Vocabulary Learning Strategies: Learning Engineering Terminology among Engineering Majors for Industry 4.0 Readiness

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Abstract It is imperative in the era of industry 4.0 for scholars including engineers and practitioners to communicate effectively through mastering technical vocabulary in their specializations. The use of strategies in learning vocabulary has been proven to have a significant impact on the process of learning vocabulary. Nevertheless, it was found that advance learning is insufficient, and the digitization era requires more words to be mastered to have clear communication. Hence, this research aims to discover the strategies used among engineering majors in learning engineering terminology. This research employed mixed methods consisting of both quantitative and qualitative approaches. The instruments of this research are, a vocabulary learning strategies questionnaire and semi-structured interviews. The questionnaires were administered to 150 students majoring in engineering from five engineering clusters. This research found that engineering students employed determination and metacognitive strategies most frequently. The most frequently used strategy was found to be listening and watching English media while the least frequently used strategy was keeping a vocabulary notebook. Findings show that future communication should focus on interactivity of the media used to increase the proficiency of technical vocabulary and the Malaysian government can drive industry 4.0 though strategies identified in this study.

Keywords Engineering Terminology, Explicit Learning Theory, Industrial Revolution 4.0, Technical Vocabulary, Vocabulary Learning Strategies

1. Introduction

Industry 4.0 has become one of the most discussed topics in the literature and among policymakers (Dalenogare, Benitez, Ayala, & Frank, 2018). While the benefits of industrial revolution 4.0 (IR 4.0) have been outlined by scholars, the readiness for firms and countries worldwide remains empirically limited (Dalenogare et al., 2018). In addition, firms face a shortage of engineers that are reliable, with integrity and able to lead firms to industry 4.0 adoption (Muhuri, Shukla, & Abraham, 2019). This poses a challenge for scholars including engineers and policymakers to increase their knowledge and technical vocabulary to be relevant and in line with industrial revolution 4.0. In Malaysia, the education board believes that proficiency of students to achieve advanced technical vocabulary in any specialization lies in English for Specific Purposes (ESP) courses that are starting to rise as the needs of language courses especially English language courses that are related to future professions are starting to be the center of attention. Students across all majors in University of Malaya need to take English courses that are related to their respective fields of study after they have finished the English proficiency courses which are usually taken in their first year of study (Ng, 2001). Designing of these courses started with a project named University of Malaya English for Special Purposes Project (UMESPP) and the research was said to be the pioneer of the productions of materials for teaching reading comprehension in the academic field (Omar, 2017). University students are now expected to be able to read and comprehend the reading materials that are related to their fields of study (Boonkongsaen & Intaraprasert, 2014a). Musikhin (2016) supported the claim by stating that the language is now needed to be related to professional areas or fields, especially for scientists and engineers. After the introduction of UMESPP, most of Malaysian universities adopt a similar approach to strengthen the understanding of students in respective studies. This is more relevant nowadays with Malaysian government embedding industry 4.0 framework in its policy (MITI, 2018).

Yet, most students experience the problem of using English in communication that is needed in both government and private sector (Omar, 2017) to capitalize on the knowledge of industry 4.0, especially engineering undergraduates (Panyawong-Ngam, Tangthong, & Anunvrapong, 2015; Young et al., 2018). One of the most fundamental employability skills in employment is communication which concerns both oral and written communication (Anastasiu et al., 2017). Zafarani and Kabgani (2014) claimed that students are prone to have difficulties in understanding the reading materials despite reading them word by word. This claim suggested that mastery of language is needed especially in the vocabulary area as vocabulary is related to reading comprehension. The relationship between vocabulary knowledge and reading comprehension has been proved by several types of research (Goodwin et al., 2018; Harmon & Wood, 2018; Newton, 2018; Sparapani, Carlisle, & Connor, 2018). Technical vocabulary is defined as vocabulary that has higher frequency words in specific fields such as engineering, science and medical (Harmon & Wood, 2018). These words have their own specific meanings that are designed specifically for certain fields (Hiebert, Scott, Castaneda, & Spichtig, 2019). Tsou and Chen (2014) stated that students tend to be frustrated and demotivated in reading authentic materials or texts that have words that they do not have the knowledge such as technical words.

