กลวิธีการอ่านบทความวิจัยภาษาอังกฤษของนักศึกษาระดับบัณฑิตศึกษา ในสาขาวิชาวิทยาศาสตร์และเทคโนโลยี ของสถาบันเทคโนโลยีพระจอมเกล้าเจ้าคุณทหารลาดกระบัง

READING STRATEGIES FOR ENGLISH RESEARCH ARTICLES OF POSTGRADUATE STUDENTS IN SCIENCE AND TECHNOLOGY AT KING MONGKUT'S INSTITUTE OF TECHNOLOGY LADKRABANG

ปิยวรรณ ศิริจันทนันท์

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วิทยานิพนธ์นี้เป็นส่วนหนึ่งของการศึกษาตามหลักสูตรปริญญาศิลปศาสตรมหาบัณฑิต
สาขาวิชาภาษาศาสตร์ประยุกต์-ภาษาอังกฤษเพื่อวิทยาศาสตร์และเทคโนโลยี
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หัวข้อวิทยานิพนธ์	กลวิธีการอ่านบทความวิจัยภาษาอังกฤษของนักศึกษาระดับบัณฑิตศึกษาในสาขาวิชาวิทยาศาสตร์และเทคโนโลยี ของสถาบันเทคโนโลยีพระจอมเกล้าเจ้าคุณทหารลาดกระบัง
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บทคัดย่อ

การวิจัยครั้งนี้มีวัตถุประสงค์เพื่อ สำรวจและเปรียบเทียบการใช้กลวิธีการอ่านบทความวิจัยภาษาอังกฤษ ของนักศึกษาระดับบัณฑิตศึกษาในสาขาวิชาวิทยาศาสตร์และเทคโนโลยีของสถาบันเทคโนโลยีพระจอมเกล้าเจ้าคุณทหารลาดกระบัง กลุ่มตัวอย่างที่ใช้ในการวิจัย คือนักศึกษาระดับบัณฑิตศึกษา ที่กำลังศึกษาอยู่ในระดับปริญญาโทและปริญญาเอก ในสาขาวิชาวิทยาศาสตร์และเทคโนโลยีปีการศึกษา 2557 จำนวน 235 คนโดยการสุ่มแบบเจาะจง (purposive sampling) เครื่องมือที่ใช้ในการวิจัยคือ แบบสอบถามกลวิธีการอ่านบทความวิจัยภาษาอังกฤษของนักศึกษาระดับบัณฑิตศึกษา ซึ่งพัฒนามาจากกรอบแนวคิดของ Oxford (1990) มีค่าความเชื่อมั่นเท่ากับ.90 สถิติที่ใช้ในงานวิจัยได้แก่ ค่าเฉลี่ย ($\overline{X}$) และ ส่วนเบี่ยงเบนมาตรฐาน (S.D) การวิเคราะห์ค่าความแปรปรวน โดยใช้ ANOVA ผลการวิจัยพบว่านักศึกษาระดับบัณฑิตศึกษาในสาขาวิชาวิทยาศาสตร์และเทคโนโลยี ในการอ่านบทความวิจัยภาษาอังกฤษอยู่ในระดับสูง ($\overline{X}$=3.61) ซึ่งมีการเรียงลำดับประเภทของกลวิธีการอ่านดังนี้ 1) ด้านอภิปัญญา ($\overline{X}$=3.76) 2) ด้านอารมณ์และความรู้สึก ($\overline{X}$=3.67) 3) ด้านสังคม ($\overline{X}$=3.63) 4) ด้านพุทธิปัญญา ($\overline{X}$=3.59) 5) ด้านการทดแทน ($\overline{X}$=3.53) และ 6) ด้านการจำ ($\overline{X}$=3.53) ตามลำดับ นอกจากนี้ การวิจัยครั้งนี้ยังพบว่านักศึกษาระดับบัณฑิตศึกษาใช้กลวิธีการอ่านในด้านสังคมแตกต่างกันอย่างมีนัยสำคัญทางสถิติที่ระดับ .05

Thesis Title	Reading Strategies for English Research Articles of Postgraduate Students in Science and Technology at King Mongkut's Institute of Technology Ladkrabang
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ABSTRACT

The aims of the study were to survey and compare the reading strategies used for reading English research articles of postgraduate students in the academic fields of science and technology at King Mongkut's Institute of Technology Ladkrabang. The sample included 235 postgraduate students studying in the Master's degree programs and doctoral degree programs in the academic fields of science and technology in the academic year 2014. The study used the purposive sampling method. The research instrument used was the Research Article Reading Strategies Questionnaire developed based on Oxford's (1990) framework. The Cronbach's Alpha Coefficient of the questionnaire was .90. The data were analyzed for means ($\overline{X}$) and standard deviations (S.D). The variations of reading strategies used by postgraduate students were checked using One-way Analysis of Variances (ANOVA). The results showed that the postgraduate students in the academic fields of science and technology utilized reading strategies for reading English research articles at a high level ($\overline{X}$=3.61). The categories of reading strategies were ranked as the following: 1) Metacognitive ($\overline{X}$=3.76), 2) Affective ($\overline{X}$=3.67), 3) Social ($\overline{X}$=3.63), 4) Cognitive ($\overline{X}$=3.59), 5) Compensation ($\overline{X}$=3.53), and 6) Memory ($\overline{X}$=3.53). Moreover, there was a statistically significant difference in the social strategy used by the postgraduate students from different academic fields at $p<0.05$*.

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Piyawan Sirichantanan

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LIST OF ABBRIVIATIONS

L2	Second Language
ESL	English as a Second Language
EFL	English as a Foreign Language
NNES	Nonnative English Speaking
SILL	Strategies Inventory for Second Language Learning

CHAPTER 1
INTRODUCTION

English has been used as an international language for communication (Crystal, 2005; Tardy, 2004). In addition, it has been regarded as the language of science and technology and international scholarly research publications (Crystal, 2005; Grabe & Kaplan, 1996; Grabe & Stoller, 2002). English is said to be the dominant language of science and technology because a lot of scientific materials, such as textbooks and research articles, are published in English (Cargill & O'Conner, 2006; Karimnia, 2013; Komiyama, 2009; Tardy, 2004). In essence, scholarly research articles published in English are the main sources of relevant scientific knowledge since they provide essential, up-to-date, and breakthrough information for future research (Kanoksilapatham, 2005; Okamura, 2006). Therefore, researchers and postgraduate students often read English research articles extensively in order to enrich their research knowledge and experience for conducting their own empirical studies.

When engaging in their disciplinary research traditions, postgraduate students need to base their research studies on the established theory and recent research findings published in their specialized areas. Thus, they have to read research materials extensively, carefully, and critically in order to obtain a deep understanding and extract essential information from English research articles. Then, they have to utilize their research skills and information obtained from the recent research findings of others to conduct their own research study in order to advance their fields, fill in the research gaps, and contribute to their academic disciplines with new research findings.

Clearly, a number of postgraduate students who use English as their second language (ESL) and foreign language (EFL) all over the world, including Thai postgraduate students in higher education, need to read an extensive range of read research articles published in English (Harmer, 2001; Hyland, 2007; Wood, 2001). To accomplish this challenging academic reading task, nonnative English speaking (NNES) postgraduate students need to be equipped with effective academic reading skills and efficient reading strategies which play important roles in the reading

comprehension process of these students (Chamot, 2004; Levine et al., 2000; Maasum & Maarof, 2012; Sheorey & Mokhtari, 2001; Tercanlioglu, 2004). Reading skills help readers to decode and construct comprehension of texts with speed, efficiency, and fluency, usually without the reader's awareness (Afflerbach 2002, Brown, 1980; Pearson & Paris, 2008). On the other hand, reading strategies are deliberate actions undertaken by active learners to comprehend meanings in the reading passage, solve comprehension problems, and enhance understanding (Paris et al., 1991; Koda, 2005; Park, 2010; Oxford, 1990; Urlaub, 2012).

Hence, reading strategies for reading English research articles in the academic fields of science and technology are crucial for postgraduate students. They need to choose and orchestrate reading strategies in order to help them to facilitate their understanding, solve comprehension problems, comprehend meanings in the research articles, and enhance their understanding.

1.1 Statement and Significance of the Problem

The postgraduate students in the academic fields of science and technology need to read English research articles to acquire knowledge in their specialized fields and they apply the findings from research articles in their own research studies. However, many NNES students seem to encounter a lot of difficulties when attempting to read English-language academic texts (Grabe, 1991; Maasum & Maarof, 2012; Paris et al., 1983). Little research has focused on the reading strategies that Thai postgraduate students used to facilitate their comprehension of English research articles.

Bunparit (2011) conducted a study with 10 low-proficiency postgraduate students at King Mongkut's University of Technology Thonburi to examine their reading strategies used while they were reading English research articles. The findings indicated that low proficiency students employed both cognitive and metacognitive strategies. However, this study was a quantitative study with a small group of low proficiency postgraduate students.

Akkararitwuthikun and Supapan (2013) studied 85 postgraduate students enrolled in the Master's degrees at Thummasart University when they read academic texts. The study reported that the high proficiency group used more global reading

strategies than support strategies. On the contrary, the lower proficiency group tended to use problem solving strategies.

Chumworatayee (2012) studied the reading strategies awareness of 93 postgraduate students at the Language Institute of Thammasart University using the Survey of Reading Strategies (SORS). The participants were divided into three levels: low proficiency, intermediate proficiency, and high proficiency. The results showed that the high proficiency group most often used more global strategies and problem-solving strategies than the low proficiency group.

Nonetheless, the research on reading strategy use for English research articles of Thai postgraduate students who study science and technology has not been adequately emphasized by previous studies in the country. The lack of comprehensive research in this area represents our knowledge gap related to the reading strategies that Thai postgraduate students who study science and technology, including postgraduate students at King Mongkut's Institute of Technology Ladkrabang, know and employ for reading English research articles.

Reading strategies are believed to be a facilitative and essential tool for assisting NNES students to overcome comprehension problems and to enhance their understanding (Afflerbach et al., 2008; Anderson, 1991). In this light, the examination of reading strategies could inform us about how postgraduate students studying science and technology approach the English research articles, employ strategic tool for processing information in the research articles, overcoming obstacles, and deriving the gist from texts, including storing information and retrieving it from their memory.

1.2 Objectives of the Study

The present research, therefore, was aimed at investigating the reading strategies used by Thai postgraduate students from different academic fields of science and technology for reading English research articles. The study established two research objectives:

1.2.1 To survey the reading strategies that postgraduate students in different academic fields of science and technology use for reading English research articles.

1.2.2 To compare reading strategies that postgraduate students from different academic fields of science and technology use for reading English research articles.

1.3 Research Questions

The following research questions were raised:

1.3.1 What reading strategies do postgraduate students from different academic fields of science and technology use for reading English research articles?

1.3.1.1 What **metacognitive reading strategies** do postgraduate students from different academic fields of science and technology use for reading English research articles?

1.3.1.2 What **cognitive reading strategies** do postgraduate students from different academic fields of science and technology use for reading English research articles?

1.3.1.3 What **memory reading strategies** do postgraduate students from different academic fields of science and technology use for reading English research articles?

1.3.1.4 What **compensation reading strategies** do postgraduate students from different academic fields of science and technology use for reading English research articles?

1.3.1.5 What **affective reading strategies** do postgraduate students from different academic fields of science and technology use for reading English research articles?

1.3.1.6 What **social reading strategies** do postgraduate students from different academic fields of science and technology use for reading English research articles?

1.3.2 Do postgraduate students from different academic fields of science and technology use different reading strategies for reading English research articles?

1.4 Hypothesis

H1: Postgraduate students from different academic fields of science and technology use different reading strategies for reading English research articles.

1.5 Scope of the Study

The current study aimed at surveying and comparing the reading strategies used by postgraduate students in the academic fields of science and technology at King Mongkut's Institute of Technology Ladkrabang on Ladkrabang campus. The population in this study was 2,084 postgraduate students in the academic year 2014 studying at the Faculty of Engineering, Science, Information Technology, Agriculture, and Agro-Industry. The study used the purposive sampling method to choose the sample. According to Yamane's formula (1967), the sample size should be 332 postgraduate students. However, the participants in the study were 235 postgraduate students because the postgraduate students who finished their coursework did not often come to institute so the researcher could not meet them.

The Research Article Reading Strategies Questionnaire was constructed based on Oxford's (1990) framework to collect data. The copies of the Research Article Reading Strategies Questionnaire were distributed by hand to the postgraduate students studying at five faculties of science and technology at KMITL on Ladkrabang campus in the academic year 2014.

The independent variable was academic fields, and the dependent variable was reading strategies.

1.6 Limitations of the Study

The limitations of this study include:

The sample in this study was limited to only Master's degree and doctoral degree students who were studying at the Faculty of Engineering, Science, Information Technology, Agriculture, and Agro-Industry of King Mongkut's Institute of Technology Ladkrabang, in Bangkok, Thailand in the academic year 2014.

The sample was drawn from scientific and technological fields at only one university; therefore, the results may not be generalized to all academic fields and all universities in Thailand.

1.7 Conceptual Framework

Oxford (1990) has grouped reading strategies into six categories: compensation, cognitive, memory, metacognitive, social, and affective.

Compensation reading strategies help the reader to understand the difficult parts of reading by using outside help, using context clues, separating vocabulary into parts, using reference materials such as dictionaries, skipping unknown words, and marking the text.

Cognitive reading strategies are related to mental and thinking activities. The strategies in this group are summarizing, synthesizing, outlining, translating, taking notes, making inferences, paraphrasing, and looking for main ideas.

Memory reading strategies assist the reader to store and retrieve information in the long term memory. The strategies in this category are looking for key words, important words, or the structure of the text.

Metacognitive reading strategies are concerned with readers' planning, monitoring, and evaluating their reading comprehension.

Social reading strategies are the interaction strategies with others such asking for clarification, and working with other peers or proficient readers.

Affective reading strategies are used to monitor emotion, motivation, and attitude. These include encouraging oneself, using music, rewarding oneself, and discussing with friends.

Oxford's (1990) framework has been applied to develop the Research Article Reading Strategies Questionnaire used for surveying the reading strategies that postgraduate students in the academic fields of science and technology at KMITL used for reading English research articles.

1.8 Significance of the Study

The current study attempted to examine two important variables: academic fields and research article reading strategies used by nonnative English speaking postgraduate students. These variables may not have been adequately investigated by previous research. Reading strategies are crucial for postgraduate students because they can help bolster their reading comprehension of English research articles. The information provided in this research could inform us about the awareness of reading strategy use of KMITL postgraduate students from different academic fields for reading English research articles. Therefore, the findings of the current study would contribute essential findings to academic reading research and course development for NNES postgraduate students who study English as a foreign language. In particular, the research findings could be useful for the English instructors at the institute to prepare English courses and design reading materials in order to help postgraduate students raise their awareness of reading strategy use, practice using effective reading strategies, and enhance their research article reading competence.

1.9 Definitions of Terms

In the current study, the terms are defined as follows:

Research articles — Research articles are the documents that explain theoretical background, describe research methodology, present research findings, and provide discussion (O'Conner & Woodford, 1976; Swales, 1990). In the current study, they refer to the research articles in the academic fields of science and technology.

Academic fields — Academic fields are branches of knowledge that have been taught or studied in Higher Education (Krishen, 2009). In the current study, the academic

fields of science and technology under investigation include · Engineering, Science, Information Technology, Agriculture, and Agro-Industry.

Postgraduate students Postgraduate students refer to students studying in the Master's degree programs and doctoral degree programs of Higher Education. In the current study, they refer to the students studying in the academic fields of science and technology at King Mongkut's Institute of Technology Ladkrabang.

Reading skills Reading skills are defined as automatic actions used for decoding word meaning and constructing comprehension of texts with speed, efficiency, and fluency, usually without the reader's awareness (Pearson & Paris, 2008).

Reading strategies Reading strategies are deliberate actions undertaken by active learners to comprehend meanings in the reading passage, solve comprehension problems, and enhance understanding (Oxford, 1990).

Cognitive reading strategies Cognitive reading strategies refer to the mental process that the reader employs to learn, obtain, store, retrieve, and utilize information. Cognitive reading strategies include repetition, translation, grouping, note-taking, deduction, elaboration, imagination, and making inferences (Oxford, 1990).

Metacognitive reading strategies Metacognitive reading strategies are strategies used to think about reading comprehension process, plan for reading, monitor comprehension or production, and evaluate reading outcomes (Oxford, 1990).

Compensation reading strategies	Compensation reading strategies help the reader to understand difficult parts during the reading process when the reader lacks cognitive resources. These strategies are such as using context clues, breaking the word into parts, using dictionaries, and skipping unfamiliar words (Oxford, 1990).
Affective reading strategies	Affective reading strategies are used by the reader for monitoring emotion, motivation, and attitude; they are such as encouraging oneself, using music, and discussing with friends (Oxford, 1990).
Social reading strategy	Social reading strategies are the strategies concerning with social interactions (Oxford, 1990). The social strategy under examination in this study is asking other to explain when failing to understand the research article.
Memory reading strategies	Memory reading strategies help the reader store information in long term memory; the strategies in this group are such as grouping, using keywords, and using the structure of the text (Oxford, 1990).

Conclusion

This chapter has presented the background to the study, the significance of the study, and the objectives of the research. The study aimed at surveying and comparing the reading strategies used by postgraduate students for reading English research articles. In addition, in this chapter, the study has formed the research hypothesis and described the scope of the study. Oxford's (1990) framework has been applied to develop **the Research Article Reading Strategies Questionnaire** used for surveying the reading strategies that postgraduate students in the academic fields of science and technology at KMITL employed for reading English research

articles. The review of related literature and previous research, research methodology, results, and discussions are presented in the subsequent chapters.

CHAPTER 2

LITERATURE REVIEW

Science and technology are more globally oriented than other fields, and English is believed to be the international language of science and technology (Crystal, 2005; Grabe & Kaplan, 1996; Kanoksilapatham, 2005; Tardy, 2004). English is one of the dominant languages used to disseminate research findings of scientific and technological studies. Thus, researchers in these fields all over the world can share research findings and obtain updated information from research articles published in English. In essence, English research articles apparently appear to be the main information sources for postgraduate research (Flowerdew, 1999; Kanoksilapatham, 2005; Okamura, 2006). Effective English reading proficiency and reading strategies are vital for postgraduate students who use English as a foreign or second language to derive essential information from research articles for their own research. However, Thai students who use English as a foreign language often encounter many difficulties when reading English materials (Chumworatayee, 2012; Wirotanan, 2002).

The current study was based on the assumption that if students know and can use a variety of effective reading strategies, the strategies can facilitate them to obtain important information from English research articles and enhance their reading comprehension (Lanford, 2009; Park, 2010). Therefore, the purpose of this study was to survey and compare the types of reading strategy used by Thai postgraduate students who study in the academic fields of science and technology when they read English research articles.

This chapter, therefore, explores the principal areas of literature concerning the objectives of the current research. It highlights the importance of English research articles for scientific and technological studies, identifies factors contributing to reading comprehension, defines and classifies reading strategies, and summarizes previous research findings on reading strategies from both international and domestic studies.

