USAGE OF READING COMPREHENSION TO ENHANCE WORD PROBLEM-SOLVING SKILLS IN MATHEMATICS OF SIXTH GRADE STUDENTS: A PRIVATE SCHOOL, BANGKOK

BY

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Abstract

Due to the low mathematics achievement of the national assessment, O-NET, of sixth grade students in the recent years, the solution to solve this issue was needed. Several studies have shown the link between mathematics achievement and reading comprehension proficiency. However, the study regarding this problem was not focused on in Thailand. The purpose of this study was to examine whether there was a relationship between reading comprehension skill and mathematical word problem-solving skills. The random sampling method was employed in order to select the 21 participants. The participants were required to complete the pretest and posttest on reading comprehension and word problem-solving skills in mathematics before and after receiving the treatment. The treatment was designed to develop the participants' reading strategies in reading comprehension. The research instrument was a reading strategy development activity, consisting of 15 sections for approximately eight weeks. The results showed the pretest and posttest correlation coefficients were 0.839 and 0.875, respectively. It revealed that there was high positive correlation between reading comprehension skills and mathematical word problem-solving skills. The results can serve as an encouragement to teachers and their supervisors to focus more directly on improving reading comprehension skills of students as a means to increasing students' scores on mathematical word-solving tests.

(Total 142 pages)

Keywords: **Word Problem-solving, Mathematics, Reading Comprehension, Relationships**

Student's Signature..... Thesis Advisor's Signature.....

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ชื่อวิทยานิพนธ์ : การพัฒนาการอ่านทำความเข้าใจเพื่อส่งเสริมทักษะการแก้โจทย์ปัญหาคณิตศาสตร์ สำหรับนักเรียนระดับชั้นประถมศึกษาปีที่ 6: โรงเรียนเอกชน กรุงเทพมหานคร

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บทคัดย่อ

เนื่องด้วยผลสัมฤทธิ์ทางการศึกษาจากการทดสอบทางการศึกษาระดับชาติขั้นพื้นฐาน (O-NET) วิชาคณิตศาสตร์ของนักเรียนระดับชั้นประถมศึกษาปีที่ 6 อยู่ในระดับต่ำกว่าเกณฑ์ จัดเป็นปัญหาที่ต้องได้รับการแก้ไข มีผลการวิจัยจำนวนมากแสดงให้เห็นถึงความสัมพันธ์ระหว่างผลสัมฤทธิ์ทางการเรียนวิชาคณิตศาสตร์และทักษะการอ่านทำความเข้าใจ อย่างไรก็ตามงานวิจัยในลักษณะนี้ไม่เป็นที่แพร่หลายภายในประเทศ งานวิจัยนี้มีวัตถุประสงค์เพื่อศึกษาความสัมพันธ์ระหว่างทักษะการอ่านทำความเข้าใจและทักษะการแก้โจทย์ปัญหาคณิตศาสตร์ กลุ่มตัวอย่างในการวิจัยครั้งนี้ เป็นนักเรียนชั้นประถมศึกษาปีที่ 6 จำนวนทั้งสิ้น 21 คน ซึ่งได้มาโดยการคัดเลือกแบบสุ่ม เครื่องมือในการวิจัยประกอบด้วยแบบทดสอบก่อน-หลังเข้าร่วมกิจกรรม ประกอบด้วยแบบทดสอบทักษะการอ่านทำความเข้าใจและแบบทดสอบทักษะการแก้โจทย์ปัญหาคณิตศาสตร์ โดยผู้เข้าร่วมวิจัยต้องตอบแบบทดสอบทั้งสองชุดก่อนและหลังเข้าร่วมกิจกรรมพัฒนาทักษะการอ่านทำความเข้าใจ ซึ่งจัดขึ้นทั้งสิ้น 15 ครั้ง ในระยะเวลา 8 สัปดาห์ ผลการวิจัยพบว่า ค่าสัมประสิทธิ์สหสัมพันธ์ ของคะแนนแบบทดสอบทั้งสองทักษะก่อนเรียนและหลังเรียน เท่ากับ 0.839 และ 0.875 ตามลำดับ ซึ่งแสดงถึงความสัมพันธ์ระดับสูงในทิศทางเดียวกันระหว่างทักษะการอ่านทำความเข้าใจและทักษะการแก้โจทย์ปัญหาคณิตศาสตร์ ผลการวิจัยนี้สามารถใช้เพื่อผลักดันและส่งเสริมให้ครูและผู้บริหารสถานศึกษาเร่งพัฒนาทักษะการอ่านทำความเข้าใจของนักเรียนซึ่งเป็นตัวแปรสำคัญในการยกระดับผลสัมฤทธิ์ทางการเรียนและการแก้โจทย์ปัญหาคณิตศาสตร์