Nation (2001) suggested the use of vocabulary learning strategies in learning vocabulary as they may help in facilitating the process of vocabulary acquisition. This is supported by Moody et al. (2018) which claimed that explicit instruction on learning strategies is necessary to engage with learning vocabulary. Boonkongsaen and Intaraprasert (2014a) stated that different students or learners may use different strategies in learning vocabulary. According to Schmitt (1997) , there are two broad types of vocabulary learning strategies which are discovery strategies and consolidation strategies. The taxonomy of language learning strategies which is developed based on Oxford (1990) has five classifications which are determination, social, memory, cognitive and metacognitive strategies.

2. Literature Review

Arani (2006) did a study with the aim to investigate the learning strategies among students in the medical field of study in learning English medical terminologies. This study explored the learning of medical terminologies by 89 Iranian students majoring in medicine to second-year classes at Kashan University of Medical Sciences, Iran. This study employed Medical Terminology mid-term examination administered by an English teacher in the faculty of medicine as the instrument along with a vocabulary learning strategies questionnaire which was developed by Schmitt (1997). The result found that students

in typical use repetition strategies including verbal and written repetitions which belong to the cognitive strategies and bilingual dictionary strategies which are one of the strategies under determination strategies most frequently compared to other strategies. In comparison to the vocabulary learning strategies used between students of the high and low level of medical terminology proficiency, high-level learners use vocabulary section in the textbook most frequently to acquire medical vocabulary while interacting with foreign medical staffs was the least preferred strategy. The low-level students, however, chose both written and verbal repetition strategies as the most frequently used strategies while interacting with foreign medical staffs was the least preferred strategies which is similar to the high-level students. The study also found that the students that are the most proficient in medical terminology based on the examination scores use more strategies in learning medical terminology compared to the less proficient students.

Lee (2007) conducted research to identify the perceived use of English vocabulary learning strategies of Korean university students. Four hundred and sixty-six students from two Korean universities in Seoul that were taking English courses participated in the research as samples. The majority of the participating students were found to be female students. In regard to their field of study, sixty percent of the students were majoring in English while the rest are students from other fields of studies such as engineering and business. The instruments that were employed in this research were Vocabulary Learning Strategy Survey and the Vocabulary Levels Test which were adapted from Schmitt (1997) which was used in measuring the students' vocabulary size. The findings of this research reported that the students employed cognitive and memory strategies more frequently than metacognitive and social strategies and social strategies were found to be the least preferred strategies in learning English vocabulary. In comparison to the vocabulary learning strategies used between male and female students, it was found that there was no significant difference in the strategies used and they employed the same strategies almost in the similar frequency. The most frequently used vocabulary learning strategy reported to be using a bilingual dictionary while the least frequently used strategies were found to be practicing word using flashcards strategy. Lee (2007) also stated that the students in the high vocabulary size group use memory strategies significantly more often than the students in the low vocabulary size group.

A study investigating on vocabulary learning strategies (VLS) used among foreign language learners was done by Cengizhan (2011). The research employed a questionnaire which was designed based on data obtained from the literature review. The questionnaire was divided into three parts. Part A collects on the students' demographic information, Part B concerns vocabulary learning strategies used among the students which involve 41 statements and

Part C asks the students on other vocabulary learning strategies that they use other than the ones that are included in Part B. The questionnaire was later distributed to the students on the tenth and eleventh class at Erdine Anatolian Teach Training High School. The result of this study revealed that metacognitive strategies were the most frequently used strategies among the students while cognitive strategies were found to be the least frequently used strategies. The results also showed that the most frequently used strategies among male students were metacognitive strategies while female students employed determination strategies most frequently in learning vocabulary. In comparison to the difference in the most frequently used strategies between students from tenth and eleventh class, there was no difference found as students from both classes preferred to use metacognitive strategies most frequently in learning vocabulary. Cengizhan (2011) concluded that metacognitive was the most frequently used strategies which include listening to songs, watching movies and testing oneself with word test while cognitive strategies which include using flashcards, keeping vocabulary notebook and preparing word lists were the least frequently used strategies among foreign language learners.