2.1 English Research Articles

English research articles are crucial information sources for postgraduate students who have to read them for finding their research topics and obtaining advanced and updated information for designing their own research studies that fulfill the knowledge gap and extend the body of research in their academic fields (Kanoksilapatham, 2005; Swales, 1990). Generally, research articles are the documents that explain theoretical background, describe experimental procedure, present research findings, and provide discussion (O'Conner & Woodford, 1976; Swales, 1990). There are several studies conducted on various research article genres of different academic fields, for example Biochemistry (Kanoksilapatham, 2005), Chemistry (Stoller & Robinson, 2013), Biology (Samraj, 2005), Dentistry (Basturkmen, 2012), and Physics (Li, 2006; Swales & Najjar, 1987). Swales (1990, 2004) explained that there are many research article structures which have been described by many researchers but the structures are not much different. The standard format for reporting the original research consists of Abstract, Introduction, Experimentation, Results and Discussion, and Conclusion (Cargill & O'Connor, 2006; Flowerdew, 2000; Swales, 1990).

2.1.1 Abstract

Normally, the abstract contains three major elements. It states the purpose(s) of the study, briefly describes research methodology, and reports the findings of the study (Zhao & Wu, 2012). It also highlights the importance of the study and the findings which impact the field (Hyland, 2000; Hyland & Tse, 2005; Martin, 2003; Melander et al., 1997; Samraj, 2005).

2.1.2 Introduction

The introduction provides the orientation of the study (Weissberg & Buker, 1990). Swales (1990) suggested that the introduction includes three moves: establishing a territory, establishing a niche or justifying the present study, and occupying a niche or describing the present study. Therefore, this section usually begins with general information about the context of the study. It connects the study to the established literature and research in the field. The author uses relevant

literature and citation statements to provide background knowledge and to establish a link to the body of research in the field (Stoller & Robinson, 2013). The next stage in the introduction identifies the research gap(s) and then the subsequent stage announces the purpose(s) of the study in order to fill in the gap (Weissberg & Buker, 1990). The final step indicates the importance and relevance of the study (Swales & Najjar, 1987).

2.1.3 Experimentation (Materials and Methods)

The method section describes the experimental process of the study. The researcher describes the research instrument, sample, material, and statistics (Weissberg & Buker, 1990). The procedure described may include analytical procedure, field-collection procedure, and synthetic procedure. This section also describes statistical analysis, mathematical procedure, or theoretical computation(s) (Stoller & Robinson, 2013). Therefore, this section is useful for the reader who wants to know how the procedure of the study may affect the findings and it is important to the reader who wants to replicate the study or adapt it for his/her own research.

2.1.4 Results and Discussion

The research findings and discussion are presented in this section. The results are reported in both written text and figures to enhance the reader's comprehension (Kanoksilapatham, 2005; Lim, 2010). Weissberg and Buker (1990) explained that numerical information is presented in figures, tables, or graphs; in addition, key research findings are summarized, interpreted, and presented in the written text. In addition, the statistical significance of the findings may be stated (Brett, 1994), and then the findings are commented (Kanoksilapatham, 2005; Weissberg & Buker, 1990). In essence, the results and discussion section presents the significant findings and how the findings should be interpreted; moreover, the authors may provide recommendations for future research and indicate the limitation of the study (Holmes, 1997; Thompson, 1993; Weissberg and Buker, 1990).

Kanoksilapatham (2005) stated that there are four major moves of the Results section of biochemistry research articles which include restating methodological issues, justifying methodological issues, announcing results, and commenting on results. Each stage often consists of sub-moves.

Weissberg and Buker (1990) suggested that there are six elements in the Discussion including 1) referring to the main purpose(s) or hypotheses of the study, 2) reviewing the findings whether they support the hypotheses and whether they agree with the findings of other researchers, 3) providing a possible explanation or speculation about the findings, 4) stating the limitations that restrict the implication of the study, 5) suggesting applications in real life, and 6) recommending for future research.

2.1.5 Conclusion

The conclusion is the last major section of research articles. This section demonstrates specific conclusions by referring to the purpose and hypotheses of the study, reviewing the essential research findings, suggesting implications and applications, and stating the limitations of the study (Yang & Allison, 2003).

English research articles are essential information sources for Thai postgraduate students who study science and technology. Previous research on research article genre helps us understand the relevant types of information included in scientific and technological scholarly research papers. To make use of relevant information from these articles, NNES postgraduate students need to possess proficient English reading proficiency, and in essence, they should know and use a variety of effective reading strategies in order to decode meanings and extract crucial information for their postgraduate research.

2.2 Reading Comprehension

2.2.1 Reading Comprehension Process

Second Language (L2) reading comprehension is comprised of two levels of processing: lower level and higher level processing (Fender, 2001; Grabe, 2009; Grabe & Stoller, 2002; Nassaji, 2003). Lower level process is the fundamental requirement for effective reading comprehension which depends on automatic linguistic processing. It is viewed as skill-oriented consisting of lexical access, syntactic parsing, and semantic proposition formation and working memory activation (Grabe & Stoller, 2002). Lexical access is the recognition of words. The fluent reader activates lexical meanings rapidly and automatically and stores word meanings in memory

(Yamashita, 2013). Then, syntactic parsing such as recognizing phrasal groupings, word orderings, and the relationships between subordinates and superordinates helps the reader to understand meanings at clause level (Grabe & Stoller, 2002). L2 readers need extensive reading hours to develop automaticity in utilizing grammatical knowledge to assist them in constructing reading comprehension. The third element of lower level process is semantic proposition formation. When the reader processes a sentence (or sentences), a semantic proposition which reflects a key element of textual information is constructed (Grabe & Stoller, 2002). As the reader continues reading, the relationship among semantic propositions is established resulting in the construction of a propositional network of textual meaning (Grabe & Stoller, 2002). For the fluent reader, the process occurs automatically and rapidly in working memory, and meanings are integrated in the appropriate process to construct an accurate sense of textual meanings (Anderson, 2000; Cziko, 1980; Goodman, 1988).

Higher level reading processes consist of text model comprehension, situation model of reader interpretation, background knowledge use, making inferences, and executive (metacognitive) control process. The fundamental of higher level processes is text model comprehension. It is the interaction of ideas from the reading text that presents the main points and supporting ideas to construct a meaning representation of text. When the reader faces text difficulties, background knowledge could support and help the reader to understand the text. Then, the situation model will be built to interpret information relying on the readers' background knowledge, attitude, motivation, and purpose (Kintsch, 1998 cited in Grabe & Stoller, 2002).

The description of reading processes explained above can help us to understand the reading and comprehension processes of L2 readers in general, including postgraduate students who study English as a foreign language when reading English scientific and technological research articles. It could be explained that when reading a research article, the reader integrates information from the text with background knowledge in this process. It enables the reader to comprehend the writer's meanings and to interpret textual meanings according to his or her own purpose. When text model and situation model are constructed, an executive (metacognitive) control process is activated to control the reader's understanding, monitor his or her comprehension, regulate the utilization of strategies as needed, evaluate information in the reading sources, and repair comprehension problems

(Grabe & Stoller, 2002). The executive control through the use of reading strategies allows the reader to check and repair his or her comprehension.

2.2.2 The Role of Background Knowledge in Reading Comprehension

Background knowledge, or schema, is also known as "the building block of cognition" (Rumelhurt, 1980 p. 34). Dechant (1991) claimed that the schema theory can help to understand how the reader acquires, stores and retrieves information from the reading text. Background knowledge, or schema, can assist the reader to comprehend the reading text because comprehension occurs when the reader integrates the old information from background knowledge with the new information (Anderson & Pearson, 1984; Brewer & Nakamura, 1984; Grabe & Stoller, 2001; Smith, 1994; Yore et al., 1998). Nassaji (2007) explained that the role of background knowledge during the reading process should be automatic to facilitate reading comprehension. Previous research has found that background knowledge serves as compensatory sources for nonnative English speaking students when they encounter linguistic difficulties or lack language abilities (Barry & Lazarte, 1995; Chan, 2003; Urquhart & Weir, 1998).

According to Carrell (1983), there are three categories of schema, namely linguistic schema, formal schema, and content schema. Firstly, linguistic schema consists of orthographic knowledge, lexical knowledge, syntactic knowledge, and semantic knowledge which can assist textual comprehension. Hence, linguistic schema seems to be the foundation of the other schemas. Secondly, formal schema refers to textual schema, and rhetorical structure of the text. Finally, content schema is related to the reader's background knowledge of the content areas. Content schema can help the reader comprehend the text (Carrell, 1983) and compensate for the lack of language schema. The reader's schema is important for facilitating his or her understanding of new information in the reading text. Droop and Verhoeven (1998) reported the positive impact of cultural background knowledge on reading comprehension and reading efficiency of both native and nonnative third grade Dutch students.

The development of schema depends on the reader's acquisition of new experiences and knowledge. Some researchers posit that schema can be refined through the processes of assimilation and accommodation (Byrnes, 2001).

Assimilation is to add new information to the old schema and accommodation is to change or create new schema to replace the old schema (Byrnes, 2001).

Carrell and Floyd (1987) suggested that the teacher should provide the students with appropriate schemata and teach them how to build the connection between the existing knowledge and new knowledge. It is obvious that the exiting knowledge could help the reader to interpret new information. Therefore, three types of schema: linguistic, formal and content schema, appear crucial for postgraduate students to understand the information presented in English research articles.

2.3 Reading Strategies

Reading strategies always play an important role in constructing effective reading comprehension because they act as the reader's tools to assist and facilitate comprehension (Anderson, 1999; Paris et al., 1991; Wichadee, 2011). Some researchers have described reading strategies as the deliberate actions that the reader applies to acquire, store, and retrieve new information while reading in order to achieve goal (Anderson, 1991; Cook & Mayer, 1983; Paris et al., 1991; Rubin, 1987; Urquhart & Weir, 1998). Likewise, Cohen (1986) described reading strategy uses as the mental processes that the reader uses to achieve reading goals. Strawser (1999 cited in Tercanlioglu, 2004) reports that a variety of reading strategies can help the reader to increase reading comprehension. To comprehend texts, the reader has to use efficient reading strategies to get crucial information from the texts (Koch, 2001; Yore & Craig, 1998).

For NNES postgraduate students who often face with reading difficulties or comprehension failures, deliberate uses of reading strategies can potentially help them to solve problems. In essence, reading strategies are important for NNES postgraduate students to understand relevant information in scientific and technological research articles. Students should be able to use a range of reading strategies efficiently and flexibly depending on their reading purposes and types of text (Garner, 1987; Paris et al., 1983).

2.3.1 The Classifications of Reading Strategies

The classifications of reading strategies always overlap in their terms and many researchers appear to group reading strategies differently.

O'Malley and Chamot (1990) divided reading strategies into three sub-categories: cognitive, metacognitive, and social strategies.

Cognitive strategies include identification, retention, storage, and retrieval of words or phrases.

Metacognitive strategies include using advanced organizers, directed attention, selective attention, self-management, functional planning, self-monitoring, delayed production, and self-evaluation.

Socio-affective Strategies consist of cooperating and questioning for clarification.

Oxford (1990) developed the Strategy Inventory for Second Language Learning (SILL) and divided reading strategies into six sub-categories: compensation, cognitive, memory, metacognitive, social, and affective.

Compensation strategies are comprised of using outside help, using context clues, separating vocabulary into parts, using dictionaries, skipping unknown words, and marking the text. These strategies help the reader to comprehend the difficult parts of reading when the reader lacks cognitive resources.

Cognitive strategies concern with mental activities which are related to reading and thinking processes. The strategies in this group are summarizing, synthesizing, outlining, translating, taking notes, making inferences, paraphrasing, and looking for main ideas (Oxford, 1990).

Memory strategies assist the reader to retain and retrieve information in long-term memory. They consist of looking for key words, important words, or the structure of the text (Oxford, 1990).

Metacognitive strategies are usually related to the reader's planning, monitoring, and evaluating his or her reading comprehension. These strategies are involved with goal setting, finding purpose of the text, comprehension checking and self-evaluation.

Social strategies are used to learn through interaction with other people (Oxford, 1990). These include cooperating with others, asking for classification, and

working with peers or proficient readers. The reader uses these strategies to learn through interactions with other people (Oxford, 1990).

Affective strategies help the reader to monitor his emotion, motivation, and attitude (Oxford, 1990). They are comprised of self-encouraging, using music to lower anxiety, taking deep breathes, meditating, and rewarding oneself (Oxford, 1990).

Anderson (1991) grouped reading strategies into five groups: supervising, supporting, paraphrase, establishing coherence in text, and test-taking.

Supervising strategies are strategies for recognizing loss of concentration, failures to understand, success in understanding portions of the text, formulating questions, and referring to previous passages.

Supporting Strategies are such as skipping unknown words, using dictionary, visualizing, scanning and skimming.

Paraphrasing strategies are, for instance, rephrasing, translating into L1, and breaking words in small units, using cognates between L1 and L2 to understand meanings.

Establishing coherence strategies consist of rereading, using context clues to interpret the meaning of words, using background knowledge, and acknowledging lack of background knowledge.

Test-taking strategies consist of a variety of strategies such as selecting a response based on understanding, looking for answers in the chronological order in texts, choosing the answers through deductive reasoning, receiving clues from answering one question that is helpful for other questions, and guessing without any particular considerations.

In addition, Chavez (1994) classified reading strategies into four groups based on the derivation of meaning: supertexual strategies, contextual strategies, intratexual strategies, and subtexual strategies.

Supertextual strategies help the reader to understand the cultural framework of the text.

Contextual strategies reveal the syntactic structure of cohesion underlying the text.

Intratextual strategies help the reader understand individual constituents in the text, in particular at the lexical level.

Subtextual strategies assist the reader in translating text-bond into text-independent meaning.

Besides, Jimenez et al. (1996) divided reading strategies into three categories: text-initiated strategies, interactive strategies, and reader-initiated.

Text-initiated strategies include using text structure, summarizing, and rereading. **Interactive strategies** consist of inferring, predicting, and questioning.

Reader-initiated strategies comprise visualizing and evaluating and making prior knowledge.

Mokhtari and Sheorey (2002) grouped reading strategies into three groups: global reading strategies, problem solving strategies, and support reading strategies.

Global strategies are such as making predictions while reading or critically analyzing the overall content of a text.

Problem-solving strategies include adjusting reading speed based on the difficulty level of a text, or using context clues to guess the meaning of unknown words. **Support strategies** are such as using a dictionary, taking notes, underlining, or highlighting textual information.

Almasi (2003) classifies reading strategies into three groups: text anticipation, text maintenance, and fix up strategies.

Text anticipation strategies include previewing the text, activating prior knowledge, setting purpose, generating predictions, verifying prediction, and updating prediction.

Text maintenance strategies are creating mental images, monitoring comprehension by self-questioning, identifying text structures, and updating and revising predictions.

Fix-up strategies consist of rereading, slowing down and reading ahead for clarification, and asking or discussing with someone.

However, the Strategy Inventory for Second Language Learning (SILL) developed by Oxford (1990) has been adopted and applied more extensively to study the language learning strategies and reading strategies of both native and ESL and EFL speaking students in various settings. Moreover, it has a high reliability and validity and has been administrated with more than 10,000 students worldwide across many cultural groups (Oxford, 1990; Vidal, 2002; Rebecca & Burry-Stock, 1995). Oxford's (1990) SILL was employed in the following research studies.

Ok (2003) examined the use of strategies of 325 Korean school students. The findings indicated that the students employed strategies at a moderate level. Female students utilized strategies more frequently and used more reading strategies in six categories than male students. The study also revealed that the students' gender, school year, and language proficiency had a significant relationship on their use of strategies.

Moreover, Chang et al. (2007) investigated the influence of gender and major on 1,758 Taiwanese college students. The students reported that they used strategies at a moderate level. There were statistically significance differences in the use of cognitive strategies, metacognitive strategies, and social strategies between male and female students.

In 2009, McMullen examined the relationship between the use of strategies, gender, and academic majors of 165 students in Saudi Arabia. The findings revealed that female students used strategies more often than male students.

Furthermore, Fewell (2010) investigated the relation between English proficiency and selection of strategies by two groups of students in the English major and Business major. SILL (1990) was translated to Japanese version. However, the findings indicated that low proficient students used strategies at a high level while high proficient students used strategies at a moderate level.

However, Oxford's (1990) Strategy Inventory for Second Language Learning (SILL) tends to be too broad for surveying research article reading strategies and it may not illuminate on relevant reading strategies that postgraduate students employ to read English research articles. It appears that when reading English research articles, postgraduate students need to rely on typical reading strategies in order to achieve the reading objectives. Different sections of research articles convey particular types of information which may require specific reading strategies to comprehend relevant information. Therefore, the reading strategy survey needed to be redesigned to examine the reading strategies crucial for research article reading goals. Oxford's (1990) Strategy Inventory for Second Language Learning (SILL) framework has been applied to design the Research Article Reading Strategies Questionnaire of the current study in order to survey and compare the reading strategies used by Thai postgraduate students for reading English research articles.

Although there are various types of assessment techniques for reading strategy examination such as summative rating scales (questionnaire/survey), interview, group discussion and think-aloud protocols (Rebecca & Burry-Stock, 1995), the current study employed summative rating scales (questionnaire/survey) to collect the data. The questionnaire using self-report scales is easy and quick to administer and survey postgraduate students' reading strategies used, and it is quite nonthreatening when administrating (Rebecca & Burry-Stock, 1995). However, the weakness of self-repot assessment technique used by the strategy questionnaire is that it does not explain in detail about the reading strategies that the reader uses.

2.4 Previous Research on Reading Strategies

Previous studies on Second and Foreign Language reading tended to focus on strategies awareness and the use of reading strategies in general (Chumworatayee, 2012; Madhumathi & Ghosh, 2012; Mokhtari & Sheorey, 2002; Oxford, 1990; Tercanlioglu, 2004; Phakiti, 2003a, 2003b), and the differences between skilled and unskilled readers (Ikeda & Takeushi, 2006; Chen & Intaraprasert, 2014). The findings have revealed that skilled readers used strategies more frequently, appropriately and successfully than unskilled readers for monitoring, controlling and evaluating their comprehension (Afflerbach, 2002; Anderson, 2005; Garner, 1987; Ikeda & Takeushi, 2006; Lau, 2006; O'Malley & Chamot, 1990; Pressley & Afflerbach, 1995; Zhang & Wu, 2009).

2.4.1 Research Conducted Abroad

International research has investigated the awareness of reading strategy use of school students and undergraduate students when they read general and academic texts (Afflerbach, 2002; Anderson, 2003; Block, 1986; Garner, 1987; Jimenez et al., 1996; Pressley & Afflerbach, 1995; Paris & Jacob, 1984; Singhal, 2001; Sheorey & Mokhtari, 2001; Zhang & Wu, 2009). The researchers employed various types of instruments such as questionnaire, interview, and test for collecting data. In addition, previous research has tended to study and explain how skilled and unskilled readers employed strategies in order to assist them to construct their comprehension (Chen & Intaraprasert, 2014; Ikeda & Takeushi, 2006). Furthermore, skilled and unskilled

readers were usually distinguished by their levels of their metacognition used to monitor their understanding and to solve comprehension problems while reading (Kletzien, 1991; Pang, 2006; Zhang & Wu, 2009). Students with high reading proficiency tended to use and orchestrate a range of reading strategies in order to facilitate and enhance their understanding during reading academic texts.