(วิทยานิพนธ์มีจำนวนทั้งสิ้น 142 หน้า)

คำสำคัญ: การแก้โจทย์ปัญหา, คณิตศาสตร์, การอ่านทำความเข้าใจ, ความสัมพันธ์

ลายมือชื่อนักศึกษา ..... ลายมือชื่ออาจารย์ที่ปรึกษา .....

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Chapter 1

Introduction

1.1 Rationale

Literacy and numeracy skills were increasingly crucial to society and the economic well-being of one's nation (World Literacy Foundation [WLF], 2012). In today's societies, these skills were more considered in the labour market. More jobs required at least a practical literacy or numeracy skills (European Commission, 2012). People with higher literacy skills were more likely to be healthy both physically and mentally, more productive and satisfied at work, and less likely to live in poverty, be unemployed, and engage in fewer crimes (Wright, 2016). In this research, English literacy skill as a global language was focused.

English has been the primary foreign language taught for the last fifty years in Thai Educational institutes. Even though there was an emphasis on English in the Thai education system, the English proficiency of Thai people was low. According to English First's English proficiency index (2019), Thailand has ranked 74th out of 100 nations by the EF EPI score 47.61%which classified as 'very low proficiency' and has ranked as the 3rd worst in East Asia except for Cambodia and Myanmar. Besides, according to the result of the O-NET (Ordinary National Education Test) of the English subject of grade 6 Thai students in 2016-2018 were 34.59, 36.34, and 39.24%, respectively (National Institute of Education Testing Service [NIETS], 2018). The development of Thai students' English literacy skill was critical and needed to be improved said the Thai Minister of Education (Mala, 2018).

To enable Thai students to come across the low English proficiency, English has prescribed for the entire primary education language in the core curriculum (Ministry of

Education, 2008). The learning area aimed to enable Thai students to use English for communication in various situations, seeking knowledge, and pursuing further education at higher levels. According to the Basic Education Core Curriculum of Thailand B.E. 2551 (A.D. 2008), there were four strands of learning areas which focused in the curriculum include; Strand 1: language for communication (ability to listen, speak, read, and write to exchange data and information), Strand 2: language and culture (ability to understand and accept similarities and differences of language and culture of foreigner and Thai), Strand 3: language and relationship with other learning areas (ability to acquire and express the knowledge with other learning areas in English) and Strand 4: language and relationship with the community and the world (ability to use English in various situations, both in the classroom and the outside community).

According to the four strands required within the core curriculum of foreign language learning, there was no provided solution to serve the requirements of strand 3: language and relationship with other language areas in Thai government schools. In contrast, private schools, there are "English Programme (EP)", "Intensive English Programme (IEP)", and other related programmes offering to the parents who wanted to enhance their children's English proficiency. In these programmes, students were provided learning English language and learning the core subjects such as Mathematics and Science by using English as a medium of instruction (EMI). Using English as a medium of instruction in a classroom called EP or IEP programme could enable students to acquire all the desired skills in learning foreign language indicated in the Basic Education Core Curriculum of Thailand (Pholabutra, 2007).

The use of the English language to teach academic subjects in countries where the first language (L1) of most of the population was not English prescribed as "English-medium instruction; EMI" (British Council, 2014). There was a fast-moving shift in teaching English, from being taught as a foreign language (EFL) to English being the medium of instruction (EMI) for academic subjects such as Mathematics and Science. EMI increasingly used in universities, secondary schools, and even primary schools. EMI could provide more opportunities for students to naturally practice their English communicative skills by providing different content and activities. By the way, there

were several limitations of teaching and learning through EMI: for example, lack of qualified EMI teachers, resources, and clear guidelines of teaching (British Council, 2014).

Both literacy and numeracy skills were essential to all people's well-being. Numeracy skill was the ability to apply basic mathematics principles: measuring, basic operations, introductory mathematics presentations, in daily life (EU High Level Group of Experts on Literacy, 2012).