Yunus, Sulaiman, and Embi (2013) conducted a study on the use of vocabulary learning strategies among Malaysia gifted students in learning English vocabulary. This research was conducted in favor of only few studies that have been conducted on investigating on gifted students as language learners as they have unique and different ways of thinking and learning. This research involved 104 gifted students that were currently enrolled in a special program called PERMATApintar Education Program. The instruments employed in this study were the Strategy Inventory Language Learning (SILL) questionnaire by Oxford (1990). The findings of the study reported that the students use indirect strategies more than direct strategies based on Oxford (1990)'s classification of strategies. Memory, cognitive and compensation strategies belong to direct strategies whereas metacognitive, affective and social strategies are in indirect strategies category. The most frequently used language learning strategies were metacognitive strategies while affective strategies that deal with feelings and emotions were found to be the least frequently strategies in learning the English language among the gifted students. The results also showed that female students are higher strategy users compared to male students. The male students used social strategies the most often while female students used metacognitive strategies the most frequently. This study concluded that Malaysian gifted students overall are high language learning strategies users.

Boonkongsaen and Intaraprasert (2014b) did a study to examine the vocabulary learning strategies employed by Thai-tertiary level students. This study compared the vocabulary learning strategies to the genders of the students and their levels of vocabulary proficiency. This research employed two instruments which are vocabulary learning strategies questionnaire and vocabulary proficiency test. Both the questionnaire and the test were administered to 905 university students from 11 institutions in Northeast of Thailand. The students were later divided into three groups according to their vocabulary proficiency test scores by using the 'Third Technique' that groups the students into top scoring, middle scoring and bottom scoring groups. Boonkongsaen and Intaraprasert (2014b) reported that female students have a higher mean score in using vocabulary learning strategies compared to male students which indicate that female students used vocabulary learning strategies more frequently than male students. This research also revealed that the female students used 12 vocabulary learning strategies more frequently than male students and only one vocabulary learning strategy that was found to be used more frequently by male students compared to female students. In respect to their vocabulary proficiency test results, this research found that students with high vocabulary proficiency used vocabulary learning strategies more often in comparison to students with moderate and low proficiency levels based on the mean scores. However, there was no significant difference found in the use of vocabulary learning strategies between students in moderate and low proficiency groups. This research concluded that the use of vocabulary learning strategies is significantly higher among female students compared to male students and high proficiency students use vocabulary learning strategies more often than students with moderate and low vocabulary proficiency level.

Ahmad, Yunusb, and Hasana (2016) conducted a study investigating on English language learning strategies employed by Malay part-time learners in learning the English language as a second language of Universiti Teknologi Mara (UiTM) with the goal of improving the learners' English proficiency level. The instruments which are two questionnaires and a semi-structured interview were administered to 120 Malay part-time learners from four UiTM branches. The first questionnaire was SILL adapted from Oxford (1990) whereas the second questionnaire collected data on the learners' background information. The result of this study reported that the respondents are medium strategy users or only sometimes use strategies. Metacognitive strategies were found to be the most frequently used strategies among part-time learners while the students least preferred to use memory strategies in learning the English language. This study concluded that learners are aware of the strategies that can be used in learning the English language. However, awareness is not enough if the strategies are not ensured to be mobilized by the learners.

Leilei (2016) did an empirical study on vocabulary learning strategies possessed by non-English major sophomores in learning English language in Chinese context. This study employed a questionnaire and an interview as the instruments in which the questionnaire

collected quantitative data while the interview obtained qualitative data. The questionnaire was distributed to 100 students majoring in Chinese language and Biology and 20 students out of 100 were selected as participants in the interview. The results of this study reported that selective attention from metacognitive strategies was found to be the most popular and most frequently used strategies. This finding suggested that the students are all positive in identifying important to-be-learned words, thus arousing their consciousness to learn these words. Concerning the most popular belief that words should be learned through the application, the students reported to dislike the use of application strategies. This study found out that most of the students enjoy learning English, although only some of the students like learning English vocabulary. Leilei (2016) stated that one student claimed that even though she spent one and half hours per day to learn English vocabulary, she could not remember all the newly learned words indicating that different strategies work differently on different individuals.