Table 2.1 International Related Research about Undergraduate Students

Ikeda and Takeushi (2006)	**Participants:** 10 Japanese students (5 skilled student and 5 unskilled students)
	Country: Japan
	Level: undergraduate students
	Instrument(s): Journal entries
	Results: Skilled readers used more strategies, better understood the aims of strategies and when to use them, used more combinations of strategic knowledge, and better knew how and when to evaluate strategy use when compared to the unskilled readers. Skilled readers use more strategies successfully and effectively than unskilled readers.
Malcolm (2009)	**Participants:** 160 ESL medical students
	Country: Iraq
	Level: undergraduate students
	Instrument(s): SORS Arabic Version
	Results: First-year students with low English ability tended to use translating strategies. In contrast, higher year students tended to employ metacognitive strategies.
Chen and Intaraprasert (2014)	**Participants:** 926 Business English major students
	Country: South China
	Level: undergraduate students
	Instrument(s): The strategies questionnaire for Business English The Business English Comprehension Test

Table 2.1 (Continued)

Chen and Intaraprasert (2014)	**Results:** Skilled readers reported using reading strategies more than unskilled readers. The students with the higher reading proficiency students employed reading strategies more frequently than lower reading proficiency students.
Sheorey and Mokhtari (2001)	**Participants:** 150 native English speaking students and 152 nonnative English speaking students
	Country: USA
	Level: College
	Instrument(s): Survey of Reading Strategies (SORS).
	Results: Both of native and nonnative English speaking students appeared to have awareness of all types of reading strategies.
Madhumathi and Ghosh (2012)	**Participants:** 52 ESL Students
	Country: India
	Level: ESL students
	Instrument(s): Survey of Reading Strategies (SORS) RCT which is the modified version of TOEFL reading comprehension
	Results: The reading strategies used were moderately correlated with the reading comprehension achievement of ESL students.
Peacock and Ho (2003)	**Participants:** 513 males and 493 females
	Country: Hong Kong
	Level: undergraduate students
	Instrument(s): Oxford's 50-item SILL and Interviews
	Results: Compensation strategies were the most frequently used, followed by cognitive and metacognitive, social, memory and affective strategies.
Dhieb-Henai (2003)	**Participants:** 62 biological students
	Country: Tunisia
	Level: undergraduate students
	Instrument(s): Tests and retrospection protocols

Table 2.1 (Continued)

Dhieb-Henai (2003)	**Results:** Metacognitive training improved subjects' familiarity with and proficiency in reading research articles.
Mahmoudi (2014)	**Participants:** 115 non-native Persian-speaking students
	Country: Iran
	Level: undergraduate students
	Instrument(s): Metacognitive Awareness of Reading Strategies Inventory
	Results: Reading strategies were used more often for problem solving than for global understanding and support.
Molla (2015)	**Participants:** 40 English major students
	Country: Ethiopia
	Level: undergraduate students
	Instrument(s): SILL questionnaire and Reading Comprehension Test
	Results: The students employed reading strategies in all categories at a moderate level.

Ikeda and Takeushi (2006) informed about the differences between skilled and unskilled NNES readers' strategy uses. They examined the journal entries of 10 Japanese students: 5 skilled and 5 unskilled undergraduate EFL readers' reading strategy uses. The researchers used the portfolio as a research instrument for analyzing and comparing reading strategies used. The researchers noticed that the skilled readers used more strategies, better understood the aims of strategies and when to use them, used more combinations of strategic knowledge, and better knew how and when to evaluate strategy use when compared to the unskilled readers. Skilled readers appeared to use more strategies successfully and effectively than unskilled readers.

Malcolm (2009) carried out a survey research to explore and compare reading strategies uses of 160 ESL medical students when they read academic texts. The participants in this study were different in English ability and year of study. The findings from this study discovered that first-year students with low English ability

tended to use translating strategies. In contrast, higher year students tended to employ metacognitive strategies.

Chen and Intaraprasert (2014) studied the reading strategies used by 926 Business English major undergraduate students from 6 universities in Southern China. The Strategies Questionnaire for Business English Reading and the English Reading Comprehension Test was used to collect data. The findings also indicated that skilled readers reported using reading strategies more than unskilled readers. In addition, the students with higher reading proficiency reported that they employed reading strategies more frequently than lower reading proficiency students.

Sheorey and Mokhtari (2001) conducted the research to study the differences in the uses of metacognitive awareness of native and nonnative English speaking students when they read academic texts. The participants were 150 native English speaking students and 152 nonnative English speaking students. The research instrument was the Survey of Reading Strategies (SORS). The findings indicated that both native and nonnative English speaking students appeared to have awareness of all types of reading strategies.

Madhumathi and Ghosh (2012) examined the awareness of reading strategies use of 52 ESL undergraduate students studying engineering at a private university in India. The study employed two instruments including the Survey of Reading Strategies and Reading Comprehension Test. The findings showed that the reading strategies used were moderately correlated with the reading comprehension achievement of ESL students.

Additionally, Peacock and Ho (2003) investigated the differences in language learning strategy use among the students from eight disciplinary fields including Building and Construction, Business, Computer Studies, Engineering, English, Mathematics, Primary Education, and Science. The research participants were 513 males and 493 females from the City University in Hong Kong. All students were asked to complete Oxford's 50-item SILL. A stratified sample of 48 students (6 from each discipline) drawn from questionnaire respondents was chosen for interviews. A local English language test was administered to collect data on the participants' language proficiency. The study found that compensation strategies were the most frequently used strategies followed by cognitive and metacognitive, social, memory and affective strategies respectively.

Moreover, Dhieb-Henai (2003) examined the reading process of 62 EFL/ESL biological students at two science institutions in Tunisia while reading research articles. The study examined how metacognitive strategy training influenced upper-intermediate readers' declarative and procedural knowledge, and their choice and use of strategies while reading research articles in the context of English for Specific Purpose. The quantitative and qualitative approaches employed tests and retrospection protocols. The findings showed that metacognitve training improved subjects' familiarity with and proficiency in reading research articles.

Furthermore, Mahmoudi (2014) conducted the research study to investigate reading strategies used by 115 non-native Persian-speaking students at Babol Noshirvani University of Technology in Iran for reading academic texts. The data were collected using the Metacognitive Awareness of Reading Strategies Inventory (MARSI). The results of the survey revealed that the participants reported medium use of reading strategies. The students reported that they employed problem solving strategies more often than global and support strategies.

Molla (2015) investigated the relationship between reading strategies and reading comprehension of 40 EFL undergraduate students at Dilla University in Ethiopia. The instruments were SILL and reading comprehension test. The results showed that the students utilized reading strategies at a moderate level in all categories.

2.4.2 Research Conducted in Thailand

A large extent of research conducted in Thailand has investigated the awareness of reading strategy use of school students and undergraduate students based on their proficiency levels when they read English academic texts.

According to the results of previous studies, different levels of proficiency of the students appeared to play an important role on the reading strategies used by school students and undergraduate students. High-proficiency students appeared to use reading strategies more often than low-proficiency students.

Table 2.2 Related Research about School and Undergraduate Students in Thailand

Wongphangamol (2005)	**Participants:** Mattayom Suksa 6 (Grade 12)
	Country: Thailand
	Level: School Students
	Instrument(s): Oxford's Quick Placement Test, Questionnaire, and Semi-structure interview
	Results: Both science and arts students used reading strategies with a moderate frequency. Compensation strategies were the highest used and memory strategies were the lowest used by the two groups.
Prommak (2005)	**Participants:** first-year Business English students
	Country: Thailand
	Level: undergraduate students
	Instrument(s): Questionnaire
	Results: The students employed various reading strategies to assist in their comprehension of English materials. The most frequently employed strategy was "looking up the meanings of unknown words and/or usage from an English-Thai dictionary."
Saengpakdeejit (2004)	**Participants:** 549 EFL undergraduate students
	Country: Thailand
	Level: undergraduate students
	Instrument(s): English Proficiency Test The Survey of Reading Strategies (SORS).
	Results: Problem solving reading strategies were the highest used, followed by global and support reading strategies.
Sucantajan (2006)	**Participants:** 50 first-year English major students
	Country: Thailand
	Level: undergraduate students
	Instrument(s): Questionnaire
	Results: Compensation strategies were most frequently used while metacognitive and cognitive strategies were used less often.

Table 2.2 (Continued)

Thampradit (2006)	**Participants:** 48 Engineering undergraduate students
	Country: Thailand
	Level: undergraduate students
	Instrument(s): Verbal report
	Results: Cognitive reading strategies were used the most frequently while metacognitive reading strategies were used the least. There was a significant difference in the use of cognitive, metacognitive and compensatory reading strategies between high and low proficiency students. The different levels of English proficiency influenced the participants reading strategies used. Conversely, gender did not appear to influence the participants reading strategies used.
Aegpongpaow (2008)	**Participants:** 20 undergraduate students
	Country: Thailand
	Level: undergraduate students
	Instrument(s): Interview, Observation and Journal entries
	Results: The students had awareness and control of the metacognitive strategies in the reading process. Moreover, high proficiency students seemed to use metacognitve strategies more often than the low proficiency students.
Phakiti (2008)	**Participants:** 561 undergraduate Thai students
	Country: Thailand
	Level: undergraduate students
	Instrument(s): Questionnaire
	Results: The uses of cognitive and metacognitive strategies were highly correlated, and skilled readers had higher awareness of strategic uses than unskilled readers.
Oranpattanachai (2010)	**Participants:** 90 Thai pre-engineering EFL readers
	Country: Thailand
	Level: undergraduate students
	Instrument(s): Survey questionnaire

2.2 (Continued)

Oranpattanachai (2010)	**Participants:** 90 Thai pre-engineering EFL readers
	Country: Thailand
	Level: undergraduate students
	Instrument(s): Survey questionnaire
	Results: The similarities appeared in the rank of perceived reading strategies adopted and the styles of text processing. The differences were measured statistically in respect to the frequency of perceived strategy use and the frequency of perceived top-down strategy use among participants.
Munsakorn (2012)	**Participants:** 380 first-year students
	Country: Thailand
	Level: undergraduate students
	Instrument(s): Questionnaire
	Results: The awareness of reading strategies of first-year students was at a high level. There was no statistically significant difference between males and females, and students who have different English learning experience at the significance level of 0.05.

Wongphangamol (2005) conducted research on reading strategies used by science and arts students who studied in Mattayom Suksa 6 (Grade 12). The participants were divided into two groups: high English ability and low English ability. Her study employed Oxford's Quick Placement Test, Questionnaire, and semi-structure interview. The findings of the study revealed that both science and arts students used reading strategies with a moderate frequency. The results showed that compensation strategies were the highest used and memory strategies were the lowest used by the two groups. Nonetheless, the arts students with high English ability employed many strategies except compensation and affective reading strategies.

Prommak (2005) studied the reading strategies of first-year Business English students at a university in Thailand. The instrument of the study was questionnaire. The results of the study showed that the students employed a variety of reading strategies to assist them to comprehend English materials. The most frequent

strategy identified was looking up the meanings of unknown words and/or usage from an English-Thai dictionary.

Saengpakdeejit (2004) conducted a study on reading strategies used for reading academic texts by 549 EFL undergraduate students. The study aimed to survey three of reading strategies: Global reading strategies, problem solving reading strategies, and support reading strategies. The research instruments were the English Proficiency Test and the Survey of Reading Strategies (SORS). The study revealed that problem solving reading strategies were the highest used, followed by global and support reading strategies.

Sucantajan (2006) studied the reading strategies for English comprehension of 50 first-year English major students at Chakrabongse Bhuvanath campus. The questionnaire was used for collecting the data. The results showed that compensation strategies were most frequently used while metacognitive and cognitive strategies were used less often.

Thampradit (2006) investigated reading strategies used by 48 Engineering undergraduate students at KMITL. There were 24 high proficiency students and 24 low proficiency students. The participants were asked to produce verbal report during reading an expository text. According to the results, cognitive reading strategies were used most frequently while metacognitive reading strategies were used the least. Moreover, there was a significant difference in the use of cognitive, metacognitive and compensatory reading strategies between high and low proficiency students. Different levels of English proficiency influenced the participants reading strategies used. Conversely, gender did not appear to influence the participants reading strategies used. There was no statistically significant interaction between gender and reading ability on the use of cognitive and metacognitive reading strategies.

Aegpongpaow (2008) attempted to explore the metacognitive strategies used by EFL students in Thailand when they read academic texts. The participants in the study were 20 undergraduate students of Srinakarinwirot University. They were divided into 2 groups as high proficiency students and low proficiency students. The instruments were interview, observation, and journal entries. The study found that the students had awareness and control of the metacognitive strategies in the reading process. Moreover, the findings also revealed that high proficiency students

seemed to use metacognitve strategies more often than the low proficiency students.

Similarly, Oranpattanachai (2010) investigated the employment of reading strategies and the effect of reading proficiency on reading processes. The participants consisted of 90 Thai pre-engineering EFL readers divided into low and high level. The data of the study were gathered by means of a survey questionnaire. The researcher found that both high and low level groups shared similarities and differences in regards to their reading processes. First, the similarities appeared in the rank of perceived reading strategies adopted and the styles of text processing. Second, the differences were measured statistically in respect to the frequency of perceived strategy use and the frequency of perceived top-down strategy use among participants.

Phakiti (2008) researched a large scale of 561 undergraduate Thai students to examine the relationship between cognitive and metacognitive strategies uses among skilled and unskilled readers by using a questionnaire. Phakiti noted that the uses of cognitive and metacognitive strategies were highly correlated, and skilled readers had higher awareness of strategic uses than unskilled readers.

Munsakorn (2012) investigated the reading strategy use of 380 first-year students at Bangkok University using a questionnaire. The findings of the study indicated that the overall awareness of reading strategies of EFL learners at BU was at a high level. There was no statistically significant difference between males and females, and among students who have different lengths of English learning experience at the significance level of 0.05.

Table 2.3 has summarized previous research studies on reading strategies used by postgraduate students in Thailand. It appears that most of the studies have been conducted to investigate the reading strategies used for reading other types of academic texts rather than English research articles. A variety of research instruments were utilized i.e. questionnaire, observation sheets, think aloud protocols, student worksheets, and semi-structure interviews to collect data. The findings of the previous studies indicated that high proficiency postgraduate students intentionally used reading strategies more than low proficiency students.

Table 2.3 Related Research about Thai Postgraduate Students in Thailand

Bunparit (2011)	**Participants:** 10 low-proficiency students
	Country: Thailand
	Level: postgraduate students
	Instrument(s): observation sheets, think aloud protocols student worksheets, and semi-structure interview
	Results: Low-proficiency students employed both cognitive and metacognitive strategies. Half of the students employed ineffective reading strategies while reading research articles. There was no relationship between reading strategies used and reading comprehension of low-proficiency ESP students.
Chumworatayee (2012)	**Participants:** 93 postgraduate students with different proficiency
	Country: Thailand
	Level: postgraduate students
	Instrument(s): The Survey of Reading Strategies (SORS).
	Results: High proficiency group mostly used more global strategies and problem-solving strategies than low-proficiency group.
Akkararitwuthikun and Supapan (2013)	**Participants:** 85 postgraduate students
	Country: Thailand
	Level: postgraduate students
	Instrument(s): The Survey of Reading Strategies (SORS).
	Results: High proficiency group employed more global reading strategies than support strategies. On the contrary, lower proficiency group tended to use problem solving strategies.

Chumworatayee (2012) investigated the reading strategies awareness of 93 postgraduate students at the Language Institute of Thammasart University using the Survey of Reading Strategies (SORS). The participants were divided into three levels: low proficiency, intermediate proficiency, and high proficiency. The results showed that high proficiency group mostly used more global strategies and problem-solving strategies than low-proficiency group.

Using SORS, Akkararitwuthikun and Supapan (2013) studied 85 postgraduate students enrolled in the Master's degrees at Thummasart University when they read academic texts. The study reported that high proficiency group employed more global reading strategies than support strategies. On the contrary, lower proficiency group tended to use problem solving strategies.

Bunparit (2011) conducted the research to investigate low-proficiency EAP postgraduate students using reading strategies while they were reading research articles at King Mongkut's University of Technology Thonburi (KMUTT). The participants in this study were ten low-proficiency students. The instruments of this study were observation sheets, think aloud protocols, student worksheets, and semi-structure interview. The findings found that low-proficiency students employed both cognitive and metacognitive strategies. The most often used metacognitive strategies were underlining and marking and the most often used of cognitive strategy was translating. The researcher also found that half of the research sample employed ineffective reading strategies while reading research articles. It appeared that there was no relationship between reading strategies used and reading comprehension of low-proficiency ESP students.

Nonetheless, studies which have surveyed the English language research article reading strategies of Thai postgraduate students in the academic fields of science and technology seem very scarce. Thus, our knowledge about this particular group of students is very limited.

2.5 The Current Study

Despite the fact that English research articles are important information sources for NNES postgraduate students, research in this area has been less examined. In addition, the questionnaire for surveying research article reading strategies of postgraduate students is not currently available. Therefore, it is necessary to develop a research tool to specifically examine the reading strategy use of these students. Based on literature and previous research on Second and Foreign Language reading, the present study developed the Research Article Reading Strategies Questionnaire. The six major groups of strategies were adopted from

Oxford's (1990) framework: compensation, cognitive, memory, metacognitive, social, and affective reading strategies. The next chapter describes the research methodology of the present study including research population, research sample, research instrument, data collection process, and data analysis procedure.

CHAPTER 3

METHODOLOGY

This chapter presents the research methodology for surveying and comparing the research article reading strategies used by KMITL postgraduate students in different academic fields of science and technology for reading research articles published in English. The chapter describes the research population, research sample, research instrument, data collection process, and data analysis procedure.

3.1 Population and Sample

3.1.1 Population

The population of the current study consisted of 2,084 postgraduate students from different academic fields of science and technology including Engineering, Science, Information Technology, Agriculture, and Agro-Industry enrolled in the academic year 2014 at King Mongkut's Institute of Technology Ladkrabang (KMITL) on Ladkrabang campus in Bangkok of Thailand.

Table 3.1 KMITL Postgraduate Students from Different Faculties in the Academic Fields of Science and Technology in 2014

Faculties	Master's Degree	Doctoral Degree	Total
Faculty of Engineering	1,026	361	1,387
Faculty of Agricultural Technology	153	27	180
Faculty of Science	223	95	318
Faculty of Agro-Industry	104	10	114
Faculty of Information Technology	50	35	85
Total	**1,556**	**528**	**2,084**

3.1.2 Research Sample

The sample of the study was the postgraduate students in the academic fields of science and technology. According to Yamane's formula (1973), the sample size was calculated with a 95 % confidence level and e = .05. The total number of the research sample should be 336 postgraduate students.

Nevertheless, the participants in the study were 235 postgraduate students because the postgraduate students who finished their coursework did not often come to institute so the researcher could not meet them. There were 87 postgraduate students from the Faculty of Engineering, 21 from the Faculty of Science, 32 from the Faculty of Information Technology, 57 from the Faculty of Agricultural Technology, and 38 from the Faculty of Agro-Industry.

Table 3.2 The Number of KMITL Postgraduate Students Participating in the Study

Faculties	Number
Faculty of Engineering	87
Faculty of Agricultural Technology	57
Faculty of Science	21
Faculty of Agro-Industry	38
Faculty of Information Technology	32
Total	235

3.2 Research Instrument

The research instrument of this study was the Research Article Reading Strategies Questionnaire constructed in the bilingual version of Thai and English. The aim of this questionnaire was to survey the reading strategies for reading English research articles of postgraduate students studying in the academic fields of science and technology.