Mathematics was significant to all people; it remarked as a 'gatekeeper to high-status occupations' (Lubienski, 2007). Mathematics was more than a subject; it was a language that people use to communicate and solve problems (Adams, 2003). For students in every grade, some students were terrified of mathematics. As the results of O-NET on Thai students' Mathematics subject in grade 6 in 2016-2018 were 40.47%, 37.12%, and 37.50%, respectively (NIETS, 2018) shown in Table 1.1. The test covered six content areas: number operation, measuring, geometry, algebra, probability, and mathematical skills (Ministry of Education, 2008). Most of the O-NET test questions were designed in word-problems to ensure that students can adapt the mathematical skills to their daily lives (NIETS, 2018). Mathematical word problems require students to be good in reading skills and mathematical concepts (Clarkson and Williams, 1994). The relationship between reading and Mathematics has studied. Bernardo (2002) pointed out that students' poor performance in mathematics was liked to linguistic issues rather than cognitive skills and developing reading ability was a powerful strategy to help students succeed in Mathematics achievement.

Table 1.1 O-NET Mathematics Average Score of Grade 6 Thai Students within Thailand

Year	2016	2017	2018
Mathematics Average Score	40.47%	37.12%	37.50%

Source: NIETS, 2018

Table 1.1, the average scores of O-NET in Mathematics of Grade 6 Thai students in 2016-2018 were below 50% of the full score and tended to decrease. According to the report of unstable and decreasing O-NET mathematics average scores, the quality of teaching was being questioned and the trend of the uncertain decreased scores. These problems should be focused on and improved.

Promoting students' ability to solving mathematical word-problem was an extreme concern. Therefore, this research aimed to develop mathematical word problem-solving skills using the reading comprehension of Grade 6 students who attend the IEP programme (using EMI) at a private school, Bangkok. After the usage of reading comprehension to word problem-solving skills in Mathematics was found, teachers would be able to use the data to plan course instruction more effectively.

1.2 Significance of the Problem

The problem of this study was the word problem-solving skill in Mathematics of Grade 6 students in a private school, Bangkok was needed to be improved according to its results of the unstable and decreasing O-NET test score in Mathematics subject.

There were several factors which affect the students' word problem-solving skills in Mathematics. Reading comprehension was one of the factors that relate to the word problem-solving skill. In this study, the usage of reading comprehension was the treatment to enhance word problem-solving skills in Mathematics of Grade 6 students in a private school, Bangkok.

1.3 Significance of the Study

This study expected to provide a solution to improve Thai students' word problem-solving skills in Mathematics by finding out the relationship between reading comprehension capability and word problem-solving skills. The significance of this study with positive solutions on, for examples, students, Mathematics teachers, school administrations, and the Ministry of Educations, were as follows:

1.3.1 For students:

Students could not doubt that they could be good at only one skill: numeracy skill or linguistic skill. These two focused skills could be collaboratively improved.

1.3.2 For parents:

Parents could help improve their children's ability in word problem-solving by providing time for their children to enhance their reading comprehension capability.

1.3.3 For teachers:

This study could help Mathematics teachers plan instruction and activity that could improve their students' word problem-solving skills in Mathematics.

1.3.4 For educators:

Thai educators, school administrations including educational policymakers of the Ministry of Educations, could use the information from this study to plan strategies that might help improve Thai children's word problem-solving skills in Mathematics and relevant subject areas.

In contrast, if the result of this study did not show the impact of reading comprehension on word problem-solving skills in Mathematics, it would also be useful for Mathematics teachers, educators, and school administrations to find other factors and solutions which were more related to improve children's word problem-solving skills.

1.4 Scope of the Study

The scope of this study includes research location, population and sample, research methodology, research instruments, and research variables as follows:

1.4.1 Population

The language of the instruction used in this study was English. For this reason, the participants of this study must be able to communicate in English and got used to studying Mathematics by using English as the medium of instruction. As a result, the participants of this study must be the students who were studying in the Intensive English Programme (IEP) classrooms in a private school, Bangkok.

The population of this study was the Thai students from two Intensive English Programme classrooms who were studying in Grade 6 at a private school in the academic year 2020.

1.4.2 Number of Sample and Sample Selection Method

The number of populations was limited to students studying in IEP Programme classrooms in a private school, Bangkok. Simple random sampling was used to choose the participants randomly. This study required participants to receive the treatment online in their free time (after school or break time) and this study was conducted during the crisis period of the spreading of Covid-19; eventually, the number of expected participants in this study was 21 students calculated by reliable sample size predictor software called 'G*Power'.