Vela and Rushidi (2016) investigated the way of keeping vocabulary notebooks is one of the strategies under metacognitive strategies on students' vocabulary acquisition. This research was conducted on previous researches that claimed keeping a vocabulary notebook is an effective tool in facilitating vocabulary learning. This research used 90 intermediate students that were taking English classes from the South East European University Language Centre. The students were divided into three groups; one experimental group and two control groups. The experimental group was asked to keep a vocabulary notebook over a ten-week period of learning the same course material and syllabus. The instruments employed in this study include a pre-test, a post-test and a questionnaire. The pre-test and post-test were used to measure the vocabulary proficiency before and after the treatment period while the questionnaire was used to investigate the students' attitude of keeping vocabulary notebook in learning vocabulary. The findings showed that the treatment group outperformed both control groups. Vela and Rushidi (2016) implied that a vocabulary notebook did have a positive effect on vocabulary acquisition. The students who were having vocabulary notebooks with them during the period of ten weeks in learning gave positive feedbacks of the treatment. They claimed that they enjoyed creating vocabulary notebooks and learning words through repetition as it helped them learn better. However, only a minority of the students stated that they would continue to keep the notebooks in the future indicating that this is not the most preferred strategies among the students. Vela and Rushidi (2016) added that this may be due to the notebooks themselves not being enough to promote learners' autonomy.

Puagsang (2017) conducted research with the aim to investigate the vocabulary learning strategies employed among vocational students in learning English vocabulary. This research employed two main instruments which are vocabulary learning strategies questionnaire and semi-structured interview. There are 39 questions in the questionnaire which were classified based on Schmitt (1997)'s taxonomy. The taxonomy has five categories which are determination strategies, social strategies, memory strategies, cognitive strategies, and metacognitive strategies. The questionnaire was administered to 242 first-year high vocational certificate students that were selected from five vocational colleges in Krabi Province, Thailand. The students were categorized based on fields of study which include engineering, accounting, and hotel and tourism. This research reported that social strategies have the highest mean score in comparison to other strategies in terms of frequency of use among the students. Puagsang (2017) also stated that the mean scores of each strategy indicate that the students sometimes used vocabulary learning strategies in learning English vocabulary. The research further explained in detail on the strategies that are frequently used among vocational students. It was found that there were nine strategies that are most frequently used among the students with analyzing any available pictures or gestures having the highest mean score. The least frequently used strategy was reported to be listening to a tape of word list strategy with the lowest mean score among other strategies. The findings of this research also showed that students in hotel and tourism field employed vocabulary learning strategies more frequently than accounting and engineering students in memory strategies.

Ghazali and Ali (2017) investigated the impact of using vocabulary games which belong to metacognitive strategies on learning technical words among engineering students. A vocabulary game called VocBlast was designed to help in vocabulary learning among engineering students as the words are taken from engineering books. The game which can be downloaded from Apple AppStore consisting of ten vocabulary games that can help learners to learn new technical words. This research employed a Likert-type questionnaire to gauge the students' perception of using VocBlast. This research selected 68 students majoring in engineering courses from Universiti Malaysia Pahang (UMP) using purposive sampling technique. The findings of this research showed that there was no significant difference between male and female students' views on the impact of using VocBlast. Ghazali and Ali (2017) stated that this situation that happened may be due to the fact that adoption of mobile technologies as suggested by Adegbija and Bola (2015) did not have any impact on both genders. This research concluded that more time is needed for the students to play with VocBlast to measure a more significant impact on vocabulary learning on longer exposure to learning aids.

The theory that becomes the backbone of this study is Explicit Learning Theory which was proposed by (Ellis, 1994, 1997). This theory falls under Incidental Vocabulary Acquisition which also includes Implicit Vocabulary Learning. This theory proposes that learning vocabulary needs both explicit and implicit acquisition. However, only explicit learning concerns learning the semantic properties of the words and mapping word form to meaning in which the learning process involves awareness. Inferring or

discovering new or unknown word meanings from context involves conscious cognitive operation including selective attention, hypothesis formation, and strategy application. Thus, it can be inferred that vocabulary learning strategies are employed in the process of learning a word and its meaning.

Basically, it means that some learners prefer to use memorization and some use repetition of reading and listening to increase their proficiency. There are already scholars covering this understanding in the literature in terms of skills. However, a literature review on the area of investigation particularly in industry 4.0 and multidisciplinary study are limited. This is due to the theory employed by scholars such as Explicit Learning theory is used in education and psychology fields. Nevertheless, there is an opportunity for the scholars to expand the theory further in the latest trend in IR 4.0.