3.2.1 Questionnaire Construction Process

To construct the Research Article Reading Strategies Questionnaire for surveying the English research article reading strategy uses of postgraduate students at KMITL, the researcher reviewed the existing literature on ESL and EFL reading. The

researcher developed 40-item of reading strategies based on Oxford's (1990) framework. The Research Article Reading Strategies Questionnaire was divided into three parts.

Part 1 General information of the respondent. This part collected data related to the respondents' background information, such as gender, age, faculty, and academic major. The respondents provided answers by choosing the alternatives and filling in the blanks.

Part 2 The reading strategies used for reading English research articles. This part asked the respondents to rate the frequencies of reading strategies that they use for reading English research articles.

The Research Article Reading Strategies Questionnaire for surveying reading strategies used for reading English research articles classified reading strategies into six categories: 8 items of metacognitive reading strategies; 2 items of affective reading strategies; 1 item of social reading strategy; 20 items of cognitive reading strategies; 6 items of compensation reading strategies; and 3 items of memory reading strategies.

Table 3.3 Reading Strategy Categories

Reading Strategy Categories	Item Number
Metacognitive reading strategies (8 items)	1, 2, 3, 4, 12, 18, 27, and 29
Affective reading strategies (2 items)	28, and 30
Social reading strategy (1 item)	31
Cognitive reading strategies (20 items)	5, 6,7, 8, 9, 10, 11, 13, 14, 15, 16, 17, 19, 26, 32, 33, 34, 35, 36, and 37
Compensation reading strategies (6 items)	20, 21, 22, 23, 24, and 25
Memory reading strategies (3 items)	38, 39, and 40

The questionnaire consisted of 40 items using a five-point Likert's scale: never (1), occasionally (2), sometimes (3), usually (4), and always (5). See Appendix B.

Part 3 Other reading strategies unlisted in the questionnaire. This part asked the respondents to indicate other reading strategies that they use for reading English research articles.

3.2.2 Questionnaire Validation Process

The questionnaire was sent to 43 experienced researchers and instructors in the academic fields of science and technology at KMITL on Ladkrabang campus. There were 8 experienced researchers and instructors from the Faculty of Engineering, 9 from the Faculty of Science, 8 from the Faculty of Information Technology, 9 from the Faculty of Agricultural Technology, and 9 from the Faculty of Agro-Industry. These experts were asked to rate on the frequency of reading strategies essential for reading English research articles in order to check the content validity of the questionnaire. Furthermore, they were asked to identify whether there were any other important reading strategies that should be included in the questionnaire.

These experts confirmed the relevance of the reading strategies included in the questionnaire. All 40 items are crucial for reading English research articles. However, no new reading strategies were suggested to be added to the list of strategies in the questionnaire.

The Research Article Reading Strategies Questionnaire was then further examined by three experts in EFL education to check its construct and content validity based on the Item Objective Congruent (IOC) index. Each of the items was rated on the three-point scale: Congruent=1, Questionable=0, and Incongruent=1.

The score rated by the experts were calculated; the items with the score lower than 0.5 were revised. The value of IOC for each item is presented in Appendix A.

There were 32 items rated higher than 0.5, meaning that they were acceptably congruent with the purposes of the study. Eight items needed revision.

After the consultation with the experts, the items were adjusted as follows:

Item 15: Identifying the limitation of the study and factors affecting the findings of the study

หาข้อจำกัดของผลการวิจัย และปัจจัยที่ส่งผลต่อผลการวิจัย

↓

Item 15: Locating statements describing the limitation of the study and factors affecting the findings of the study

หาข้อจำกัดของผลการวิจัย และปัจจัยที่ส่งผลต่อผลการวิจัย

Item 16: Looking for suggestions for application(s) in real life

หาข้อเสนอแนะสำหรับการนำผลวิจัยไปประยุกต์ใช้ในชีวิตจริง

↓

Item 16: Locating statements about suggestions for applying research findings in real life

หาข้อเสนอแนะสำหรับการนำผลวิจัยไปประยุกต์ใช้ในชีวิตจริง

Item 27: Concentrating on text

มีสมาธิในการอ่าน

↓

Item 27: Concentrating on reading

มีสมาธิในการอ่าน

Item 30: Encouraging when feeling discouraged

ให้กำลังใจตนเองเมื่อรู้สึกท้อ

↓

Item 30: Encouraging myself when feeling discouraged

ให้กำลังใจตนเองเมื่อรู้สึกท้อ

Item 33: Writing a summary in Thai when finishing reading

เขียนสรุปใจความสำคัญเป็นภาษาไทยเมื่ออ่านจบ

↓

Item 33: Writing a summary of important information in Thai when finishing reading

เขียนสรุปใจความสำคัญเป็นภาษาไทยเมื่ออ่านจบ

Item 34: Writing a summary in English when finishing reading
เขียนสรุปใจความสำคัญเป็นภาษาอังกฤษเมื่ออ่านจบ

↓

Item 34: Writing a summary of important information in English when finishing reading
เขียนสรุปใจความสำคัญเป็นภาษาอังกฤษเมื่ออ่านจบ

Item 39: Associating ideas
เชื่อมโยงข้อมูลต่างๆในการอ่าน

↓

Item 39: Associating ideas in the text
เชื่อมโยงข้อมูลต่างๆในการอ่าน

Item 40: Elaborating with additional Information
ขยายความเพิ่มเติมด้วยข้อมูลอื่นๆที่เกี่ยวข้องกับสิ่งที่อ่าน

↓

Item 40: Elaborating with additional Information related to the text
ขยายความเพิ่มเติมด้วยข้อมูลอื่นๆที่เกี่ยวข้องกับสิ่งที่อ่าน

"The Research Article Reading Strategies Questionnaire" was tried out with a small group of 5 postgraduate students in the academic fields of science and technology. The respondents were asked to mark the statements which were ambiguous, or unclear, or irrelevant. It was found that no revision in the questionnaire was necessary.

3.2.3 Questionnaire Pilot Process

The questionnaire was piloted with 80 postgraduate students. They were conveniently asked to complete the questionnaire and to comment on the content of the questionnaire items focusing the meaning and clarity of the statements.

The preliminary data from the questionnaire then were analyzed for the Cronbach's Alpha Coefficient to measure its reliability. The Cronbach's Alpha Coefficient of the Research Article Reading Strategies Questionnaire was .90 which was high. The researcher then did not make any change in the questionnaire.

3.3 Data Collection Procedure

Step1. The researcher asked for an approval letter from the Dean of the Faculty of Industrial Education to conduct research at KMITL. Then, the letter from the Dean of the Faculty of Industrial Education and the introductory letter about the present research from the researcher were sent to the Dean of the Faculty of Engineering, the Dean of the Faculty of Science, the Dean of the Faculty of Information Technology, the Dean of the Faculty of Agricultural Technology, and the Dean of the Faculty of Agro-Industry in order to ask for permission for collecting data at their faculties.

Step2. After the researcher obtained the permission from the Deans of all faculties to collect data, in the academic year 2014, the researcher met with groups of KMITL postgraduate students and individual students in the Master's degree programs and doctoral degree programs on Ladkrabang campus in order to inform about the purposes of the survey and how to complete the questionnaire. The postgraduate students were assured that their confidentiality was secured and their responses would be used for this study only.

Then, copies of the Research Article Reading Strategies Questionnaire were distributed to KMITL postgraduate students by hand. Eighty-seven copies of the questionnaire were distributed to the postgraduate students from the Faculty of Engineering, 21 copies to the postgraduate students from the Faculty of Science, 32 copies to the postgraduate students from the Faculty of Information Technology, 57 copies to the postgraduate students from the Faculty of Agricultural Technology, and 38 copies to the postgraduate students from the Faculty of Agro-Industry. The postgraduate students were asked to rate the reading strategies that they used for reading English research articles and wrote other strategies that they used in the open-ended section of the Research Article Reading Strategies Questionnaire.

3.4 Data Analysis Procedure

The quantitative data derived from the second part of the Research Article Reading Strategies Questionnaire were analyzed using SPSS and reported in terms of means ($\bar{X}$) and standard deviations (S.D.).

The mean scores of reading strategies were identified in three levels as suggested by Oxford and Burry-Stock (1995): high, moderate, and low. These three levels were used for interpreting the findings as described below:

Mean of 3.50 and higher	=	high
Mean of 2.50 to 3.49	=	moderate
Mean of 2.49 and lower	=	low

Moreover, the variations of reading strategies used by postgraduate students from different faculties were checked using a one-way analysis of variances (ANOVA). The significance level was set at $p < .05$. The Scheffe post-hoc test was used to determine the significant difference in reading strategy categories used by KMITL postgraduate students from different academic fields.

The data from Part 3 (the open-ended section) were analyzed in terms of contents and put in 6 categories of reading strategies: metacognitive, affective, social, cognitive, compensation and memory reading strategies.

Conclusion

This chapter has presented the research methodology including the research population and sample, research instrument, data collection process, and data analysis procedure. The sample of the study consisted of 235 postgraduate students who studied in the academic fields of science and technology at KMITL. The study developed the Research Article Reading Strategies Questionnaire to be used as the research instrument for surveying the reading strategies for reading English research articles. The data were analyzed for means ($\bar{X}$) and standard deviations (S.D), and the means of reading strategies were compared using one-way analysis of variance (ANOVA) to analyze mean differences between reading strategies use of postgraduate students from different academic fields. Furthermore, post-hoc (Scheffe) was

employed to determine the significant difference in reading strategies used by postgraduate students from different academic fields. The next chapter presents the results of the study.

CHAPTER 4

RESULTS

This chapter presents the results of the study which surveyed and compared the reading strategies that postgraduate students from different academic fields of science and technology at King Mongkut's Institute of Technology Ladkrabang (KMITL) used for reading English research articles. The present study was conducted to answer the following research questions:

1. What reading strategies do postgraduate students from different academic fields of science and technology use for reading English research articles?

1.1 What **metacognitive reading strategies** do postgraduate students from different academic fields of science and technology use for reading English research articles?

1.2 What **cognitive reading strategies** do postgraduate students from different academic fields of science and technology use for reading English research articles?

1.3 What **memory reading strategies** do postgraduate students from different academic fields of science and technology use for reading English research articles?

1.4 What **compensation reading strategies** do postgraduate students from different academic fields of science and technology use for reading English research articles?

1.5 What **affective reading strategies** do postgraduate students from different academic fields of science and technology use for reading English research articles?

1.6 What **social reading strategies** do postgraduate students from different academic fields of science and technology use for reading English research articles?

2. Do postgraduate students from different academic fields of science and technology use different reading strategies for reading English research articles?

4.1 General Information of the Postgraduate Students

The findings of general information of the postgraduate students are presented in Table 4.1 and Table 4.2.

Table 4.1 presents the numbers and percentages of postgraduate students from different academic fields of science and technology who answered the questionnaire. The total number of postgraduate students participating in the study was 235 (n=235). The majority of the participants were the postgraduate students from the Faculty of Engineering (n=87), followed by the postgraduate students from the Faculty of Agricultural Technology (n= 57), the Faculty of Agricultural Technology (n=57), the Faculty of Agro-Industry (n=38), the Faculty of Information Technology (n=32), and the Faculty of Science (n=21).

According to Table 4.1, there were 198 (84.25%) Master's degree students; 98 (41.70%) were males and 100 (42.55%) were females. There were 37 (15.74%) doctorate students; 20 (8.51%) were males and 17 (7.23%) were females.

Table 4.1 General Information of Postgraduate Students (n= 235)

Faculty	Faculty of Engineering (n=87) (37.02%)				Faculty of Science (n=21) (8.93%)				Faculty of Information Technology (n=32) (13.61%)				Faculty of Agricultural Technology (n=57) (24.25%)				Faculty of Agro-Industry (n=38) (16.17%)				
Sex	Male		Female		Male		Female		Male		Female		Male		Female		Male		Female		Total
Number	59 (25.10%)		28 (11.91%)		12 (5.10%)		9 (3.82%)		17 (7.23%)		15 (6.38%)		20 (8.51%)		37 (15.74%)		10 (4.25%)		28 (11.91%)		235
Degree	Master	Ph.D.	Master	Ph.D.	Master	Ph.D.	Master	Ph.D.	Master	Ph.D.	Master	Ph.D.	Master	Ph.D.	Master	Ph.D.	Master	Ph.D.	Master	Ph.D.	Total
Total	44 (18.72%)	15 (6.38%)	27 (11.48%)	1 (0.42%)	12 (5.10%)	0 (0%)	9 (3.82%)	0 (0%)	14 (5.95%)	3 (1.27%)	13 (5.53%)	2 (0.85%)	19 (8.08%)	1 (0.42%)	26 (11.06%)	11 (4.68%)	9 (3.82%)	1 (0.42%)	25 (10.63%)	3 (1.27%)	235 (100)
Age (X)	25.77	42.00	26.65	34.00	25.25	0	24.00	0	30.07	32.33	33.46	32.33	24.86	30.0	24.12	30.40	23.9	32.00	25.38	29.05	26.27

As can be seen in Table 4.1, the majority of the participants in the study were the students from the **Faculty of Engineering**. There were 87 (37.02%) engineering postgraduate students; 59 (25.10%) were males and 28 (11.91%) were females. The results revealed that 44 (18.72%) of males studied in the Master's degree programs whose mean age was 25.77 years old. There were 15 (6.38%) of them studying in the doctoral degree programs whose mean was 42 years old. There were 27 (11.48%) female students studying in the Master's degree programs whose mean age was 26.65 years old. There was 1 female student studying in the doctoral degree program who was 34 years old.

There were 21 (8.93%) postgraduate students from the **Faculty of Science**. All of the students were studying in the Master's degree programs. 12 (5.10%) of the students were males whose mean age was 25.25 years old and 9 (3.82%) of them were females whose mean age was 24 years old.

There were 57 (24.25%) postgraduate students from the **Faculty of Agricultural Technology**; 20 (8.51%) of the students were males and 37 (15.74%) were females. There were 19 (8.08%) male students studying in the Master's degree programs whose mean age was 24.86 years old. There was 1 (0.42%) male student studying in the doctoral degree program who was 30 years old. There were 26 (11.06%) female students studying the Master's degree program whose mean age was 24.12 years old. There were 11 (4.68%) female students studying in the doctoral degree programs whose mean age was 30.40 years old.

There were 38 (11.91%) postgraduate students from the **Faculty of Agro-Industry**; 10 (4.28%) of the students were males and 28 (11.91%) of them were females. There were 9 (3.82%) male students studying in the Master's degree programs whose mean age was 23.90 years old. There was 1 (0.42%) male student studying in the doctoral degree program who was 32 years old. There were 25 (10.63%) female students studying in the Master's degree programs whose mean age was 25.38 years old. There were 3 (1.27%) female students studying in the doctoral degree programs whose mean age was 29.05 years old.

There were 32 (13.61%) postgraduate students from the **Faculty of Information Technology**; 17 (7.23%) of the students were males and 15 (6.38%) were females. There were 14 (5.95%) males studying in Master's degree programs whose mean age was 30.07 years old. There were 3 (1.27%) males studying in the doctoral degree programs whose mean age was 32.33 years old. They were 13 (5.53) females in the Master's degree programs whose mean age was 33.46 years old. There were 2 (0.85%) female students studying in the doctoral degree programs whose mean age was 32.33 years olds.

Table 4.2 Frequencies, Percentages and Means of Self-Assessment of Reading Ability by Postgraduate Students (n=235)

Faculty		Faculty of Engineering				Faculty of Science				Faculty of Information Technology				Faculty of Agricultural Technology				Faculty of Agro-Industry				Total
Sex		Male		Female		Male		Female		Male		Female		Male		Female		Male		Female		
Degrees		Master	Ph.D.	Master	Ph.D.	Master	Ph.D.	Master	Ph.D.	Master	Ph.D.	Master	Ph.D.	Master	Ph.D.	Master	Ph.D.	Master	Ph.D.	Master	Ph.D.	
Self-Assess of Reading Ability	Low	7	1	12	0	2	0	1	0	2	0	1	0	8	0	13	1	5	0	8	0	61 (25.95%)
	Moderate	32	8	15	1	10	0	8	0	10	1	9	1	10	1	10	10	4	1	16	3	150 (63.82%)
	High	5	6	0	0	0	0	0	0	2	2	3	1	1	0	3	0	0	0	1	0	24 (10.21%)
	$\bar{X}$	1.62				1.84				1.78				1.77				1.82				1.76

Table 4.2 presents the frequencies, percentages and means of the postgraduate students who rated their reading abilities. About a quarter of the postgraduate students (61 = 25.95%) rated their reading abilities at **a high level**, and more than half of the postgraduate students (150 = 63.82%) rated their reading abilities at **a moderate level**. The minority in the group (24 = 10.21%) rated their reading ability at **a low level**.

The overall mean of self-rated reading abilities of the sample was at **a moderate level** ($\overline{X}$=1.76). According to the findings, the postgraduate students from the Faculty of Engineering rated their reading ability at **a low level** ($\overline{X}$=1.62). The postgraduate students from the Faculty of Science ($\overline{X}$=1.84), Faculty of Information Technology ($\overline{X}$=1.78), Faculty of Agricultural Technology ($\overline{X}$=1.77), and Faculty of Agro-Industry ($\overline{X}$=1.82) rated their reading ability at **a moderate level**.

4.2 Reading Strategies Used by Postgraduate Students from Different Academic Fields for Reading English Research Articles

The findings of reading strategies used by postgraduate students from different academic fields of science and technology for reading English research articles are presented to answer the following research questions:

1. What reading strategies do postgraduate students from different academic fields of science and technology use for reading English research articles?

1.1 What **metacognitive reading strategies** do postgraduate students from different academic fields of science and technology use for reading English research articles?

1.2 What **cognitive reading strategies** do postgraduate students from different academic fields of science and technology use for reading English research articles?

1.3 What **memory reading strategies** do postgraduate students from different academic fields of science and technology use for reading English research articles?

1.4 What **compensation reading strategies** do postgraduate students from different academic fields of science and technology use for reading English research articles?

1.5 What **affective reading strategies** do postgraduate students from different academic fields of science and technology use for reading English research articles?

1.6 What **social reading strategies** do postgraduate students from different academic fields of science and technology use for reading English research articles?

The mean scores of reading strategies were identified by three levels as suggested by Oxford and Burry-Stock (1995): high, moderate, and low. These three levels were used for interpreting the findings as described below:

Mean of 3.50 and higher	=	high
Mean of 2.50 to 3.49	=	moderate
Mean of 2.49 and lower	=	low

Moreover, the results of the reading strategies used for reading English research articles of KMITL postgraduate students were reported based on categories: Metacognitive, Affective, Social, Cognitive, Compensation, and Memory reading strategies.

Table 4.3, 4.4, 4.5, 4.6, 4.7, and 4.8 show the means and standard deviations of individual reading strategies in categories used by KMITL postgraduate students in the different academic fields of science and technology for reading English research articles.

4.2.1 Metacognitive Reading Strategies

The means and standard deviations of metacognitive reading strategies are presented in Table 4.3. There are 8 metacognitive reading strategies in the questionnaire.