1.4.3 Research Methodology

This study was conducted using quantitative and experimental research by collecting and interpreting pre-test and post-test scores in reading comprehension and word problem-solving skills in Mathematics of all 21 participants.

The participants must take the pre-test on reading comprehension and word problem-solving in Mathematics before receiving the treatment and post-test after receiving the whole 15 sections of the treatment.

The usage of reading comprehension was used as the treatment of this study. The treatment divided into 15 sections each section took approximately 40 minutes in total. Each program section of treatment consisted of 5 minutes of discussing the reading topic before reading, 10 minutes of reading silently, 10 minutes of practising reading aloud, 5 minutes of discussing the reading passage after reading, and 10 minutes of answering questions, vocabulary and writing short self-reflection. The treatment was designed by applying the Metacognitive Awareness of Reading Strategies Inventory (MARSI) created by Mokhtari and Reichard (2002) to track one's reading strategies.

1.4.4 Research Instruments

The research instruments used in this study were as follows;

1) Pre-test and post-test of mathematical word problems:

It was consisted of multiple-choice (15 items) and showing the solution (2 items). (Sample of the test shown in Appendix C)

2) Pre-test and post-test of reading comprehension test:

It consisted of multiple-choice (10 items) and T/F questions (5 items) (Sample of the comprehension test shown in Appendix D)

1.4.5 Instructional Tool (Lesson Plans)

The Mathematical lesson plans of Grade 6 students would be created as additional instructional tool for this study according to the school grade 6 curriculum and requirements applied from the Basic Educational Core Curriculum (Ministry of Education, 2008; The Institute for the Promotion of Teaching Science and Technology, 2017) (Lesson plans shown in Appendix A).

1.5 Research Objectives

1.5.1 To assess the usage of reading comprehension on improving word problem-solving skills in Mathematics of Grade 6 students in a private school, Bangkok.

1.5.2 To find out the relationship between reading comprehension skill and word problem-solving skills of Grade 6 students in a private school, Bangkok.

1.6 Research Hypotheses

$H1_0$ There is no effect of the usage of reading comprehension on the improvement of word problem-solving skills in Mathematics.

$H1_a$ There is an effect of the usage of reading comprehension on the improvement of word problem-solving skills in Mathematics.

$H2_0$ There is no relationship between reading comprehension skill and word problem-solving skills in Mathematics.

$H2_a$ There is a relationship between reading comprehension skill and word problem-solving skills in Mathematics.

1.7 Conceptual Framework

This study was experimental and quantitative research to investigate the usage of reading comprehension to enhance word problem-solving skills in Mathematics of Grade 6 students. The conceptual framework was shown in Figure 1.1 as follows:

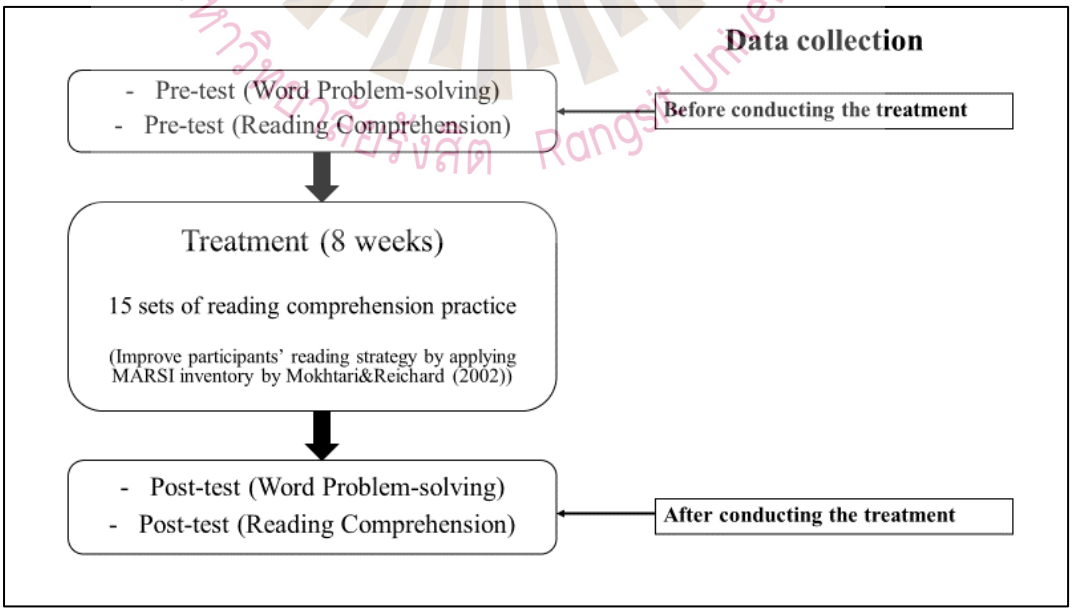


Figure 1.1 Illustration of the Conceptual Framework

Figure 1.1, the 21 Grade 6 students attended the study as the participants of this research. The participants took the pre-test and post-test of reading comprehension and word problem-solving in Mathematics before and after receiving the treatment. The usage of reading comprehension was used as the treatment of this study.

Due to this study was an experimental research, several variables might affect the results of the study. Thus, the related variables were shown in Fig 1.2 as follows:

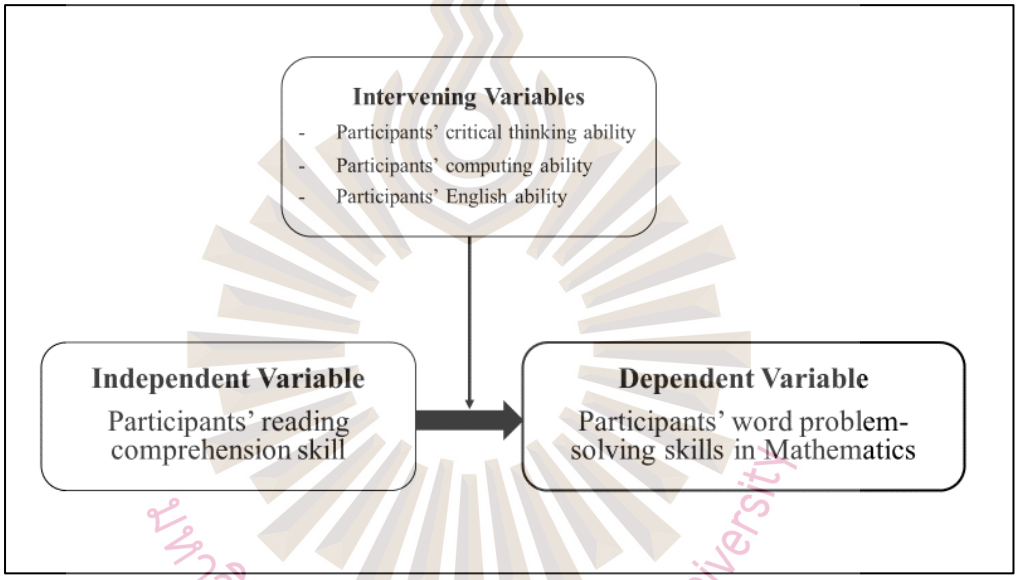


Figure 1.2 Illustration of the Variables

Figure 1.2 shows the independent variable of this study was the usage of reading comprehension used as the treatment. The treatment divided into 15 sections; each section was arranged for 40 minutes in total. Each section of treatment consisted of 5 minutes of discussing the reading topic before reading, 10 minutes of reading silently, 10 minutes of practising reading aloud, 5 minutes of discussing the reading passage after reading, and 10 minutes of answering questions, reviewing vocabulary, and writing short self-reflection. The treatment was designed by applying the Metacognitive Awareness of Reading Strategies Inventory (MARSI) created by Mokhtari and Reichard (2002) to track one's reading strategies.

1.8 Time Frames

This section presented the time frames for completing the research, as shown in Table 1.2. By the following table, the researcher expected to complete this research by April 2021.

Table 1.2 Research Time Frames

The stages of the research project	2020					2021			
	04	06	08	10	12	01	02	03	04
Selection of the research topic	✓								
Collection of data from books and journals	✓								
Formulating research design	✓								
Conducting literature review	✓								
Creation of research methodology	✓	✓							
Conducting treatment	✓	✓							
Collection of data		✓	✓						
Data analysis and data interpretation			✓	✓					
Conclusion and recommendations				✓	✓				
Formation of the rough research report					✓	✓	✓		
Submission of the final report								✓	✓

1.9 Terminology

"Usage of Reading comprehension" refers to the treatment of this research, divided into 15 sections. Each program section of treatment consisted of 5 minutes of discussing the reading topic before reading, 10 minutes of reading silently, 10 minutes of practising reading aloud, 5 minutes of discussing the reading passage after reading, and 10 minutes of answering questions, vocabulary, and writing short self-reflection.