This research was conducted to answer these research questions:
1. What are the most and the least frequently used strategies among engineering undergraduates in learning engineering terminology?
2. Is there any significant difference in strategies used among engineering undergraduates in learning engineering terminology according to the field of study?
3. Is there any significant difference in strategies used among engineering undergraduates in learning engineering terminology according to years of study?
4. Is there any significant difference in strategies used among engineering undergraduates in learning engineering terminology according to English language proficiency?

3. Methodology/Materials

This research employed a mixed method design in which quantitative and qualitative approaches were used in collecting data. Kumar (2019) stated that the main core of mixed method design is the use of multiple methods that belong to both quantitative and qualitative paradigms. This design was adopted from studies by Fan (2015); Puagsang (2017); Wanpen, Sonkoontod, and Nonkukhetkhong (2013) which employed both quantitative and qualitative paradigms in answering their research questions.

3.1. Participants

150 students majoring in engineering from five different clusters participated in this study and 12 students volunteered to be participating in the interview sessions. The five clusters involved in this study represent the main engineering clusters available in Malaysia. The population of this study is university students while the sample frame is engineering students in the third and fourth year of study.

3.2. Vocabulary Learning Strategies Questionnaire (VLSQ)

A vocabulary learning strategies questionnaire was employed in investigating the use of vocabulary learning strategies in learning technical vocabulary. Questionnaires are suitable for a study that has a substantial number of participants and they usually take minimal time from the participants. The questionnaire was adapted from Puagsang (2017) which consists of 39 5-point Likert-scale questions. The questions were divided into five categories based on Schmitt taxonomy which includes determination, social, memory, cognitive and metacognitive. This study reliability test of Cronbach alpha has a high value of 0.917. This pilot test was conducted before real data collection took place through e-survey.

3.3. Semi-Structured Interview

The interview was held after the collection of quantitative data using the questionnaire was completed. The interview was a one-to-one interview which helps in eliminating responses based on other students' views on vocabulary learning strategies. The interview questions were adapted from Fan (2015). The interview questions later went through Interview Protocol Refinement (IPR) as proposed by Castillo-Montoya (2016) to strengthen the reliability of the questions. The process of refining the questions includes suitability and language check which aims to eliminate vague content and words that might affect the outcomes of the interview.

3.4. Data Analysis

The data were analyzed using descriptive statistics, analysis of variance (ANOVA) and independent sample t-test. The mean scores were ranked according to the ranking of frequency by Puagsang (2017). The interpretation of the mean score was applied also from research by Puagsang (2017) in analyzing the vocabulary learning strategies questionnaire. The mean score of vocabulary learning strategies was interpreted as follows: Always used (4.21 to 5.00), Frequently used (3.41 to 4.20), Sometimes used (2.61 to 3.40), Seldom used (1.81 to 2.60), Never used (1.00 to 1.80)

4. Results and Findings

4.1. Results

This section presents the data analysis of the data collected which includes descriptive statistics, ANOVA test, and independent sample t-test. Table 1 shows the descriptive statistics of vocabulary learning strategies used among engineering undergraduates.

Table 1. Descriptive statistics of vocabulary learning strategies used among engineering undergraduates

Vocabulary Learning Strategies	Mean	Std. Deviation	Frequency Level
Determination	3.49	0.510	Frequently
Social	3.23	0.641	Sometimes
Memory	3.25	0.577	Sometimes
Cognitive	3.09	0.643	Sometimes
Metacognitive	3.68	0.587	Frequently

Table 1 shows the mean scores of vocabulary learning strategies used among engineering undergraduates based on Schmitt's taxonomy. It was found that the strategies that were most frequently used among engineering students are determination and metacognitive strategies with a mean score of 3.49 and 3.68 respectively with metacognitive being the most frequently used vocabulary learning strategies. Social strategies with 3.23, memory strategies with 3.25 and cognitive strategies with 3.09 belong to the sometimes-used strategies category. Table 2 shows the descriptive statistics of the ten most frequently used strategies in learning technical vocabulary

Table 2. Descriptive statistics of the ten most frequently used strategies in learning technical vocabulary