Table 4.3 Means and Standard Deviations of **Metacognitive Reading Strategies** Used by KMITL Postgraduate Students from Different Academic Fields of Science and Technology (n=235)

Items	Reading Strategies	Engineering		Science		Information Technology		Agriculture		Agro-Industry		Total	
		$\bar{X}$	S.D.	$\bar{X}$	S.D.	$\bar{X}$	S.D.	$\bar{X}$	S.D.	$\bar{X}$	S.D.	$\bar{X}$	S.D.
1	Setting a reading purpose	3.71	0.90	4.09	0.43	3.62	0.55	3.84	0.97	3.71	0.80	3.76	0.83
2	Planning before reading	3.36	0.89	3.57	0.50	3.46	0.71	3.57	0.98	3.42	0.75	3.45	0.84
3	Choosing relevant research articles according to the reading purpose	4.16	0.84	4.09	0.76	3.53	0.80	4.07	0.77	4.15	0.67	4.04	0.81
4	Determining what to read in each article	3.83	0.88	3.71	0.56	3.56	0.75	3.89	0.74	3.81	0.76	3.80	0.79
12	Linking what is being read with the background knowledge to help understanding	3.81	0.77	3.71	0.71	3.62	0.79	3.70	0.86	3.73	0.64	3.74	0.77
18	Choosing relevant information from the research article to apply in my own work	3.83	0.87	4.09	0.70	3.62	0.55	3.96	0.84	4.05	0.65	3.89	0.78
27	Concentrating on reading	3.63	0.85	4.00	0.70	3.90	0.85	3.68	0.90	3.63	0.81	3.71	0.85
29	Pausing and thinking about what have been read	3.80	0.87	3.85	0.65	3.65	0.74	3.52	0.78	3.71	0.80	3.70	0.80
	Total	**3.76**	**0.85**	**3.88**	**0.62**	**3.62**	**0.71**	**3.77**	**0.85**	**3.77**	**0.73**	**3.76**	**0.80**

The results showed that the overall mean of metacognitive reading strategies used was **high** ($\bar{X}$=3.76). The metacognitive reading strategies often used were

choosing the relevant research articles according to the reading purpose ($\overline{X}$=4.04), followed by choosing relevant information from research articles to apply in their own work ($\overline{X}$=3.89); Determining what to read in each article ($\overline{X}$=3.80); Setting a reading purpose ($\overline{X}$=3.76); Linking what is being read with the background knowledge to help understanding ($\overline{X}$=3.74); Concentrating on reading ($\overline{X}$=3.71); Pausing and thinking about what have been read ($\overline{X}$=3.70). Conversely, the least used metacognitive reading strategy was planning before reading ($\overline{X}$=3.45) which was at a moderate level.

The postgraduate students from **the Faculty of Science** who used the highest metacognitive reading strategy reported using the following strategies: Setting a reading purpose ($\overline{X}$=4.09); Choosing relevant research articles according to the reading purpose ($\overline{X}$=4.09); Choosing relevant information from the research article to apply in their own work ($\overline{X}$=4.09); Concentrating on reading ($\overline{X}$=4.00); Pausing and thinking about what have been read ($\overline{X}$=3.85); Planning before reading ($\overline{X}$=3.57); determining what to read in each article ($\overline{X}$=3.71); and linking what is being read with the background knowledge to help understanding ($\overline{X}$=3.71).

On the other hand, the postgraduate students from the **Faculty of Information Technology** who used the lowest metacognitive reading strategies reported using the following strategies: Concentrating on reading ($\overline{X}$=3.90); Pausing and thinking about what have been read ($\overline{X}$=3.65); Setting a reading purpose ($\overline{X}$=3.62); Linking what is being read with the background knowledge to help understanding ($\overline{X}$=3.62); Choosing relevant information from the research article to apply in their own work ($\overline{X}$=3.62); Determining what to read in each article ($\overline{X}$=3.56); Choosing relevant research articles according to the reading purpose ($\overline{X}$=3.53) and Planning before reading ($\overline{X}$=3.46).

Although KMITL postgraduate students from different academic fields of science and technology appeared to use metacognitive reading strategies at a high level, the average mean of 3.76 indicates that it is still not very high. Therefore, these postgraduate students should be encouraged to employ a more variety of useful metacognitive reading strategies for finding the purpose of the text, checking their understanding, and monitoring and evaluating their comprehension.

4.2.2 Affective Reading Strategies

Table 4.4 presents means and standard deviations of affective reading strategies used by KMITL postgraduate students.

Table 4.4 Means and Standard Deviations of **Affective Reading Strategies** Used by KMITL Postgraduate Students from Different Academic Fields of Science and Technology (n=235)

Items	Reading Strategies	Engineering		Science		Information Technology		Agriculture		Agro-Industry		Total	
		$\bar{x}$	S.D	$\bar{x}$	S.D	$\bar{x}$	S.D	$\bar{x}$	S.D	$\bar{x}$	S.D	$\bar{x}$	S.D.
28	Trying to get back on track when losing concentration	3.72	0.88	3.85	0.72	3.78	0.55	3.70	0.77	3.76	0.71	3.74	0.77
30	Encouraging myself when feeling discouraged	3.55	1.04	3.66	0.79	3.56	0.87	3.68	0.96	3.63	0.78	3.60	0.93
	Total	**3.63**	**0.96**	**3.75**	**0.75**	**3.67**	**0.71**	**3.69**	**0.86**	**3.69**	**0.74**	**3.67**	**0.85**

The results indicated that the overall mean of affective reading strategies used was high ($\bar{X}$=3.67). The highest mean of the affective strategy was trying to get back on track when losing concentration ($\bar{X}$=3.74), followed by encouraging themselves when they felt discouraged ($\bar{X}$=3.60).

The postgraduate students from **the Faculty of Science** who used the highest affective reading strategies reported using the following strategies: Trying to get back on track when losing concentration ($\bar{X}$=3.85) and encouraging themselves when feeling discouraged ($\bar{X}$=3.66).

On the contrary, the postgraduate students from the **Faculty of Engineering** who used the lowest affective strategies reported using the following strategies: Trying to get back on track when losing concentration ($\bar{X}$=3.72), and encouraging themselves when feeling discouraged ($\bar{X}$=3.55).

According to the results, the postgraduate students at KMITL from different academic fields of science and technology seemed to utilize affective reading strategies at a high level in order to monitor their emotion and boost their

motivation (Oxford, 1990). When they lost concentration and failed to understand, these strategies could assist them.

4.2.3 Social Reading Strategy

Table 4.5 presents means and standard deviations of social reading strategy used by KMITL postgraduate students.

Table 4.5 Means and Standard Deviations of **Social Reading Strategy** Used by KMITL Postgraduate Students from Different Academic Fields of Science and Technology (n=235)

Items	Reading Strategies	Engineering		Science		Information Technology		Agriculture		Agro-Industry		Total	
		$\bar{X}$	S.D.	$\bar{X}$	S.D.	$\bar{X}$	S.D.	$\bar{X}$	S.D.	$\bar{X}$	S.D.	$\bar{X}$	S.D.
31	Asking others to explain when failing to understand the research articles	3.56	0.91	3.95	0.74	3.31	0.96	3.61	0.95	3.94	0.80	3.63	0.91
	Total	**3.56**	**0.91**	**3.95**	**0.74**	**3.31**	**0.96**	**3.61**	**0.95**	**3.94**	**0.80**	**3.63**	**0.91**

As can be seen in Table 4.5, KMITL postgraduate students employed the social reading strategy with a significant difference for reading English research articles. The results indicated that the overall mean of the social reading strategy used was high ($\bar{X}$=3.63). The postgraduate students from different academic fields of science and technology employed the social reading strategy at a high level. It appeared that when the students failed to understand, they tended to ask other people to explain the information for them. The social reading strategy can assist the reader to learn through social interaction with others (Oxford, 1990).

4.2.4 Cognitive Reading Strategies

Table 4.6 presents means and standard deviations of cognitive reading strategies used by KMITL postgraduate students. There are 20 items of cognitive strategies in the questionnaire.

Table 4.6 Means and Standard Deviations of **Cognitive Reading Strategies** Used by KMITL Postgraduate Students from Different Academic Fields of Science and Technology (n=235)

Items	Reading Strategies	Engineering		Science		Information Technology		Agriculture		Agro-Industry		Total	
		$\bar{X}$	S.D.	$\bar{X}$	S.D.	$\bar{X}$	S.D.	$\bar{X}$	S.D.	$\bar{X}$	S.D.	$\bar{X}$	S.D.
5	Reading the abstract to obtain important research information	4.14	0.86	4.23	0.76	3.59	0.66	3.71	0.88	4.18	0.83	3.98	0.86
6	Surveying text	3.79	0.91	3.71	0.71	3.5	0.76	3.80	0.71	3.76	0.88	3.74	0.82
7	Skimming quickly for main idea	3.48	0.99	3.66	0.48	3.43	0.66	3.57	0.98	3.36	0.78	3.49	0.88
8	Reading slowly and carefully	3.50	0.98	3.80	0.67	3.62	0.60	3.49	0.90	3.39	0.75	3.52	0.86
9	Finding the statement of research gap	3.60	0.93	3.57	0.59	3.78	0.70	3.35	0.97	3.38	0.83	3.60	0.88
10	Identifying the purpose of the study	3.82	0.87	3.42	.67	3.71	0.68	3.54	0.82	3.92	0.74	3.72	0.81
11	Finding the significance of the study	3.86	0.90	3.66	0.65	3.87	0.60	3.84	0.99	3.94	0.65	3.85	0.83
13	Evaluating the validity and reliability of the study	3.59	0.90	3.71	0.78	3.71	0.72	3.57	0.92	3.42	0.72	3.59	0.84
14	Identifying generalized facts from the results of the study	3.58	0.78	3.71	0.46	3.65	0.54	3.47	0.92	3.42	0.64	3.55	0.75
15	Locating statements describing the limitations of the study and factors affecting the findings of the study	3.66	0.92	3.61	0.58	3.56	0.66	3.57	0.92	3.42	0.68	3.58	0.82

Table 4.6 (Continued)

Items	Reading Strategies	Engineering		Science		Information Technology		Agriculture		Agro-Industry		Total	
		$\bar{X}$	S.D.	$\bar{X}$	S.D.	$\bar{X}$	S.D.	$\bar{X}$	S.D.	$\bar{X}$	S.D.	$\bar{X}$	S.D.
16	Locating statements about suggestions for applying research findings in real life	3.49	0.84	3.61	0.80	3.62	0.90	3.56	0.92	3.28	0.83	3.50	0.86
17	Finding recommendation(s) for future research	3.49	0.83	3.38	0.80	3.68	0.69	3.64	0.83	3.50	0.72	3.54	0.79
19	Using figures, graphs, and mathematical equations to help understanding	4.00	0.87	4.42	0.59	3.50	0.71	3.94	0.93	3.97	0.86	3.95	0.86
26	Translating English sentences into Thai when the text becomes difficult	3.67	1.10	3.76	0.70	3.62	0.90	3.92	0.82	3.92	0.91	3.77	0.95
32	Rereading for better understanding	3.86	0.85	4.04	0.74	3.65	0.74	3.73	0.81	4.10	0.79	3.85	0.81
33	Writing a summary of important information in Thai when finishing reading	3.27	1.11	3.90	0.99	3.37	0.83	3.64	0.79	3.34	0.90	3.44	0.97
34	Writing a summary of important information in English when finishing reading	2.94	1.31	3.09	1.51	3.15	1.01	3.10	0.99	2.65	1.16	2.97	1.20
35	Taking notes of important information	3.67	1.06	4.04	0.74	3.50	0.91	3.68	0.78	3.13	1.06	3.68	0.93
36	Creating text mapping to increase comprehension	3.25	1.08	3.42	1.07	3.12	1.07	3.26	1.02	3.13	1.06	3.23	1.05

Table 4.6 (Continued)

Items	Reading Strategies	Engineering		Science		Information Technology		Agriculture		Agro-Industry		Total	
		$\bar{X}$	S.D.	$\bar{X}$	S.D.	$\bar{X}$	S.D.	$\bar{X}$	S.D.	$\bar{X}$	S.D.	$\bar{X}$	S.D.
37	Making outline to increase comprehension	3.31	1.11	3.76	0.99	3.09	0.96	3.17	1.05	3.23	0.94	3.27	1.04
Total		3.59	0.96	3.72	0.76	3.53	0.76	3.57	0.89	3.52	0.83	3.59	0.89

According to Table 4.6, the overall mean of reported **cognitive reading strategies** used was high ($\bar{X}$=3.59). The findings indicated that the highest use of cognitive strategy in this category was reading the abstract to obtain important research information ($\bar{X}$=3.98), followed by using figures, graphs, and mathematical equations to help understanding ($\bar{X}$=3.95); Finding the significance of the study ($\bar{X}$=3.85); Rereading for better understanding ($\bar{X}$=3.85); Translating English sentences into Thai when the text becomes difficult ($\bar{X}$=3.77); Surveying text ($\bar{X}$=3.74); Identifying the purpose of the study ($\bar{X}$=3.72); Taking notes of important information ($\bar{X}$=3.68); Finding the statement of research gap ($\bar{X}$=3.60); Evaluating the validity and reliability of the study ($\bar{X}$=3.59); Locating statements describing the limitations of the study and factors affecting the findings of the study ($\bar{X}$=3.58); Identifying generalized facts from the results of the study ($\bar{X}$=3.55); Finding recommendation(s) for future research ($\bar{X}$=3.54); Reading slowly and carefully ($\bar{X}$=3.52); Locating statements about suggestions for applying research findings in real life ($\bar{X}$=3.50); Skimming quickly for main idea ($\bar{X}$=3.49); Writing a summary of important information in Thai when finishing reading ($\bar{X}$=3.44); Making outline to increase comprehension ($\bar{X}$=3.27); and creating text mapping to increase comprehension ($\bar{X}$=3.23). When postgraduate students finished reading, they reported that they tended to write a summary of important information in English at a moderate level ($\bar{X}$=2.97).

The postgraduate students from the **Faculty of Science** who used the highest **cognitive reading strategies** reported using the following strategies: Using figures, graphs, and mathematical equations to help understanding ($\bar{X}$=4.42); Reading the abstract to obtain important research information ($\bar{X}$=4.23); Rereading for better understanding ($\bar{X}$=4.04); Taking notes of important information ($\bar{X}$=4.04); Writing a summary of important information in Thai when finishing reading ($\bar{X}$=3.90); Reading

slowly and carefully ($\bar{X}$=3.80); Translating English sentences into Thai when the text becomes difficult ($\bar{X}$=3.76); Making outline to increase comprehension ($\bar{X}$=3.76); Surveying text ($\bar{X}$=3.71); Evaluating the validity and reliability of the study ($\bar{X}$=3.71); Identifying generalized facts from the results of the study ($\bar{X}$=3.71); Skimming quickly for main idea ($\bar{X}$=3.66); Finding the significance of the study ($\bar{X}$=3.66); Locating statements describing the limitations of the study and factors affecting the findings of the study ($\bar{X}$=3.61); Locating statements about suggestions for applying research findings in real life ($\bar{X}$=3.61); Finding the statement of research gap ($\bar{X}$=3.57); Identifying the purpose of the study ($\bar{X}$=3.42); Creating text mapping to increase comprehension ($\bar{X}$=3.42); Finding recommendation(s) for future research ($\bar{X}$=3.38); and writing a summary of important information in English when finishing reading ($\bar{X}$=3.09).

Conversely, the postgraduate students from the **Faculty of Agro-Industry** who used the lowest cognitive reading strategies reported using the following strategies: Reading the abstract to obtain important research information ($\bar{X}$=4.18); Rereading for better understanding ($\bar{X}$=4.10); Using figures, graphs, and mathematical equations to help understanding ($\bar{X}$=3.97); Finding the significance of the study ($\bar{X}$=3.94); Identifying the purpose of the study ($\bar{X}$=3.92); Translating English sentences into Thai when the text becomes difficult ($\bar{X}$=3.92); Surveying text ($\bar{X}$=3.76); Finding recommendation(s) for future research ($\bar{X}$=3.50); Evaluating the validity and reliability of the study ($\bar{X}$=3.42); Identifying generalized facts from the results of the study ($\bar{X}$=3.42); Locating statements describing the limitations of the study and factors affecting the findings of the study ($\bar{X}$=3.42); Reading slowly and carefully ($\bar{X}$=3.39); Finding the statement of research gap ($\bar{X}$=3.38); Skimming quickly for main idea ($\bar{X}$=3.36); Writing a summary of important information in Thai when finishing reading ($\bar{X}$=3.34); Locating statements about suggestions for applying research findings in real life ($\bar{X}$=3.28); Making outline to increase comprehension ($\bar{X}$=3.23); Taking notes of important information ($\bar{X}$=3.13); Creating text mapping to increase comprehension ($\bar{X}$=3.13); and writing a summary of important information in English when finishing reading ($\bar{X}$=2.65).

The results revealed that the postgraduate students from all faculties appeared to use cognitive reading strategies at a similar level which was high. KMITL postgraduate students utilized cognitive reading strategies which concern mental

process related to reading and thinking process (Brown, 1994; Oxford, 1990). However, the postgraduate students could be trained to use a more variety of these cognitive strategies for reading English research articles effectively.

4.2.5 Compensation Reading Strategies

The means and standard deviations of compensation reading strategies used by postgraduate students at KMITL are presented in Table 4.7. There are 6 items of compensation strategies.

Table 4.7 Means and Standard Deviations of Compensation Reading Strategies Used by KMITL Postgraduate Students from Different Academic Fields of Science and Technology (n=235)

Items	Reading Strategies	Engineering		Science		Information Technology		Agriculture		Agro-Industry		Total	
		$\bar{X}$	S.D.	$\bar{X}$	S.D.	$\bar{X}$	S.D.	$\bar{X}$	S.D.	$\bar{X}$	S.D.	$\bar{X}$	S.D.
20	Adjusting reading speed appropriate for the level of text difficulty	3.42	0.80	3.90	0.88	3.34	0.74	3.56	0.94	3.57	0.68	3.51	0.82
21	Reading aloud to increase understanding when failing to understand	3.05	1.18	3.52	0.81	3.56	0.71	3.29	1.05	2.81	1.03	3.18	1.06
22	Using grammatical knowledge to help understanding	3.44	.99	3.47	0.74	3.53	.62	3.47	0.96	3.02	0.91	3.40	0.92
23	Separating words or phrases into small units to help understanding when failing to understand	3.63	0.96	3.47	0.67	3.65	.60	3.59	0.96	3.21	0.87	3.54	0.89

Table 4.7 (Continued)

Items	Reading Strategies	Engineering		Science		Information Technology		Agriculture		Agro-Industry		Total	
		$\bar{X}$	S.D.	$\bar{X}$	S.D.	$\bar{X}$	S.D.	$\bar{X}$	S.D.	$\bar{X}$	S.D.	$\bar{X}$	S.D.
24	Guessing the meanings of unknown words by using context clues	3.62	1.00	3.76	0.83	3.78	.65	3.47	0.84	3.55	0.86	3.60	0.88
25	Using dictionary to find the meanings of unfamiliar vocabulary	4.01	0.95	4.09	0.83	3.50	.87	3.96	0.86	4.21	0.84	3.97	0.91
Total		3.52	0.98	3.70	0.79	3.56	0.69	3.55	0.93	3.39	0.86	3.53	0.91

The results revealed that the overall mean of **compensation reading strategies** used was high ($\bar{X}$=3.53). The findings indicated that the highest use of compensation strategy in this category was using dictionary to find the meanings of unfamiliar vocabulary ($\bar{X}$=3.97), followed by guessing the meanings of unknown words by using context clues ($\bar{X}$=3.97); Guessing the meanings of unknown words by using context clues ($\bar{X}$=3.60); Separating words or phrases into small units to help understanding when failing to understand ($\bar{X}$=3.54); Adjusting reading speed appropriate for the level of text difficulty ($\bar{X}$=3.51); Using grammatical knowledge to help understanding ($\bar{X}$=3.40). On the other hand, the least used compensation reading strategy was reading aloud to increase understanding when failing to understand ($\bar{X}$=3.18).