"Reading comprehension" refers to the ability of Grade 6 students in a private school, Bangkok to perceive and understand a given text. In this study, reading comprehension score was tracked as the independent variable.

"Word Problem-solving" refers to the skills of Grade 6 students in a private school to recognize and define problems, invent, and implement solutions, and track the evaluate results in Mathematics.

"Intensive English Programme (IEP)" refers to the programme which was provided teaching English, Mathematics, and Science subjects by using "English-medium instruction; EMI" in Grade 6 students a private school, Bangkok. The frequencies of Mathematics, Science, and English classes were 1, 1, and 2 period(s) for a week, respectively.

"Grade 6 students" refers to the students studying in Primary 6 in the IEP programme at a private school, Bangkok.

1.10 Limitations

The following limitations presented in this study:

1.10.1 This study was taken online due to the spreading of the pandemic virus, Covid-19 since December 2019. This might affect the study results because the discussion was the important step to improve the participants' reading comprehension.

Taking an online training might make the participants who were Grade 6 students felt uncomfortable due to feeling unfamiliar to the online learning/training activities if compared with conducting it as face-to-face activity.

1.10.2 This study was conducted in a medium-sized private school in which the number of students limited. Due to the previous statement and the issue in 1.10.1, the number of participants was limited to 21 students. For further study, this research topic should be conducted on a larger group of participants.

1.10.3 This study was conducted by collecting data from all the 21 participants. The number of the participants was limited by the language use in this study which required the participants to be able to basically communicate in English and knowing some technical term of Mathematics in English. Besides the research was conducted during the crisis time, spreading of the Covid-19, made parents and guardians might feel stress to giving permission to let their children attend to an activity.

1.11 Assumptions

The following assumptions presented in this study:

1.11.1 All participants deliberately did pre-test, post-test and kept focusing while attending to every treatment section.

1.11.2 It assumed that the participants' computing ability is in the level of satisfactory.

1.11.3 It assumed that the participants could communicate in English.

1.11.4 It was further assumed that all the participants kept focusing and put their best efforts on the school's general Mathematics class.

Chapter 2

Literature Review

Chapter two provided relevant information which should be demonstrated on what knowledge and ideas established on the topics. The descriptive list of the literature topics and related research, including a summary of each topic is as follows:

2.1 Reading Comprehension

2.1.1 Models of Reading Comprehension

2.1.2 Reading Strategy

2.1.3 Cognitive Processing and Reading Comprehension

2.1.4 Difficulties in Second Language Reading

2.1.5 Cultural Differences and Second Language Reading

2.1.6 Reading Motivation and Reading Comprehension

2.1.7 Oral Reading Fluency VS Silent Reading Fluency in Reading Comprehension

2.2 Word Problem-solving Skills in Mathematics

2.2.1 Word Problem-solving Skills in Mathematics According to the Basic Educational Core Curriculum

2.2.2 Factors Affecting Word Problem-solving Skills in Mathematics

2.3 Assessment Criteria and Statistical Analysis Used in this Research

2.3.1 Assessment Criteria for Forming Pre-test and Post-test Questions

2.3.2 Statistical Analysis Used in this Research

2.1 Reading Comprehension

Reading has focused on researching for many years. While focusing on reading comprehension, this research has focused on the usage of reading comprehension, such as models of reading comprehension, the purpose of reading, reading strategy and many others.

People read for many purposes, according to O'Hara (1996) and Moorhead (2018). For example, there are five reading types classified by Goodman (1994) as follows; 1) environmental reading, 2) occupational reading, 3) informational reading, 4) recreational reading and 5) ritualistic reading. Furthermore, Smith (2019) states the general four purposes in academic reading as follows: 1) to get information, 2) to understand ideas or theories, 3) to understand the author's viewpoint and 4) to support your views.

Reading comprehension should be considered the heart of reading instruction (Tierney, Readence & Dishner, 1995; Rutzler, 2017). Reading comprehension is about comprehension and lexical access to a word's memory location (Perfetti, 1985; Carretti, Borella, Cornoldi & De Beni, 2009). The lexical access quality stressed as central to reading comprehension (Perfetti, Landi & Oakhill, 2005).