Strategies	Category	Mean Score
Listen to and watch English media	MET	4.29
Analyze any available pictures or gestures	DET	3.95
Guess word meaning from textual context	DET	3.95
Read English media (cartoon books, magazines)	MET	3.94
Try to speak or describe in English	MET	3.85
Ask classmates for meaning	SOC	3.84
Translate word from English to the first language	MET	3.77
Translate word from the first language to English	MET	3.75
Play online games	MET	3.74
Learn word through verbal repetition	COG	3.71

As shown in Table 2, listening and watching English media such as movies and songs strategy was found to be the most frequently used and most preferred strategy among engineering undergraduates. It is aligned with the overall strategy used among engineering undergraduates which are strategies from Metacognitive category. Metacognitive strategies were found to be the dominating strategies in the ten most frequently used strategies. Table 3 shows the ten least frequently used vocabulary learning strategies among engineering undergraduates.

According to Table 3, the least frequently used strategy is found to be keeping a vocabulary notebook everywhere you go under Cognitive category with 2.41. Similarly, another least frequently used strategy was found to be another strategy under Cognitive category which was listening to a tape of word list with a mean score of 2.45. Table 4 shows the mean score for vocabulary learning strategies used

among engineering undergraduates according to their field of study.

Table 3. Descriptive statistics of the ten least frequently used strategies in learning technical vocabulary

Strategies	Category	Mean Score
Review words by reading the vocabulary sections in textbooks	COG	3.07
Ask teachers to describe similar meaning or provide a synonym of the word	SOC	3.05
Make a group of words by topic	MEM	3.01
Play vocabulary games	MET	2.97
Ask teachers for a sentence including the word	SOC	2.95
Ask teachers for a first language translation	SOC	2.86
Spell words aloud when studying	MEM	2.85
Use flashcards	DET	2.69
Listen to a tape of word list	COG	2.45
Keep a vocabulary notebook everywhere you go	COG	2.41

Table 4. Mean score for vocabulary learning strategies used among engineering undergraduates according to their field of study

Field of Study	N	Mean	Std. Deviation	Frequency
Chemical Engineering and Natural Resources	30	3.35	0.276	Sometimes
Civil Engineering and Earth Resources	34	3.30	0.440	Sometimes
Electrical and Electronics Engineering	26	3.30	0.406	Sometimes
Manufacturing Engineering	27	3.49	0.481	Frequently
Mechanical Engineering	33	3.38	0.556	Sometimes

Manufacturing Engineering students were found to be using vocabulary learning strategies frequently compared to students from other four faculties with a mean score of 3.49. Students majoring in Chemical Engineering and Natural Resources were found to be in the sometimes-used vocabulary learning strategies with a mean score of 3.35. Similarly, students from Civil Engineering and Earth Resources, Electric and Electronic and Mechanical Engineering Faculties also belonged to the sometimes-used vocabulary learning strategies with a mean score of 3.30, 3.30 and 3.38 respectively. Table 5 shows the result of ANOVA which was done to determine the significant difference in vocabulary learning strategies used among engineering undergraduates according to the field of study.

Table 5. ANOVA test result

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	0.688	4	0.172	0.871	.483*
Within Groups	28.626	145	0.197		
Total	29.313	149			

It was found that p $(p > .05)$ indicates that there was no significant difference in vocabulary learning strategies used among engineering undergraduates in learning technical vocabulary according to the field of study F $(4, 145) = 0.87$, $p = 0.48$. Table 6 shows the mean scores of vocabulary learning strategies used in learning technical vocabulary among engineering undergraduates according to years of study.

Table 6. Mean score for vocabulary learning strategies used among engineering undergraduates according to their year of study

Year of Study	N	Mean	Std. Deviation	Frequency
3	105	3.31	0.397	Sometimes
4	45	3.48	0.524	Frequently

According to Table 6, it was found that fourth-year students used vocabulary learning strategies more frequently with a mean score of 3.48 than third-year students with a mean score of 3.31. Table 7 shows the result of Independent Sample T-test which was used to determine the significant difference in vocabulary learning strategies used among engineering undergraduates according to years of study.

Table 7. Independent Sample T-test result

Vocabulary Learning Strategies	t	df	Sig. (2-tailed)
	-2.104	148	.037*

As shown in Table 7, it was found that p $(p = 0.04)$ is lower than 0.05. Thus, it can be implied that there is a significant difference in vocabulary learning strategies among engineering undergraduates with a different year of study; t $(148) = -2.10$, $p = 0.04$. Table 8 shows the mean scores of vocabulary learning strategies used among engineering undergraduates according to English proficiency level. English language proficiency in this study was measured using the Malaysian University English Test (MUET) which is the standard test to measure English proficiency level in Malaysia.

