interesting and enjoyable vocabulary learning source outside classroom context. The students can choose the types of media and vocabulary games they prefer and enjoy using them in their spare time. Consequently, the students might feel motivated to seek more access to the media over time. Additionally, the enjoyment from using English language media and playing vocabulary games might make the students less aware that they are learning vocabulary.

Metacognitive strategies include the process of planning, monitoring, and evaluating one's vocabulary development (Schmitt, 1997). Although the students use English language media and play vocabulary games to learn vocabulary, the interviews reveal that the students rarely plan their vocabulary study schedule or monitor their vocabulary learning progress due to time constraints. As a result, studying vocabulary continuously was found to be the least employed metacognitive strategy. The use of English language media and games in the current study might not be sufficient to make vocabulary retention successful. In order to consolidate and expand vocabulary knowledge, other metacognitive strategies such as deliberate planning and constant evaluating of vocabulary learning progress might be required in complementary to media use.

4.1.5 Cognitive Strategy

Cognitive strategy was found to be the least employed vocabulary learning strategy group by the participants compared to other vocabulary learning strategy groups. The participants reported using some mechanical means such as taking notes, highlighting new words, saying words repeatedly, and writing words repeatedly when consolidating vocabulary meaning.

Note taking and highlighting were the most frequently used cognitive strategy. The participants often took notes or highlighted new words encountered during reading English texts to help them remember the words better. In order to enhance word memorization, the participants reported that they sometimes said and wrote the words repeatedly until they could remember them. They believed that saying and writing vocabulary repeatedly could potentially enrich their vocabulary

การประชุมเสนอผลงานวิจัยระดับบัณฑิตศึกษา มสธ. ครั้งที่ 3
The 3rd STOU Graduate Research Conference

knowledge. As the findings of determination strategy in this study revealed that the participants preferred learning vocabulary by convenient means, it is possible that the students used verbal and written repetition for the similar reasons. To the students, these two strategies might appear to be easy and not time-consuming. Thus, the students sometimes used them when consolidating vocabulary meanings. In addition, the use of verbal and written repetition is found to be common among EFL learners as these strategies involve less mental manipulation (O'Malley & Chamot, 1990).

The least employed cognitive strategy was using flash cards to record new words. The participants did not regard using flash cards to record new words as a suitable vocabulary learning strategy for their level of study. Based on the participants' preference, flash cards were replaced by other strategies such as memorization and note taking.

The findings of the current study revealed that the participants paid less attention on learning vocabulary and consolidating vocabulary knowledge. Instead, the students' attention on learning vocabulary was rather opportunistic. Additionally, vocabulary learning was not regularly planned and monitored. The participants only focused on learning vocabulary based on classroom materials. Their focus was on technical vocabulary that was directly related to their subjects of study and achieving short-term outcomes such as passing examinations. Thus, the students' vocabulary test scores might have resulted from their habits of vocabulary study. According to the findings, the lack of consistency in studying vocabulary might be one of the factors contributing to limited vocabulary knowledge.

5. Pedagogical Implications

The findings revealed that the participants' vocabulary knowledge is limited despite using various kinds of vocabulary learning strategy. The students' limited vocabulary knowledge may be the result of less deliberate vocabulary learning and the lack of effective use of vocabulary learning strategies. It is evident that although all strategies were used when acquiring and consolidating vocabulary, there is a lack in continuity of strategy uses which might be responsible for the participants' inadequate vocabulary knowledge. Therefore, pedagogical implications are proposed to improve the students' vocabulary acquisition in terms of vocabulary knowledge development and vocabulary learning strategy as follows.

5.1 Vocabulary Knowledge Development

It is evident that the vocabulary knowledge of the participants is insufficient considering their academic level. In order to develop the students' vocabulary knowledge, language teachers should emphasize the importance of vocabulary knowledge and provide substantial vocabulary contents in language courses. As vocabulary acquisition is a cumulative process of learning, the students should be exposed to adequate and comprehensible vocabulary inputs. Language teacher can encourage vocabulary learning by direct teaching of vocabulary and plan the language courses that involve essential vocabulary for the students' academic level. In addition, the importance of high frequency vocabulary and academic vocabulary should be emphasized since the students are likely to encounter these kinds of vocabulary in their studies. Word lists such as the Academic Word List should be introduced to the students since the list contains essential academic words and provides wide range of vocabulary coverage in all kinds of academic texts.

The findings revealed that the students often gain vocabulary knowledge through the use of English language media and online sources. Hence, language teacher should integrate English language media to their language courses. Movies, songs, and vocabulary related games, for instance, can be used as parts of vocabulary lessons. Since the students believe that they gain vocabulary knowledge through movies and music, adding movies and songs to the language courses can make the contents of language lessons more interesting and enjoyable. Moreover, it should be noted that vocabulary learning in classroom contexts might be inadequate to increase vocabulary knowledge. Hence, the use of online sources for vocabulary study should be promoted. Teachers should also introduce students to some useful websites which provide vocabulary-based contents and exercises.