Understanding the factors related to contributing to reading comprehension capability is significant for creating the appropriate treatment of the study experiment. The related information needed to explore showing in the following parts.

2.1.1 Models of Reading Comprehension

The primary goal of reading is to comprehend the process and analyze a document. The three reading theories; constructionist model, construction-integration model, and schema theory, will be reviewed in this section.

2.1.1.1 Constructionist Model

This model has shown the link between reading process and reading strategies on how readers succeed in reading a text (Graesser, 2007). There are three assumptions for explaining reading comprehension in this model: 1) reader goals – reading a text for the specific outcomes, 2) coherence – seeking to construct mental representation, and 3) explanation – seeking to explain events, actions, and states in the text. In summary, a reader with a goal tends to understand a text by creating coherence and explaning of why things in the text occur. The constructionist model emphasized the role of reader goals in the process of reading comprehension.

2.1.1.2 Construction-integration Model (CIM)

The construction-integration model (Kintsch & Van Dijk, 1983) is one of the most well-known reading comprehension models. This model has shown that reading comprehension was based on a person's knowledge of perceptual and cognitive

processes. There are three stages of reading comprehension in this model: 1) surface code, 2) text-base, and 3) situation model. The first stage, surface code, is the process of recording the exact wording and syntax of a sentence. The second stage, text-base, is the process to capture the core meaning of a text. The third stage, situation model, is the process to integrate the prior knowledge with the new information from the text.

2.1.1.3 Schema Model

Schema defined as a concept of experience in the past (Bartlett, 1932). The early models have shown that comprehension resulted in the existing schema in memory and new information from reading. The schema model defined as the theory to understand how the human brain organized information and comprehends text (Anderson & Pearson, 1984).

To summarize the review of the regarding models in reading comprehension, readers should have their own specific goals to comprehend the texts according to the constructionist model. Schema model showed the importance of the reader's background knowledge and experience on reading comprehension. And the construction-integration model shows the processes of readers to comprehend the texts. These three models integrated to create the treatment for this study. Firstly, the treatment should be relevant to Grade 6 students according to the schema model. Secondly, the researcher must track the participants' process of reading. Also, the researcher must provide activities to promote the participants' ability to comprehend words and sentences to capture the core meaning of the texts. Furthermore, according to the constructionist model, to inspire the participants to establish intrinsic and extrinsic motivation needed in this study.

2.1.2 Reading Strategy

Reading strategy was "a cognitive or behavioural action that enacted under particular contextual conditions, intending to improve some aspects of comprehension" (Grassser, 2007). There are several researchers in the education field have proposed the

classification of reading strategies. Five groups of reading strategies were identified by observing how college students read by Pugh (1978); scanning, search reading, skimming, receptive reading, and responsive reading. Reading strategies were classified into three groups: before reading, while reading, and after reading by Paris, Wasik, and Turner (1991). Murray (2003) ranked many active reading literature strategies into three strategies: 1) behavioural strategies – skimming, scanning, reviewing, and exploring 2) cognitive strategies – summarizing, connecting, evaluating, questioning, and predicting and 3) metacognitive strategies – understanding, setting a goal and managing goal priority.

In the Human-computer Interaction (HCI) field, there was also lots of research on different reading strategies. For example, three groups of reading strategies were classified by O'Hara (1996) which are 1) how a text was read – receptive reading, reflective reading, skimming, scanning, serial/ non-serial reading, and single/ repeated reading, 2) the support activities – underlining, note-taking, and networking and 3) why a text is read – reading to learn, reading to self-inform, reading to search, reading for research, etc.

Many researchers in the education field have focused on encouraging a reader's awareness and usage of reading strategies. For example, Metacognitive Awareness of Reading Strategies Inventory (MARSI) was developed by Mokhtari and Reichard (2002) which contained statements to track one's reading strategies. The strategies were categorized into three groups of reading strategies which are global, problem-solving, and support strategies (shown in Table 2.1)

The Metacognitive Awareness of Reading Strategies Inventory (MARSI) showed the steps of one's reading strategies. Global strategies helped set up readers' reading goals by preparing readers to understand the text's big picture. Problem-solving strategies were ways to help readers when facing problems or to lose their attention while reading. And support strategies were ways to solve problems while reading by using other tools and solutions such as, taking notes, discussing with others, and using reference materials to comprehend the texts reading.