Table 8. Mean scores of vocabulary learning strategies used among engineering undergraduates according to English proficiency level

MUET	N	Mean	Std. Deviation	Frequency
Band 2	37	3.41	0.487	Frequently
Band 3	69	3.33	0.412	Sometimes
Band 4	38	3.39	0.469	Sometimes
Band 5	6	3.24	0.403	Sometimes

It was found that students with Band 2 used vocabulary learning strategies more frequently than students with Band 3, Band 4 and Band 5 which were found to be the moderate user of vocabulary learning strategies. Table 9 shows the result of ANOVA which was used to determine the significant difference in vocabulary learning strategies among engineering undergraduates with different English proficiency levels.

Table 9. ANOVA test result

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	.0281	3	0.094	0.471	.703*
Within Groups	29.032	146	0.199		
Total	29.313	149			

As shown in Table 9, it was found that p $(p = 0.70)$ is more than 0.05. Thus, it can be implied that there is no significant difference in vocabulary learning strategies used among engineering undergraduates with different English proficiency levels: F $(3, 146) = 0.47$, $p = 0.70$.

4.2. Findings

The engineering students use metacognitive strategies most frequently which corresponds to the result of research by metacognitive strategies to be the most preferred vocabulary learning strategies among engineering undergraduates. The finding is consistent with results from researches by Ahmad et al. (2016); Cengizhan (2011); Leilei (2016); Yunus et al. (2013). However, this study is different from the other studies as this study investigates the strategies used in learning technical vocabulary while the other studies mentioned investigate the use of strategies in learning general and academic vocabulary. Thus, it shows that the use of metacognitive strategies is consistent with learning all types of vocabulary namely general, academic and technical vocabulary. In moving forward to IR 4.0, educators need to be aware of the strategies outlined under metacognitive strategies as these strategies can be helpful in assisting students to learn technical vocabulary. According to Puagsang (2017)'s results, the engineering students preferred to use social strategies more frequently followed by determination strategies which are different from current research's result in which metacognitive dominates the use of vocabulary learning strategies and is followed by determination strategies. This situation is similar to research by Arani (2006) in which the students prefer to use written and verbal repetitions and bilingual dictionary strategies which belong to cognitive strategies more often than metacognitive. Similarly, Lee (2007) reported that the participating students in the research employed cognitive and memory strategies more frequently than metacognitive and social strategies. The results from these abovementioned studies imply that there are possibilities of students preferring to use other types of strategies instead of metacognitive strategies which were found to be the most popular and frequently used strategies. Educators need to pay attention to other strategies besides metacognitive strategies as these strategies might not be helpful towards certain students. Combining learning strategies and integrating them in the lesson is essential as it can create more possibilities in learning and might be time and cost saving. In support of the revolution, simplifying yet creating more chances and

possibilities in learning is encouraged to make sure that the learning process is beneficial and fruitful.

Listening and watching English media namely movies and songs was proven to be the most frequently used strategies which may be due to the convenience of the strategy. This finding is consistent with Cengizhan (2011)'s discovery in which the most frequently used strategies were listening to songs and watching movies. It means that the materials for learning technical vocabulary can be easily obtained. For example, students can watch movies or videos that contain technical vocabulary via Youtube, a website that contains almost every video uploaded to the internet. This result shows that students are moving forward and utilizing technology at full capacity. With the help of the internet, students can choose and select the content that they want to learn as easy as clicking a button. Technical vocabulary learning might be complex, and students might be having a hard time comprehending the materials during the learning process. However, the learning process can be simplified by using media which are mostly created to assist students in learning. Simplified and easy to understand materials and techniques might be the reason that students are opting for media and the use of technology in learning these terminologies. Students can also watch documentary shows that are usually high in technical vocabulary. For example, Mythbusters shows from Discovery Channel talk about physics and engineering topics in every episode. Using media especially digital media in learning helps the students to engage with the content directly besides the more interesting and interactive content . Besides, digital media such as videos, songs, and podcasts are easily accessible in comparison to physical media such as books, reports, and dictionaries which might be a hassle to some learners. In comparison to Puagsang (2017)'s study, watching and listening to English media was not the frequently used strategies but it belongs to the sometimes-used strategies.