Most importantly, regular and systematic vocabulary assessment should be considered. Regular vocabulary knowledge assessment can potentially make the students aware of the importance of vocabulary knowledge and thus encourage them to study vocabulary regularly.

5.2 Vocabulary Learning Strategy Training

As the process of vocabulary acquisition is effort demanding and the great amount of vocabulary knowledge is required in academic studies, it is important to encourage the students to be self-regulated and strategic language learners. Vocabulary learning strategies play an important role in

การประชุมเสนอผลงานวิจัยระดับบัณฑิตศึกษา มสธ. ครั้งที่ 3
The 3rd STOU Graduate Research Conference

vocabulary knowledge development. Thus, the importance as well as the benefits of using vocabulary strategies should be emphasized.

First of all, English teachers should introduce varieties of vocabulary learning strategies to their students. Teachers can create language courses that allow the students to experience as many vocabulary learning strategies as possible. It is important to recognize individual learner's difference in using vocabulary learning strategies so teachers can support the students to use strategies they prefer and suggest other suitable strategies for them. The findings revealed that the students preferred using dictionaries to discover the meaning of new vocabulary. Thus, training students to use both English-English and English-Thai dictionaries effectively would be worthwhile. Moreover, the findings also reveal that students often guessed the meaning of unknown words from contextual clues. Teachers should teach their students to make the most of contextual clues and guess intelligently. For example, teachers can train their students to scan the texts, look at pictures, and look for words they already know to formulate some idea before reading the texts.

Besides training the students to acquire new vocabulary effectively, it is also essential to teach them how to retain and expand their vocabulary knowledge. According to the findings, although vocabulary knowledge is perceived as an important factor contributing to language learning success, the students stated that they did not have time to study vocabulary on a regular basis. The findings of the questionnaires also revealed that cognitive strategy and metacognitive strategy were the two least often used vocabulary learning strategy groups. Therefore, cognitive strategy and metacognitive strategy should be promoted. Though seem to be shallow compared to other vocabulary learning strategies, the importance of cognitive strategies such as note taking, verbal and written repetition should not be overlooked. The use of these strategies can be directly taught. For example, teachers can train their students to pay attention to new vocabulary and take notes of vocabulary that will be relevant and useful to their academic studies. Moreover, metacognitive strategies can also be promoted in classroom context. Nation (2001) suggests that a combination of incidental learning and deliberate learning can potentially lead to better vocabulary learning. Therefore, language teachers can promote elaborative learning and the use of these strategies by encouraging the students to be more self-regulated and more responsible for their own study. The students should be encouraged to set their learning goals, write reflective journal about their learning progress, and deliberately practice vocabulary regularly both inside and outside classroom contexts. The importance of planning and evaluating the student's own learning should be emphasized.

Additionally, language teachers can promote self-regulated vocabulary learning behavior through English language media use. Besides adding some vocabulary contents from English language media to language courses, teachers can recommend the students to seek more access to vocabulary learning sources outside classroom contexts. As frequent exposure to vocabulary inputs makes vocabulary become more familiar and easier to recall, it would be useful to teach the students to maximize their learning from learning sources outside classrooms contexts, particularly from online learning materials. Moreover, setting vocabulary learning objectives and frequent self evaluation should also be recommended to the students in order to promote self-regulated learning habits.

Finally, positive feedback should be given to students' attempts to use vocabulary learning strategies in class. In order to promote the students' awareness and confidence in using vocabulary learning strategies, affirmative comments and suggestions on how to use vocabulary learning strategies effectively should be provided when students try to use vocabulary learning strategies regardless of the strategies' effectiveness.

6. Limitations of the study

Although the present study is a case study conducted exclusively on a group of science students at a selected university, the study provides useful insights regarding vocabulary knowledge and vocabulary learning strategies employed by Thai undergraduate students in science program. The students' vocabulary knowledge, their vocabulary learning strategies, and their potential shortcomings in vocabulary acquisition were acknowledged in this study. Moreover, pedagogical implications were provided as a contribution to improve English teaching in EFL context.

7. Conclusion

It can be concluded that the science undergraduate students in this study have limited and insufficient vocabulary knowledge which can potentially affect their academic study. Moreover, the use of vocabulary learning strategies is at moderate level. It can be interpreted that this group of

การประชุมเสนอผลงานวิจัยระดับบัณฑิตศึกษา มสธ. ครั้งที่ 3
The 3rd STOU Graduate Research Conference

science students might not be fully aware of the benefits of using vocabulary learning strategies to enhance their vocabulary knowledge and language proficiency. Thus, the importance and the use of vocabulary learning strategies should be introduced and promoted in order to support vocabulary learning outside classroom contexts, ensure deliberate, continuous, and systematic vocabulary acquisition as well as encourage the students to become more self-directed, strategic, and independent language learners.

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