The postgraduate students from the **Faculty of Science** who used the highest compensation reading strategies reported using the following strategies: Using dictionary to find the meanings of unfamiliar vocabulary ($\bar{X}$=4.09); Adjusting reading speed appropriate for the level of text difficulty ($\bar{X}$=3.90); Guessing the meanings of unknown words by using context clues ($\bar{X}$=3.76); Reading aloud to increase understanding when failing to understand ($\bar{X}$=3.52); Using grammatical knowledge to help understanding ($\bar{X}$=3.47); and separating words or phrases into small units to help understanding when failing to understand ($\bar{X}$=3.47).

On the other hand, the postgraduate students from the **Faculty of Agro-Industry** who used the lowest compensation reading strategies reported using the following strategies: Using dictionary to find the meanings of unfamiliar vocabulary ($\overline{X}$=4.21); Adjusting reading speed appropriate for the level of text difficulty ($\overline{X}$=3.57); Guessing the meanings of unknown words by using context clues ($\overline{X}$=3.55); Separating words or phrases into small units to help understanding when failing to understand ($\overline{X}$=3.21); Using grammatical knowledge to help understanding ($\overline{X}$=3.02); and Reading aloud to increase understanding when failing to understand ($\overline{X}$=2.81).

According to the findings shown in Table 4.9, KMITL postgraduate students from different academic fields of science and technology employed compensation reading strategies at a similar level which was high. Compensation reading strategies are additional skills to assist the students when they face difficulties while reading (Oxford, 1990; Bunparit, 2011). Nevertheless, the postgraduate students should practice to use a more variety of compensation reading strategies for reading English research articles.

4.2.6 Memory Reading Strategies

Table 4.8 shows means and standard deviations of memory reading strategies utilized by KMITL postgraduate students. There are 3 strategies in this category.

Table 4.8 Means and Standard Deviations of **Memory Reading Strategies** Used by KMITL Postgraduate Students from Different Academic Fields of Science and Technology (n=235)

Items	Reading Strategies	Engineering		Science		Information Technology		Agriculture		Agro-Industry		Total	
		$\overline{X}$	S.D.	$\overline{X}$	S.D.	$\overline{X}$	S.D.	$\overline{X}$	S.D.	$\overline{X}$	S.D.	$\overline{X}$	S.D.
38	Grouping information	3.52	0.99	3.57	0.74	3.43	0.84	3.38	0.90	3.39	0.67	3.46	0.88
39	Associating ideas in the text	3.58	0.81	3.57	0.59	3.68	0.59	3.54	0.82	3.52	0.55	3.59	0.73
40	Elaborating with additional information related to the text	3.57	0.87	3.71	0.71	3.46	0.56	3.63	0.79	3.42	0.82	3.56	0.79
Total		**3.55**	**0.89**	**3.61**	**0.68**	**3.52**	**0.66**	**3.51**	**0.83**	**3.44**	**0.68**	**3.53**	**0.80**

The results showed that the overall mean of **memory reading strategies** used was high ($\overline{X}$=3.53). The highest used memory reading strategy was associating ideas in the text ($\overline{X}$=3.59), followed by elaborating with additional information related to the text ($\overline{X}$=3.56). The lowest used memory strategy was grouping information ($\overline{X}$=3.46).

The postgraduate students from the **Faculty of Science** who used the highest memory reading strategies reported using the following strategies: Elaborating with additional information related to the text ($\overline{X}$=3.71); Grouping information ($\overline{X}$=3.57); and associating ideas in the text ($\overline{X}$=3.57).

On the other hand, the postgraduate students from the **Faculty of Agro-Industry** who used the lowest memory reading strategies reported using the following strategies: Associating ideas in the text ($\overline{X}$=3.52); Elaborating with additional information related to the text ($\overline{X}$=3.42); and grouping information ($\overline{X}$=3.39).

According to the findings, the postgraduate students from different academic fields of science and technology apparently employed memory reading strategies for reading research articles at the similar level which was high. However, the instructor should train them to employ a more variety of memory strategies.

4.3 The Results of Open-ended Question

In open-ended section, the postgraduate students were asked to indicate other reading strategies that they used for reading English research articles. KMITL postgraduate students did not specify any other reading strategies unlisted in the questionnaire. Therefore, there were not any findings to report.

4.4 Differences in Reading Strategies Used by KMITL Postgraduate Students from Different Academic Fields of Science and Technology for Reading English Research Articles

Table 4.9 presents the means and standard deviations of reading strategies in six categories which were used by postgraduates from different academic fields of

science and technology and Figure 4.1 compares the results. The findings were used to answer the following research question:

Research question: Do postgraduate students from different academic fields of science and technology use different reading strategies for reading English research articles?

Table 4.9 Means and Standard Deviations of Reading Strategies Used by KMITL Postgraduate Students Based on Academic Fields of Science and Technology and Reading Strategy Categories (n=235)

Reading Strategies	Engineering		Science		Information Technology		Agriculture		Agro-Industry		Total	
	$\bar{X}$	S.D.	$\bar{X}$	S.D.	$\bar{X}$	S.D.	$\bar{X}$	S.D.	$\bar{X}$	S.D.	$\bar{X}$	S.D.
Metacognitive Strategies (1)	3.76	0.85	3.88	0.62	3.62	0.71	3.77	0.85	3.77	0.73	3.76	0.80
Cognitive Strategies (2)	3.59	0.96	3.72	0.76	3.53	0.76	3.57	0.89	3.52	0.83	3.59	0.89
Compensation Strategies (3)	3.52	0.98	3.70	0.79	3.56	0.69	3.55	0.93	3.39	0.86	3.53	0.91
Affective Strategies (4)	3.63	0.96	3.75	0.75	3.67	0.71	3.69	0.86	3.69	0.74	3.67	0.85
Social Strategy (5)	3.56	0.91	3.95	0.74	3.31	0.96	3.61	0.95	3.94	0.80	3.63	0.91
Memory Strategies (6)	3.55	0.89	3.61	0.68	3.52	0.66	3.51	0.83	3.44	0.68	3.53	0.80
Total	**3.60**	**0.92**	**3.76**	**0.72**	**3.53**	**0.74**	**3.61**	**0.88**	3.62	0.77	3.61	**0.86**

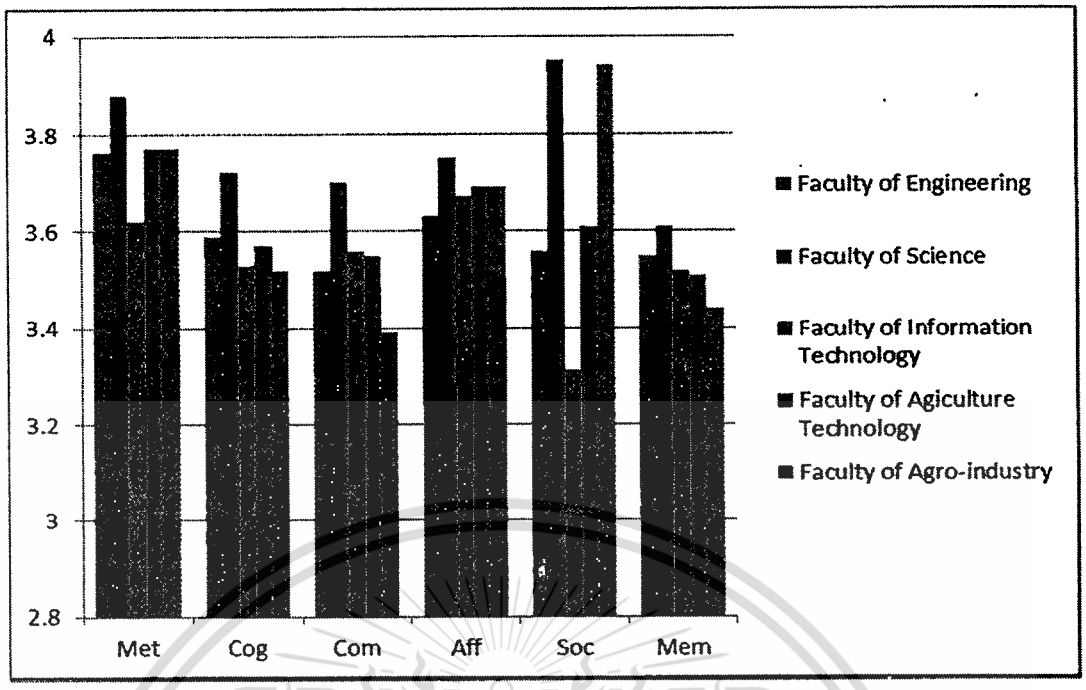

Figure 4.1 Reading Strategies Uses of KMITL Postgraduate Students Based on Reading Categories and Faculties

4.4.1 Ranking by Academic Fields

According to Table 4.9, the overall mean ($\overline{X}$=3.61) of the sample showed **a high level** of reading strategies used for reading English research articles. The means of reading strategies used by postgraduate students from different academic fields of science and technology were also **high** ranging from 3.76-3.53. The rank of academic fields based on the mean of reading strategies used was as follow: 1) Science ($\overline{X}$3.76); 2) Agro-Industry ($\overline{X}$=3.62); 3) Agricultural Technology ($\overline{X}$=3.61); 4) Engineering ($\overline{X}$=3.60); and 5) Information Technology ($\overline{X}$=3.53).

The findings of the study indicated that KMITL postgraduate students from the **Faculty of Science** reported their uses of reading strategies in all categories at **a high level** ($\overline{X}$=3.76) and in the following respective order: Social ($\overline{X}$=3.35), Metacognitive ($\overline{X}$=3.88), Affective ($\overline{X}$=3.75), Cognitive ($\overline{X}$=3.72), Compensation ($\overline{X}$=3.70), and Memory ($\overline{X}$=3.61).

The postgraduate students from the **Faculty of Agro-Industry** also reported their use of reading strategies in all categories at **a high level** ($\overline{X}$=3.62) and in the following respective order: Social ($\overline{X}$=3.94), Metacognitive ($\overline{X}$=3.77), Affective

($\overline{X}$=3.69), Cognitive ($\overline{X}$=3.52), Memory ($\overline{X}$=3.44), and Compensation ($\overline{X}$=3.39) reading strategies.

Likewise, the postgraduate students from the **Faculty of Agricultural Technology** reported their use of reading strategies in all categories at **a high level** ($\overline{X}$=3.61) and in the following respective order: Metacognitive ($\overline{X}$=3.77), Affective ($\overline{X}$=3.69), Social ($\overline{X}$=3.61), Cognitive ($\overline{X}$=3.57), Compensation ($\overline{X}$=3.55), and Memory ($\overline{X}$=3.51) reading strategies.

In the same way, the postgraduate students from the **Faculty of Engineering reported** their use of reading strategies in all categories at **a high level** ($\overline{X}$=3.60) and in the following respective order: Metacognitive ($\overline{X}$=3.76), Affective ($\overline{X}$=3.63), Cognitive ($\overline{X}$=3.59), Social ($\overline{X}$=3.56), Memory ($\overline{X}$=3.55), and Compensation ($\overline{X}$=3.52) reading strategies.

Similarly, the postgraduate students from the **Faculty of Information Technology reported** their use of reading strategies in all categories at **a high level** ($\overline{X}$=3.53) and in the following respective order: Affective ($\overline{X}$=3.67), Metacognitive ($\overline{X}$=3.62), Compensation ($\overline{X}$=3.56) Cognitive ($\overline{X}$=3.53), Memory ($\overline{X}$=3.52), and Social ($\overline{X}$=3.31) reading strategies.

4.4.2 Ranking by Reading Strategy Categories

The categories of reading strategies for reading English research articles were ranked as the following: 1) Metacognitive ($\overline{X}$=3.76), 2) Affective ($\overline{X}$=3.67), 3) Social ($\overline{X}$=3.63), 4) Cognitive ($\overline{X}$=3.59), 5) Compensation ($\overline{X}$=3.53), and 6) Memory ($\overline{X}$=3.53).

The study found that **metacognitive reading strategies** were the most often used strategies by the postgraduate students who studied at the Faculty of Science ($\overline{X}$=3.88), followed by the postgraduate students from the Faculty of Agricultural Technology ($\overline{X}$=3.77), Agro-Industry ($\overline{X}$=3.77), Engineering ($\overline{X}$=3.76), and Information Technology ($\overline{X}$=3.62).

For **affective reading strategies,** the postgraduate students who studied at the Faculty of Science employed these strategies the most ($\overline{X}$=3.75), followed by the postgraduate students from the Faculty of Agricultural Technology ($\overline{X}$=3.69), Agro-Industry ($\overline{X}$=3.69), Information Technology ($\overline{X}$=3.67), and Engineering ($\overline{X}$=3.63).

According to the findings, the social reading strategy was the highest used by the postgraduate students from the Faculty of Science ($\overline{X}$=3.95), followed by the postgraduate students from the Faculty of Agro-Industry ($\overline{X}$=3.94), Agricultural Technology ($\overline{X}$=3.61), Engineering ($\overline{X}$=3.56), and Information Technology ($\overline{X}$=3.31).

The postgraduate students who studied at the Faculty of Science utilized the highest cognitive reading strategies ($\overline{X}$=3.72), followed by the postgraduate students from the Faculty of Engineering ($\overline{X}$=3.59), Agricultural Technology ($\overline{X}$=3.57), Information Technology ($\overline{X}$=3.53), and Agro-Industry ($\overline{X}$=3.52).

As can be seen in Table 4.9, the postgraduate students who studied at the Faculty of Science used the highest compensation reading strategies, followed by the postgraduate students from the Faculty of Information Technology ($\overline{X}$=3.56), Agricultural Technology ($\overline{X}$=3.55), Engineering ($\overline{X}$=3.52), and Agro-Industry ($\overline{X}$=3.39).

Memory reading strategies were the highest used by the postgraduate students from the Faculty of Science ($\overline{X}$=3.61), followed by the postgraduate students from the Faculty of Engineering, Information Technology ($\overline{X}$=3.52), Agricultural Technology ($\overline{X}$=3.51), and Agro-Industry ($\overline{X}$=3.44).

Then, quantitative data of reading strategies used by KMITL postgraduate students from different academic fields of science and technology were analyzed using one-way analysis of variance (ANOVA) with *p*-value of <0.05 in order to test the hypothesis:

H1: Postgraduate students from different academic fields of science and technology use different reading strategies for reading English research articles.

Table 4.10, 4.11 4.12, 4.13, 4.14, and 4.15 show the results of the analysis of One-way ANOVA of six reading strategy categories: Metacognitive, Affective, Social, Cognitive, Memory and Compensation.

Table 4.10 Results of ANOVA for **Metacognitive Reading Strategies** Used by Postgraduate Students from Different Academic Fields of Science and Technology (n=235)

Source	SS	df	MS	F	p-value
Between	1.00	4	0.25	1.03	0.39
Within	55.57	230	0.24		
Total	56.57	234			

*The mean difference is significant at *p<0.05

The findings indicated that there was no statistically significant difference in metacognitive reading strategies used by MKITL postgraduate students from different academic fields of science and technology for reading English research articles, F(4, 230) = 1.03, p = 0.39 at p>0.05.

Table 4.11 Results of ANOVA for **Affective Reading Strategies** Used by Postgraduate Students from Different Academic Fields of Science and Technology (n=235)

Source	SS	df	MS	F	p-value
Between	0.31	4	0.07	0.16	0.95
Within	107.60	230	0.46		
Total	107.92	234			

* The mean difference is significant at *p<0.05.

Table 4.11 shows the results of One-way ANOVA for affective reading strategies. There was not a statistically significant difference in affective strategies used by postgraduate students from different academic fields, F(4,230) = 0.16, p= 0.95 at p>0.05.

Table 4.12 Results of ANOVA for **Social Reading Strategy** Used by Postgraduate Students from Different Academic Fields of Science and Technology (n=235)

Source	SS	df	MS	F	p-value
Between	9.62	4	2.40	2.96	0.02*
Within	186.63	230	0.81		
Total	196.25	234			

*. The mean difference is significant at *p<0.05

Table 4.12 shows the results of One-way ANOVA for social reading strategy used by postgraduate students from different academic fields of science and technology. There was a statistically significant difference in social strategy used by postgraduate students from different faculties, F(4,230) = 2.96, p= 0.02* at p<0.05*.

Table 4.13 Results of ANOVA for **Cognitive Reading Strategies** Used by Postgraduate Students from Different Academic Fields of Science and Technology (n=235)

Source	SS	df	MS	F	p-value
Between	0.51	4	0.12	0.54	0.70
Within	53.79	230	0.23		
Total	54.31	234			

* The mean difference is significant at *p<0.05.

Table 4.13 shows a compensation of cognitive reading strategies used by KMITL postgraduate students from different faculties in the fields of science and technology. Nonetheless, the findings showed that there was not a statistically significant difference in cognitive strategies used, F (4,230) = 0.54, p= 0.70 at p>0.05.

Table 4.14 Results of ANOVA for **Compensation Reading Strategies** Used by Postgraduate Students from Different Academic Fields of Science and Technology (n=235)

Source	SS	df	MS	F	p-value
Between	1.38	4	.34	1.00	0.40
Within	78.70	230	.34		
Total	80.08	234			

* The mean difference is significant at *p<0.05.

Table 4.14 shows a compensation of reading strategies used by KMITL post graduate students from different academic fields of science and technology examined by using ANOVA with p-value<0.05. However, there was not a statistically significant difference, F (4, 230) = 1.00, p= 0.40 at p>0.05.

Table 4.15 Results of ANOVA for **Memory Reading Strategies** Used by Postgraduate Students from Different Academic Fields of Science and Technology (n=235)

Source	SS	df	MS	F	p-value
Between	0.52	4	0.13	0.29	0.87
Within	100.61	230	0.43		
Total	101.13	234			

*. The mean difference is significant at *p<0.05

Table 4.15 shows a compensation of memory reading strategies used for reading English research articles by KMITL postgraduate students from different academic fields of science of technology. There was not a statistically significant difference in memory strategies used, F (4,230) = 0.29, p=0.87 at p>0.05.

4.5 Multiple Comparisons of Differences in Social Reading Strategy Used by KMITL Postgraduate Students

According to the results of one-way analysis of variances (ANOVA), the study found a significant difference in the **social reading strategy** used by KMITL postgraduate students from different academic fields, $F(4,230) = 2.96$, $p = 0.02^*$ at $p<0.05^*$. Therefore, post-hoc (Scheffe) was examined in order to show the significant difference. Table 4.16 shows multiple comparisons of social strategy used by postgraduate students from the Faculty of Engineering, Science, Information Technology, Agricultural Technology, and Agro-Industry.