Cognitive strategies were found to be the least frequently used strategies among engineering undergraduates which were similar to research by Cengizhan (2011). Keeping a vocabulary notebook everywhere you go was found to be the least frequently used strategy among other strategies. This is consistent with the findings of research by Vela and Rushidi (2016) that stated only the minority of the students want to continue using and keeping the vocabulary notebooks. This may be due to the inconvenience caused by this strategy. Inconvenience in this context refers to the need to bring the vocabulary notebooks wherever one goes. Furthermore, it is no longer relevant to the current era in which one can easily jot down the newly learned vocabulary in a mobile phone instead of pulling out a pen and a book to do the process. In addition, this strategy might not be relevant for IR 4.0 as it serves as a reminder to the learner and for documentation rather than for technical vocabulary improvements. Another strategy that was found to be the least preferred strategy is listening to a tape of the word list. This may be due to the fact that tapes that contain word lists are not easily obtained and it

is also troublesome because the students need to listen to them instead of reading them. Tapes of word lists are now replaced by songs that are friendlier towards the learners. Similar to children songs which are helpful for children in learning vocabulary, word lists that are turned into songs are more preferable than the traditional word list tapes. This is similar to Puagsang (2017)'s result in which both keeping a vocabulary notebook and listening to a tape of word list were found to be the least frequently used strategies. Arani (2006) and Lee (2007), however, found that social strategies were the least frequently used strategies among participating students which is not consistent with the current research.

As for the difference of strategies used in learning engineering terminology according to the field of study, students majoring in manufacturing engineering were found to be using strategies more frequently in comparison to other engineering majors. It was also reported that there was no significant difference found in the strategies used among these engineering majors in learning engineering terminology. It implied that all these engineering majors used strategies moderately. This finding is supported by the result of the interview conducted in this research. According to the interview, most students claimed that they did not use strategies frequently in learning this terminology while some of them have their own preferences in the strategies they use in learning. Some students also said that they prefer only to use one strategy that suits their learning styles. As for the year of study, it was found that fourth-year students used strategies more frequently in comparison to the third-year students. This may be due to the awareness level of the learning strategies that can be used in learning engineering terminology and the exposure of engineering terminology as the level of study increases. Students with lower English proficiency level which is Band 2 used strategies more frequently in comparison to students with higher English proficiency level. This may be because their English proficiency level is low, so they have to employ strategies more frequently in learning this terminology. Exposure may be one of the factors of the reason students with higher English proficiency level used strategies moderately. Students with higher English proficiency level may be exposed to higher level English texts, thus they are more familiar with the terminology in comparison to students with lower English proficiency level. Therefore, exposure to higher level English texts which contain an abundance of jargons and terminologies is crucial in preparing students especially those who are majoring in technical courses in preparation towards the IR 4.0.

5. Conclusions

This research found that engineering majors preferred to use determination strategies (analyzing pictures or gestures) and metacognitive strategies (listening and watching English media) more frequently in comparison to memory, cognitive

and social strategies. It was also found that listening and watching English media was the most popular and most frequently employed strategy among these engineering majors. Keeping vocabulary notebook everywhere you go was found to be the least frequently used strategy among engineering undergraduates. It signifies that this strategy might cause trouble or hassle to some students despite having been proven to be one of the most effective strategies in improving vocabulary knowledge. Further research is recommended to be conducted in exploring the effectiveness of this strategy and the reason students do not use it frequently.

Current research proposes that further research be done in investigating the vocabulary learning strategies used among engineering students with different fields of study such as marine engineering, biomedical engineering, and aerospace engineering. It would be interesting to find out if there are significant differences in using vocabulary learning strategies among other engineering fields. This study shows that information technology is capable of mediating student's technical vocabulary mastery to achieve performance. Furthermore, the type of media has the potential to be a connector or influencer in technical vocabulary mastery. It would be beneficial if further research can reveal the vocabulary learning strategies employed by students majoring in other technical courses such as medical, law and accounting. Furthermore, further research can select a specific strategy from the taxonomy and investigate the effect of the strategy on students' vocabulary acquisition.

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