Table 4.16 Multiple Comparison of Social Strategy Used by Postgraduate Students from Different Academic Fields of Science and Technology (n=235)

Faculty	Engineering ($\bar{X}$=3.56)	Science ($\bar{X}$=3.95)	Information Technology ($\bar{X}$=3.31)	Agricultural Technology ($\bar{X}$=3.61)	Agro-Industry ($\bar{X}$=3.94)
Engineering ($\bar{X}$=3.56)	-				
Science ($\bar{X}$=3.95)	-0.39	-			
Information Technology ($\bar{X}$=3.31)	0.25	0.64*	-		
Agricultural Technology ($\bar{X}$=3.61)	-0.05	0.34	-0.03	-	
Agro-Industry ($\bar{X}$=3.94)	-0.38*	0.01	-0.63*	-0.33	-

Social reading strategy was examined for statistically significant differences and the results indicated that KMITL postgraduate students from different academic fields utilized the social reading strategy differently.

As can be seen in Table 4.16, there was a statistically significant difference in the social reading strategy used between the postgraduate students from **the Faculty of Engineering** ($\overline{X}$=3.56) and the postgraduate students from **the Faculty of Agro- Industry** ($\overline{X}$=3.94) with a mean difference 0.38. Moreover, the postgraduate students from **the Faculty of Science** used the strategy differently from the students from **the Faculty of Information Technology** a mean difference 0.64. Additionally, the results reported that the postgraduate students from **the Faculty of Information Technology** utilized the social strategy differently from the students from **the Faculty of Agro-Industry** with a mean difference 0.63.

According to the results, it appears that KMITL postgraduate students from some faculties employed the social strategy with a statistically significant difference for reading English research articles in the fields of science and technology

Conclusion

This chapter has presented the findings of reading strategies used for reading English research articles of KMITL postgraduate students in different academic fields of science and technology. The strategies used for reading English research articles were ranked as followed 1) Metacognitive, 2) Affective, 3) Social, 4) Cognitive, 5) Compensation, and 6) Memory. The results showed that KMITL postgraduate students from different academic fields of science and technology appeared to employ these reading strategies for reading English research articles at a high level. KMITL postgraduate students from the Faculty of Science reported the high uses of reading strategies in all categories.

Furthermore, the results showed that there was not a statistically significant difference in metacognitive, cognitive, affective, and memory reading strategies used by KMITL postgraduate students from different academic fields of science and technology. Nonetheless, there was a statistically significant difference in the social strategy used by the postgraduate students from the Faculty of Engineering and the postgraduate students from the Faculty of Agro-Industry. KMITL postgraduate

students from the Faculty of Science used the social strategy differently from the postgraduate students from the Faculty of Information Technology. Finally, the postgraduate students from the Faculty of Information Technology utilized the social strategy differently from the postgraduate students from the Faculty of Agro-Industry.

The next chapter discusses the findings of the current study, pedagogical implications, limitations and recommendations for further research.

CHAPTER 5

CONCLUSION, DISCUSSION AND SUGGESTIONS

This chapter discusses the research findings of the reading strategies used for reading English research articles of the postgraduate students who studied in the academic fields of science and technology at King Mongkut's Institute of Technology Ladkrabang, Ladkrabang Campus. It also provides recommendations for teachers and future research. The sections in this chapter include the summary of the findings, discussions, limitations of the study, recommendations for future research, pedagogical implications, and conclusion.

5.1 Summary of the Findings

This study aimed at surveying and comparing the reading strategies used for reading English research articles of KMITL postgraduate students in different academic fields of science and technology. Furthermore, the study was intended to investigate whether postgraduate students from different academic fields used different reading strategies for reading English research articles.

The study developed 40 items of the **Research Article Reading Strategies Questionnaire consisting of six reading strategy categories: Metacognitive, Cognitive, Affective, Social, Compensation, and Memory** strategies based on Oxford's (1990) framework. The questionnaire was evaluated by 43 experienced researchers and instructors in the academic fields of science and technology and then by three experts in teaching English as a Foreign Language. It was piloted before collecting data and the Cronbach alpha showed a high internal consistency reliability (α=0.90). Finally, the **Research Article Reading Strategies Questionnaire** was employed to survey the reading strategies used for reading English research articles of KMITL postgraduate students from different academic fields of science and technology.

The results showed that postgraduate students from different academic fields of science and technology employed six categories of reading strategies for reading English research articles similarly and at a high level. The reading strategies for

reading English research articles were ranked as follow: 1) Metacognitive, 2) Affective, 3) Social, 4) Cognitive, 5) Compensation, and 6) Memory strategies. The findings revealed that there was a statistically significant difference between the postgraduate students' social strategy use for reading English research articles $F(4,230) = 2.96$, $p= 0.02^*$ at $p< 0.05$. The findings indicated that the postgraduate students from the Faculty of Engineering and the postgraduate students from the Faculty of Agro-Industry used the social strategy differently. KMITL postgraduate students from the Faculty of Science used the strategy differently from the postgraduate students from the Faculty of Information Technology. Finally, the postgraduate students from the Faculty of Information Technology utilized the social strategy differently from the postgraduate students from the Faculty of Agro-Industry.

5.2 Discussions

For reading scientific and technological research articles, KMITL postgraduate students used a variety of reading strategies to assist their comprehension of the text and enhance their understanding. Park (2010) stated that the use of reading strategies assists students to solve reading and comprehension problems. Many previous studies confirmed that a variety of reading strategies could help readers to raise comprehension and achieve reading purposes (Cohen, 1986; Park, 2010; Strawser, 1999; Thampradit, 2006).

5.2.1 Metacognitive Reading Strategies

According to the findings, the postgraduate students in this study utilized metacognitive reading strategies at a high level. There was not a significant difference in their uses of metacognitive reading strategies. Metacognitive reading strategies involve the ability to control or monitor readers' comprehension (Block, 1992; Moktari & Reichard, 2002). The metacognitive strategies most often used by KMITL postgraduate students were choosing the relevant research articles according to the reading purpose and choosing relevant information from the research articles to apply in their own work. The findings of the current study are consistent with the findings of the previous studies which stated that metacognitive reading strategies play an important role in helping second language and foreign language learners to

comprehend reading texts (Akkararitwuthikun & Supapan, 2013; Chumpavan, 2000; Chumworatayee, 2012; Koch, 2001). On the other hand, the findings of this study are inconsistent with the study of Song (1998), Sucantajan (2006) and Thumpradit (2006). Song (1998) found that nonnative English speaking students rarely used metacognitive reading strategies such as background knowledge or text internal organization in order to help comprehend the texts. Moreover, Sucantajan (2006) found that first-year students used metacognitive reading strategies less often than cognitive and compensation reading strategies. Additionally, Thampradit (2006) also found that engineering students employed metacognitive reading strategies less often than cognitive reading strategies.

Koch (2001) and Dhieb-Henai (2003) suggested that a metacognitive reading strategy training could help students develop their comprehension of scientific texts and research articles. Metacognitive reading strategies are self-monitoring instruments for reading scientific texts (Koch, 2001).

5.2.2 Affective Reading Strategies

The findings showed that postgraduate students from different academic fields utilized affective reading strategies at the similar level which was high. There was not a significant difference in their uses of affective reading strategies. Affective reading strategies are utilized for monitoring emotion, motivation and attitude and the strategies can assist students when they lose concentration or when they feel discouraged (Oxford, 1990). The highest used affective reading strategy was trying to get back on track when losing concentration. On the contrary, the results of this study are inconsistent with the study of Wongphagamol (2005) who revealed that high proficiency EFL students employed affective reading strategies at a low level.

Although the postgraduate students appeared to employ affective strategies for reading research articles at a high level, they could be encouraged to use a more variety of affective reading strategies such as self-encouraging, using music to lower anxiety, meditating, and taking positive statements.

5.2.3 Social Reading Strategy

Social reading strategy is the strategy concerning with social interaction. The postgraduate students in this study asked other people to explain when failing to understand the research articles. They used this strategy at a high level, and there

was a significant difference in the social reading strategy used by KMITL postgraduate students from different academic fields. In contrast, Goh and Foong (1997) found that ESL students from China employed social strategies at a low level.

Al-Gramdi (2010) claimed that social strategies are useful for readers studying in the academic fields of science and technology. Importantly, KMITL postgraduate students should be guided and trained to use a more variety of social reading strategies such as cooperating with peers or proficient readers, and asking questions. The strategies can help facilitate their comprehension of research articles.

5.2.4 Cognitive Reading Strategies

The present study found that the postgraduate students from different academic fields of science and technology used cognitive reading strategies at a similar level which was high. Cognitive reading strategies are related to mental process and information processing for learning in order to obtain, store, retrieve and use information (Brown, 1994; Oxford, 1990). The most often used cognitive reading strategies were reading the abstract to obtain important research information and using figures, graphs, and mathematical equations to help understand the text.

The results support the findings in the study of Grabe (1991) who suggested that photographs, graphics and diagrams are crucial to the reading process and reading comprehension. In addition, Thampadit's (2006) study found that 48 engineering students most often used cognitive strategies for reading expository texts. However, the results of the current are in contrast with Sucantajan's (2006) findings which reported that EFL freshmen in the English major employed cognitive strategies at a low level.

5.2.5 Compensation Reading Strategies

The study showed that postgraduate students from different academic fields of science and technology used compensation reading strategies for reading English research articles at a high level and there was not a significant difference in their uses of compensation reading strategies among students from five academic fields. Compensation reading strategies concern with outside help in order to facilitate comprehension of the difficult text (Oxford, 1990). The strategy most often used was using dictionaries to find the meanings of unfamiliar vocabulary. This is consistent with the studies of Bouvet (2002) and Pang (2010) who suggested that when readers

found unknown words, they used dictionaries to find the definitions of the words. Additionally, the findings of the study also support the finding in the study of Prommak (2005) who found that Thai undergraduate students most often used dictionaries to look up the meanings of unknown words. Moreover, the findings of the present study supported Peacock and Ho's (2003) findings which stated that students most frequently used compensation strategies. In addition, Al-Ghamdi (2010) found that the students studying in Applied Science and Engineering used compensation strategies most frequently. The results, however, contradict with the findings of Wongphagamol (2003) who found that the arts students with high ability did not employ compensation reading strategies often.

5.2.6 Memory Reading Strategies

The results of the study indicated that the postgraduate students used memory reading strategies for reading English research articles at a high level and at a similar level. Memory reading strategies assist students to retrieve and retain information in long term memory (Oxford, 1990). The postgraduate students associated ideas in research articles with their background knowledge and elaborated with additional information related to the research articles. Nonetheless, the findings of the study are inconsistent with the study of Molla (2015) who reported that the students employed memory reading strategies at a moderate level.

5.3 Limitations of the Study

This study was conducted to survey the reading strategies used by postgraduate students in the academic fields of science and technology at King Mongkut's Institute of Technology Ladkrabang (KMITL). However, the number of participants was small as there were 235 postgraduate students from the Faculty of Engineering, Science, Information Technology, Agricultural Technology, and Agro-Industry. Due to the small number of participants and the lack of diversity, this study can hardly be generalizable to the entire population of postgraduate students in Higher Education in Thailand. Therefore, the study needs replications in the future with a larger number of postgraduate students in the academic fields of science and technology at various academic institutions.

5.4 Pedagogical Implications

Reading strategies are crucial for postgraduate students in order to obtain important and updated information from English research articles (Flowerdew, 1999; Kanoksilapatham, 2005; Okamura, 2006). Dhieb-Henai (2003) suggested that the instruction on reading strategies is necessary for reading research articles. It can help students read more efficiently and rapidly. Therefore, teaching reading strategies to postgraduate students in the academic fields of science and technology for reading English research articles is essential.

Thus, there are several recommendations concerning the instruction on reading strategies for English research articles for postgraduate students.

1. The instructor needs to know about the reading strategies used by the postgraduate students in the academic fields that they teach (Peacook & Ho, 2003). The Research Articles Reading Strategies Questionnaire developed by the present study is suggested to be employed for examining their reading strategies used.

Importantly, the instructor should urge students to use authentic reading materials and select particularly discipline-related research articles for practicing reading strategies (Nuttall, 1996; Takallou, 2011; Wallance, 1992). Then, a variety of reading strategies should be provided (Carrell, 1991; Forrest-Pressley & Waller, 1984; Grabe, 1991; Peacock & Ho, 2003; Song 1998). Reading strategies should be introduced and demonstrated by the instructor one at a time allowing adequate time for students to practice individual strategies (Duke & Pearson, 2002). Then, students should be encouraged to choose and orchestrate appropriate and effective reading strategies for reading English research articles.

2. The instructors should provide the students with a range of effective approaches to texts. The Pre- While- Post reading activities could be implemented in the reading strategy training for postgraduate students (Chompuchart, 2006; Garner, 1987; Paris et al., 1991; Tierney & Cunningham, 1984; Urquhert & Weir, 1998). The strategies for the Pre-reading session may include defining reading purposes in order to facilitate conceptual readiness, choosing relevant research articles according to the reading goal, determining what to read in each part of the research article, and skimming for essential information.

While- reading session may apply the strategies of recognizing structure of the text and logical organization in English research articles, looking for specific information, making connections, taking notes of crucial information, finding the statement of research gap and significance of the study, using dictionary to find the meaning of unknown words, and using graphs and mathematical equations to assist understanding.

Finally, the Post-reading activities should train students to use strategies, for instance summarizing essential information in the research articles, evaluating the validity and reliability of the study, creating text mapping, and outlining the text in order to enhance comprehension.

5.5 Recommendations for Future Research

The current study surveyed and compared the reading strategies used for reading English research articles of KMITL postgraduate students in the academic fields of science and Technology. The findings may become a valuable reference for future research, and some recommendations are listed below.

1. In future research, the Research Article Reading Strategies Questionnaire could be used to survey the reading strategies of EFL postgraduate students in other academic fields of science and technology, such as medicine, dentistry, pharmacy, and nursing. The framework outlined for developing the research instrument, could be utilized by future studies to survey the reading strategies for English research articles of postgraduate students in other academic fields such as social sciences, education, and arts.

2. Future studies may use multiple research instruments such as interview, observation, or think aloud protocol in order to provide a more comprehensive profile of reading strategy use of postgraduate students.

3. Furthermore, there is a need for future research to examine the relationship between reading strategy use, age, gender, field of study, and reading proficiency.

4. Future studies should investigate differences between the reading strategy use for English research articles of Master's degree students and doctoral degree students.

5.6 Conclusions

The current study has developed the useful Research Article Reading Strategies Questionnaire for surveying and collecting specific reading strategies for English research articles. The main findings in this research have shown that KMITL postgraduate students who studied in the academic fields of science and technology utilized a wide range of reading strategies for reading English research articles at a high level in all categories (metacognitive, affective, social, cognitive, compensation and memory reading strategies). The findings of this study also indicated that KMITL postgraduate students often used metacognitive reading strategies more often than other strategies for reading English research articles.

Furthermore, the current study revealed that the postgraduate students from the Faculty of Science used more reading strategies in all categories than the postgraduate students from other academic fields. On the other hand, the postgraduate students from the Faculty of Information Technology used the least reading strategies for reading English research articles.

Additionally, the study found that there was no statistically significant difference in metacognitive, affective, cognitive, compensation, and memory reading strategies used among KMITL postgraduate students from different academic fields of science and technology. Conversely, the study found statistically significant differences in social reading strategy use between the postgraduate students from some academic fields.

These results of this survey on reading strategies used by EFL postgraduate students in the academic fields of science and technology will be helpful for EFL teachers and researchers who wish to improve the best possible development in their postgraduate students' reading strategies for reading English research articles.

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APPENDICES

Appendix A

The Item-Objective Congruent Index of the Research Article Reading Strategies Questionnaire

Appendix A

The Item-Objective Congruent Index of the Research Article Reading Strategies Questionnaire

Item	Expert			IOC	Meaning
	1	2	3		
1	1	1	1	1	Reserved
2	0	1	1	0.66	Reserved
3	1	1	1	1	Reserved
4	1	1	1	1	Reserved
5	1	1	1	1	Reserved
6	1	0	1	0.66	Reserved
7	1	0	1	0.66	Reserved
8	1	0	1	0.66	Reserved
9	1	1	1	1	Reserved
10	1	0	1	0.66	Reserved
11	1	1	1	1	Reserved
12	1	0	1	0.66	Reserved
13	1	1	1	1	Reserved
14	1	0	1	0.66	Reserved
15	1	-1	1	0.33	Modified
16	0	-1	1	.00	Modified
17	1	1	1	1	Reserved
18	1	0	1	0.66	Reserved
19	1	0	1	0.66	Reserved
20	0	1	1	0.66	Reserved
21	1	0	1	0.66	Reserved
22	1	1	1	1	Reserved
23	1	0	1	0.66	Reserved

Appendix A (Continued)

The Item-Objective Congruent Index of the Research Article Reading Strategies Questionnaire

Item	Expert			IOC	Meaning
	1	2	3		
24	1	1	1	1	Reserved
25	1	1	1	1	Reserved
26	1	1	1	1	Reserved
27	-1	0	1	0.00	Modified
28	1	0	1	0.66	Reserved
29	1	0	1	0.66	Reserved
30	-1	0	1	0.33	Modified
31	1	0	1	0.66	Reserved
32	1	1	1	1	Reserved
33	0	0	1	0.33	Modified
34	0	0	1	0.33	Modified
35	1	0	1	0.66	Reserved
36	1	0	1	0.66	Reserved
37	1	0	1	0.66	Reserved
38	1	0	1	0.66	Reserved
39	0	0	1	0.33	Modified
40	0	0	1	0.33	Modified

Appendix B

The Research Article Reading Strategies Questionnaire

FOR EXPERTS

Appendix B

The Research Article Reading Strategies Questionnaire (FOR EXPERTS)

เรื่อง กลวิธีการอ่านของนักศึกษาระดับบัณฑิตศึกษาที่ใช้ในการอ่านบทความวิจัยภาษาอังกฤษในสาขาวิชาวิทยาศาสตร์และเทคโนโลยี

English-language Research Articles Reading Strategies of Postgraduate Students in the Disciplinary Fields of Science and Technology

1. แบบสอบถามฉบับนี้ จัดทำขึ้นโดยมีวัตถุประสงค์เพื่อต้องการสำรวจความคิดเห็นของนักศึกษาระดับบัณฑิตศึกษา ในสาขาวิชาวิทยาศาสตร์และเทคโนโลยี ในการใช้กลวิธีการอ่านที่ใช้ในการอ่านบทความวิจัยภาษาอังกฤษในสาขาวิชาวิทยาศาสตร์และเทคโนโลยี ประกอบด้วยคำถาม 3 ตอนคือ

1. The aim of this questionnaire is to explore reading strategies used by postgraduate students who are studying in the disciplinary fields of science and technology when they are reading English research articles. The questionnaire is divided into three parts:

ตอนที่ 1 ข้อมูลทั่วไปของผู้ตอบแบบสอบถาม

Part 1: General information of the respondent

ตอนที่ 2 การใช้กลวิธีการอ่านของนักศึกษาในสาขาวิชาวิทยาศาสตร์และเทคโนโลยีที่มีต่อกลวิธีการอ่าน บทความวิจัยภาษาอังกฤษในสาขาวิชาวิทยาศาสตร์และเทคโนโลยี

Part 2: The respondents' reading strategies used while reading English research articles in the field of science and technology

2. ขอความกรุณาตอบแบบสอบถามตามความเป็นจริงมากที่สุด เพื่องานวิจัยครั้งนี้จะได้มีความสมบูรณ์และเป็นประโยชน์ในการศึกษาต่อไปในอนาคต

2. Please read the instructions carefully and answer each question as honestly as possible. Your response will be treated as confidential. Your cooperation in answering in this questionnaire is highly appreciated.

ข้อ Items	กลวิธีการอ่าน Reading Strategies	Coding of Strategies	ความคิดเห็นของผู้เชี่ยวชาญ			ข้อเสนอแนะ Suggestion
			เห็นด้วย Agree +1	ไม่แน่ใจ Not sure 0	ไม่เห็นด้วย Disagree -1	
1	ตั้งจุดประสงค์ของการอ่าน Setting a reading purpose	Met				
2	วางแผนก่อนการอ่าน Planning before reading	Met				
3	เลือกบทความที่ตรงกับจุดประสงค์การอ่าน Choosing relevant research articles according to the reading purpose	Met				
4	ตัดสินใจว่าจะเลือกอ่านอะไร ในแต่ละบทความ Determining what to read in each article	Met				
5	อ่านบทคัดย่อเพื่อทราบข้อมูลสำคัญของงานวิจัย Reading the abstract to obtain important research information	Cog				
6	อ่านอย่างคร่าวๆ Surveying text	Cog				
7	อ่านจับใจความสำคัญอย่างรวดเร็ว Skimming quickly for main idea	Cog				
8	อ่านอย่างช้าๆและอย่างระมัดระวัง Reading slowly and carefully	Cog				
9	หาข้อความที่ระบุปัญหาการวิจัย Finding the statement of research gap	Cog				
10	ระบุจุดประสงค์ของการวิจัย Identifying the purpose of the study	Cog				
11	หาความสำคัญของงานวิจัย Finding the significance of the study	Cog				

ข้อ Items	กลวิธีการอ่าน Reading Strategies	Coding of Strategies	ความคิดเห็นของผู้เชี่ยวชาญ			ข้อเสนอแนะ Suggestion
			เห็นด้วย Agree +1	ไม่แน่ใจ Not sure 0	ไม่เห็นด้วย Disagree -1	
12	เชื่อมโยงความสัมพันธ์ระหว่างสิ่งที่กำลังอ่านกับความรู้เดิม Linking what is being read with the background knowledge to help understanding	Met				
13	ประเมินความถูกต้องและความน่าเชื่อถือของงานวิจัยที่อ่าน Evaluating the validity and reliability of the study	Cog				
14	ระบุข้อเท็จจริงที่สรุปจากผลการศึกษาวิจัย Identifying generalized facts from the results of the study	Cog				
15	ระบุข้อจำกัดของการวิจัย และปัจจัยที่ส่งผลต่อการวิจัย Identifying the limitations of the study and factors affecting the findings of the study	Cog				
16	หาข้อเสนอแนะสำหรับการนำผลวิจัยไปประยุกต์ใช้ในชีวิตจริง Looking for suggestions for application(s) in real life	Cog				
17	หาข้อเสนอแนะสำหรับการศึกษาวิจัยในอนาคต Finding recommendation(s) for future research	Cog				
18	เลือกข้อมูลที่สำคัญจากบทความที่อ่านเพื่อนำมาประยุกต์ใช้ในงานวิจัยของตน Choosing relevant information from the research article to apply in own work	Met				

ข้อ Items	กลวิธีการอ่าน Reading Strategies	Coding of Strategies	ความคิดเห็นของผู้เชี่ยวชาญ			ข้อเสนอแนะ Suggestion
			เห็นด้วย Agree +1	ไม่แน่ใจ Not sure 0	ไม่เห็นด้วย Disagree -1	
19	ใช้รูป กราฟ และสมการ เพื่อช่วยให้เข้าใจ Using figures, graphs, and mathematical equations to help understanding	Cog				
20	ปรับความเร็วในการอ่านให้เหมาะสมกับระดับความยากง่ายของสิ่งที่อ่าน Adjusting reading speed appropriate for the level of text difficulty	Com				
21	จะอ่านออกเสียงดังเพื่อช่วยให้เข้าใจ เมื่อไม่เข้าใจสิ่งที่อ่าน Reading aloud to increase understanding when failing to understand	Com				
22	ใช้ความรู้ทางด้านไวยากรณ์เพื่อช่วยให้เข้าใจ Using grammatical knowledge to help understanding	Com				
23	แยกคำ หรือกลุ่มคำ เพื่อให้เข้าใจส่วนย่อยๆ แต่ละส่วน เมื่อไม่เข้าใจสิ่งที่อ่าน Separating words or phrases into small units to help understanding when failing to understand	Com				
24	เดาความหมายของคำศัพท์ที่ไม่รู้จากบริบท Guessing the meanings of unknown words by using context clues	Com				
25	ใช้พจนานุกรมเพื่อหาความหมายของคำศัพท์ที่ไม่คุ้นเคย Using dictionary to find the meanings of unfamiliar vocabulary	Com				

ข้อ Items	กลวิธีการอ่าน Reading Strategies	Coding of Strategies	ความคิดเห็นของผู้เชี่ยวชาญ			ข้อเสนอแนะ Suggestion
			เห็นด้วย Agree +1	ไม่แน่ใจ Not sure 0	ไม่เห็นด้วย Disagree -1	
26	แปลประโยคจากภาษาอังกฤษเป็นภาษาไทยเพื่อช่วยให้เข้าใจความหมาย Translating English sentences into Thai when the text becomes difficult	Cog				
27	มีสมาธิในการอ่าน Concentrating on text	Met				
28	พยายามดึงสมาธิของตนมาที่บทความที่กำลังอ่านเมื่อสูญเสียสมาธิ Trying to get back on track when losing concentration	Aff				
29	หยุดและคิดเกี่ยวกับสิ่งที่อ่าน Pausing and thinking about what have been read	Met				
30	ให้กำลังใจตนเองเมื่อรู้สึกท้อ Encouraging oneself when feeling discouraged	Aff				
31	ขอให้ผู้อื่นช่วยอธิบายให้ เมื่ออ่านบทความไม่เข้าใจ Asking others to explain when failing to understand the research articles	Soc				
32	อ่านซ้ำเพื่อให้เข้าใจมากขึ้น Rereading for better understanding	Cog				
33	เขียนสรุปใจความสำคัญเป็นภาษาไทยเมื่ออ่านจบ Writing a summary in Thai when finishing reading	Cog				
34	เขียนสรุปใจความสำคัญเป็นภาษาอังกฤษเมื่ออ่านจบ Writing a summary in English when finishing reading	Cog				

ข้อ Items	กลวิธีการอ่าน Reading Strategies	Coding of Strategies	ความคิดเห็นของผู้เชี่ยวชาญ			ข้อเสนอแนะ Suggestion
			เห็นด้วย Agree +1	ไม่แน่ใจ Not sure 0	ไม่เห็นด้วย Disagree -1	
35	จดบันทึกข้อมูลสำคัญ Taking notes of important information	Cog				
36	สร้างแผนผังเนื้อหา (text mapping) เพื่อเพิ่มความเข้าใจ Creating text mapping to increase comprehension	Cog				
37	สร้างเค้าโครง (outline) เนื้อหาที่อ่านเพื่อเพิ่มความเข้าใจ Making outline to increase comprehension	Cog				
38	จัดกลุ่มข้อมูล Grouping information	Mem				
39	เชื่อมโยงข้อมูงต่างๆในบทอ่าน Associating Ideas	Mem				
40	ขยายความเพิ่มเติมด้วยข้อมูลอื่นๆที่เกี่ยวข้องกับสิ่งที่อ่าน Elaborating with additional Information	Mem				

Coding of Strategies

Com	refer to Compensation Strategy	Cog	refer to Cognitive Strategy
Mem	refer to Memory Strategy	Aff	refer to Affective Strategy
Met	refer to Metacognitive Strategy	Soc	refer to Social Strategy

Appendix C

The Research Article Reading Strategies Questionnaire

FOR COLLECTING DATA

Appendix C

The Research Article Reading Strategies Questionnaire for Collecting Data

แบบสอบถามเพื่อการวิจัย

เรื่อง กลวิธีการอ่านของนักศึกษาระดับบัณฑิตศึกษาที่ใช้ในการอ่านบทความวิจัยภาษาอังกฤษในสาขาวิชาวิทยาศาสตร์และเทคโนโลยี

คำชี้แจง

1. แบบสอบถามฉบับนี้ จัดทำขึ้นโดยมีวัตถุประสงค์เพื่อศึกษาการใช้กลวิธีการอ่านของนักศึกษา ระดับบัณฑิตศึกษาที่ใช้ในการอ่านบทความวิจัยภาษาอังกฤษในสาขาวิชาวิทยาศาสตร์และเทคโนโลยีประกอบด้วย คำถาม 2 ตอน คือ

ตอนที่ 1 ข้อมูลทั่วไปของผู้ตอบแบบสอบถาม

ตอนที่ 2 ความคิดเห็นของนักศึกษาในสาขาวิชาวิทยาศาสตร์และเทคโนโลยีที่มีต่อกลวิธีการอ่าน บทความวิจัยภาษาอังกฤษในสาขาวิชาวิทยาศาสตร์และเทคโนโลยี

ตอนที่ 3 กลวิธีการอ่านอื่นๆเพิ่มเติมนอกเหนือจากที่ระบุไว้ในแบบสอบถาม

2. ขอความกรุณาตอบแบบสอบถามตามความเป็นจริงมากที่สุด เพื่องานวิจัยครั้งนี้จะได้มีความสมบูรณ์และเป็นประโยชน์ในการศึกษาต่อไปในอนาคต

ขอขอบคุณผู้ตอบแบบสอบถามทุกท่าน

นางสาวปิยวรรณ ศิริจันทนันท์
นักศึกษาปริญญาโท ศิลปศาสตรมหาบัณฑิต คณะครุศาสตร์อุตสาหกรรม
สาขาภาษาศาสตร์ประยุกต์ เพื่อวิทยาศาสตร์และเทคโนโลยี
สถาบันเทคโนโลยีพระจอมเกล้าเจ้าคุณทหารลาดกระบัง

ตอนที่ 1 ข้อมูลทั่วไปของผู้ตอบแบบสอบถาม

Part 1: General information of the respondent

คำชี้แจง กรุณาทำเครื่องหมาย [√] และเติมคำลงในช่องว่างให้ ตรงกับข้อมูลของท่าน

Direction: Please respond fully to the following questions/statements by making [√] in the space provided.

1. อายุ_____ Age _____

2.เพศ Sex ☐ ชาย Male ☐ หญิง Female

3.Your Degree: ☐ ป. โท Master's degree ☐ ป. เอก Doctoral degree

4. You are studying in:

☐ คณะวิศวกรรมศาสตร์ Faculty of Engineering

☐ คณะวิทยาศาสตร์ Faculty of Science

☐ คณะเทคโนโลยีสารสนเทศ Faculty of Information Technology

☐ คณะเทคโนโลยีการเกษตร Faculty of Agricultural Technology

☐ คณะอุตสาหกรรมการเกษตร Faculty of Agro- Industry

5. ท่านกำลังศึกษาปีที่: ☐ปีที่1 ☐ ปีที่2 ☐ปีที่3 ☐ ปีที่4 ☐ ปีที่5

Year of study: ☐ 1st Year ☐ 2nd Year ☐3rd Year ☐ 4th Year ☐ 5th Year

6. กรุณาประเมินความสามารถในการอ่านบทความวิจัยภาษาอังกฤษของท่านในสาขาวิชาของตนเอง

Please evaluate your reading ability when you are reading English research articles related to your field.

☐ น้อย Low

☐ กลาง Fair

☐ มาก High

ตอนที่ 2 แบบสำรวจกลวิธีการอ่านที่ใช้ในการอ่านบทความวิจัยภาษาอังกฤษ ในสาขาวิชาวิทยาศาสตร์และเทคโนโลยี

คำชี้แจง โปรดระบุกลวิธีการอ่านบทความวิจัยภาษาอังกฤษโดยทำเครื่องหมาย [√] ลงในช่องที่ตรงกับระดับที่ท่านใช้

ข้อ	กลวิธีการอ่าน	ระดับการใช้				
		5 มากที่สุด	4 มาก	3 ปานกลาง	2 น้อย	1 น้อยที่สุด
1	ตั้งจุดประสงค์ของการอ่าน Setting a reading purpose					
2	วางแผนก่อนการอ่าน Planning before reading					
3	เลือกบทความที่ตรงกับจุดประสงค์การอ่าน Choosing relevant research articles according to the reading purpose					
4	ตัดสินใจว่าจะเลือกอ่านอะไร ในแต่ละบทความ Determining what to read in each article					
5	อ่านบทคัดย่อเพื่อทราบข้อมูลสำคัญของงานวิจัย Reading the abstract to obtain important research information					
6	อ่านอย่างคร่าวๆ Surveying text					
7	อ่านจับใจความสำคัญอย่างรวดเร็ว Skimming quickly for main idea					
8	อ่านอย่างช้าๆและอย่างระมัดระวัง Reading slowly and carefully					
9	หาข้อความที่ระบุปัญหาการวิจัย Finding the statement of research gap					
10	ระบุจุดประสงค์ของการวิจัย Identifying the purpose of the study					
11	หาความสำคัญของงานวิจัย Finding the significance of the study					

ข้อ	กลวิธีการอ่าน	ระดับการใช้				
		5 มากที่สุด	4 มาก	3 ปานกลาง	2 น้อย	1 น้อยที่สุด
12	เชื่อมโยงความสัมพันธ์ระหว่างสิ่งที่กำลังอ่านกับความรู้เดิม Linking what is being read with the background knowledge to help understanding					
13	ประเมินความถูกต้องและความน่าเชื่อถือของงานวิจัยที่อ่าน Evaluating the validity and reliability of the study					
14	ระบุข้อเท็จจริงที่สรุปจากผลการศึกษาวิจัย Identifying generalized facts from the results of the study					
15	หาข้อจำกัดของผลการวิจัย และปัจจัยที่ส่งผลต่อผลการวิจัย Locating statements describing the limitations of the study and factors affecting the findings of the study					
16	หาข้อเสนอแนะสำหรับการนำผลวิจัยไปประยุกต์ใช้ในชีวิตจริง Locating statements about suggestions for applying research findings in real life					
17	หาข้อเสนอแนะสำหรับการศึกษาวิจัยในอนาคต Finding recommendation(s) for future research					
18	เลือกข้อมูลที่สำคัญจากบทความที่อ่านเพื่อนำมาประยุกต์ใช้ในงานวิจัยของตน Choosing relevant information from the research article to apply in my own work					
19	ใช้รูป กราฟ และสมการ เพื่อช่วยให้เข้าใจ Using figures, graphs, and mathematical equations to help understanding					
20	ปรับความเร็วในการอ่านให้เหมาะสมกับระดับความยากง่ายของสิ่งที่อ่าน Adjusting reading speed appropriate for the level of text difficulty					
21	จะอ่านออกเสียงดังเพื่อช่วยให้เข้าใจ เมื่อไม่เข้าใจสิ่งที่อ่าน Reading aloud to increase understanding when failing to understand					

ข้อ	กลวิธีการอ่าน	ระดับการใช้				
		5 มากที่สุด	4 มาก	3 ปานกลาง	2 น้อย	1 น้อยที่สุด
22	ใช้ความรู้ทางด้านไวยากรณ์เพื่อช่วยให้เข้าใจ Using grammatical knowledge to help understanding					
23	แยกคำ หรือกลุ่มคำ เพื่อให้เข้าใจส่วนย่อยๆ แต่ละส่วน เมื่อไม่เข้าใจสิ่งที่อ่าน Separating words or phrases into small units to help understanding when failing to understand					
24	เดาความหมายของคำศัพท์ที่ไม่รู้จากบริบท Guessing the meanings of unknown words by using context clues					
25	ใช้พจนานุกรมเพื่อหาความหมายของคำศัพท์ที่ไม่คุ้นเคย Using dictionary to find the meanings of unfamiliar vocabulary					
26	แปลประโยคจากภาษาอังกฤษเป็นภาษาไทยเพื่อช่วยให้เข้าใจความหมาย Translating English sentences into Thai when the text becomes difficult					
27	มีสมาธิในการอ่าน Concentrating on reading					
28	พยายามดึงสมาธิของตนมาที่บทความที่กำลังอ่านเมื่อสูญเสียสมาธิ Trying to get back on track when losing concentration					
29	หยุดและคิดเกี่ยวกับสิ่งที่อ่าน Pausing and thinking about what have been read					
30	ให้กำลังใจตนเองเมื่อรู้สึกท้อ Encouraging myself when feeling discouraged					
31	ขอให้ผู้อื่นช่วยอธิบายให้ เมื่ออ่านบทความไม่เข้าใจ Asking others to explain when failing to understand the research articles					

ข้อ	กลวิธีการอ่าน	ระดับการใช้				
		5 มากที่สุด	4 มาก	3 ปานกลาง	2 น้อย	1 น้อยที่สุด
32	อ่านซ้ำเพื่อให้เข้าใจมากขึ้น Rereading for better understanding					
33	เขียนสรุปใจความสำคัญเป็นภาษาไทยเมื่ออ่านจบ Writing a summary of important information in Thai when finishing reading					
34	เขียนสรุปใจความสำคัญเป็นภาษาอังกฤษเมื่ออ่านจบ Writing a summary of important information in English when finishing reading					
35	จดบันทึกข้อมูลสำคัญ Taking notes of important information					
36	สร้างแผนผังเนื้อหา (text mapping) เพื่อเพิ่มความเข้าใจ Creating text mapping to increase comprehension					
37	สร้างเค้าโครง (outline) เนื้อหาที่อ่านเพื่อเพิ่มความเข้าใจ Making outline to increase comprehension					
38	จัดกลุ่มข้อมูล Grouping information					
39	เชื่อมโยงข้อมูงต่างๆในบทอ่าน Associating ideas in the text					
40	ขยายความเพิ่มเติมด้วยข้อมูลอื่นๆที่เกี่ยวข้องกับสิ่งที่อ่าน Elaborating with additional information related to the text					

ตอนที่ 3 กลวิธีการอ่านอื่นๆเพิ่มเติมที่นอกเหนือจากที่ระบุไว้ในแบบสอบถาม

คำชี้แจง ท่านคิดว่ามีกลวิธีการอ่านอื่นๆ ที่จำเป็นต่อการอ่านบทความวิจัยภาษาอังกฤษในสาขาวิชาวิทยาศาสตร์และเทคโนโลยี นอกเหนือจากที่ระบุ อีกหรือไม่ โปรดระบุ

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Appendix D

List of Experts Validating Instruments

Appendix D

List of Experts Validating Instruments

1. Assistant Professor Dr. Nisakorn Prakongchart

   Faculty of Humanities and Social Science, Rajabhat Kampangpet University

   61 Moo 1, Nakorn Chum District, Muang, Kampangpet 62000

2. Dr. Chutamas Sundrarajun

   Deputy Chairperson of Department of Business English

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3. Assistant Professor Dr. Singhanat Nomnian

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Author Biography

Name:	Miss Piyawan Sirichantanan
Date of Birth:	March 26, 1987
Place of Birth	Bangkok
Address:	103 Moo´9, Lampathiw, Ladkrabang District, Bangkok 10520
Educational Background:	
2005	Mathayom 6 from Protpittayapayat School, Bangkok
2008	Bechelor of Arts (English for Specific Purposes), King Mongkut's Institute of Technology Ladkrabang
Work Experience:	
2010 - 2012	English teacher at Protpittayapayat School, Ladkrabang, Bangkok
2013 to present	English teacher at Sarasas Witead Romklao School, Ladkrabang, Bangkok