Table 2.1 The Metacognitive Awareness of Reading Strategies Inventory

Type	Statements
Global strategies	- I have a purpose in mind when I read - I think about what I know to help me understand what I read - I preview the text to see what it's about before reading it - I think about whether the content of the text fits my reading purpose - I skim the text first by noting characteristics like length and organization
Problem-solving strategies	- I read slowly but carefully to be sure I understand what I'm reading - I try to get back on track when I lose concentration - I adjust my reading speed according to what I'm reading - When text becomes difficult, I pay closer attention to what I'm reading
Support strategies	- I take notes while reading to help me understand what I read - When text becomes difficult, I read aloud to help me know what I read - I summarize when I read to reflect on important in the text - I discuss what I read with others to check my understanding - I use reference materials such as dictionaries to help me understand what I read

Source: Mokhtari & Reichard, 2002

Table 2.1 showed the Metacognitive Awareness of Reading Strategies Inventory (MARSI) developed by Mokhtari and Reichard (2002) was applied to this study's treatment. The participants must read silently, read aloud, discuss with the researcher and friends about the texts, and write their self-reflection. These processes of the treatment were designed to track the participants' reading strategies.

2.1.3 Cognitive Processing and Reading Comprehension

As the review in section ‘2.1.1 Models of Reading Comprehension, reading involved cognitive processes. In this section, the terms concerning the cognitive processes: cognitive load theory, metacognition, and working memory were reviewed.

2.1.3.1 Cognitive Load Theory

Cognitive Load Theory (CLT) was based on an understanding of human cognitive architecture to design an instruction that matched human cognitive architecture’s structure and functions (Sweller, 1988). CLT was defined as ‘multidimensional construct representing the load that performing a particular task imposes on the learner’s cognitive system’ (Paas, et al., 2003). There were three components of CLT: 1) intrinsic cognitive load, 2) extrinsic cognitive load, and 3) germane cognitive load. Intrinsic cognitive load was the level of difficulty of the task performed. Extrinsic cognitive load is affected by external factors. Germane cognitive load was defined as the processing capacity used to construct schema in performing a task (Sweller, 1998) and the conscious application of learning strategies (Schnotz & Kürschner, 2007). In summary, the study of CLT aimed to decrease extrinsic cognitive load and enhance germane cognitive load within a human’s cognitive processing capacity.

2.1.3.2 Metacognition

Metacognition was defined as knowing how to manage and adjust one’s cognitive processes (Flavell, 1976). Cognitive activities such as planning, problem-solving, monitoring and evaluating the processes are involved with metacognition. Metacognition was related to the cognitive process, and it was strongly related to the central executive's role (Cox, 2005).

Metacognitive knowledge and metacognitive experience consisted of metacognition (Flavell, 1987). Metacognitive knowledge referred to knowledge in

cognitive processes classified into person variables, task variables and strategy variables. Metacognitive experience refers to the use of metacognitive strategies. For readers who wanted to achieve their reading goals by using the reading process's awareness and knowledge on usage of reading strategies, metacognition played a vital role in their reading comprehension (Harvey, Goudvis, & Graves, 2000).

In this study, the participants were children who were 11-12 years old. Some of the participants might come with intense metacognition, while some might come with weak metacognition. One of the challenges of this study was to promote participants' metacognition, which was essential to improve reading comprehension.

2.1.3.3 Working Memory

Working memory played a vital role in information processing of a human such as reading comprehension, learning, and problem-solving (Haberlant, 1999). Working memory referred to the system that takes responsibility in processing and storing information and was related to the cognitive processes in storing information (Baddeley & Hitch, 1974).

Working memory consists of fluid intelligence and crystallized intelligence. Fluid intelligence refers to the capacity to think logically and solve unfamiliar situation problems. There are three components of fluid intelligence: visuospatial sketchpad, the phonological loop and episodic buffer. In contrast, crystallized intelligence referred to general knowledge and the ability to use skills and experience increased with age.

In summary, working memory was essential to promote one's reading comprehension. Without potential working memory, readers might struggle in the process of reading comprehension. In this study, the treatment was created to promote participants' working memory by providing discussion time and self-reflection. These two activities helped to recall the storing information which influences the participants' working memory.

2.1.4 Difficulties in Second Language Reading

In this research, the participants practice their reading comprehension by reading English passages, while English is their second language. Research on difficulties in second language reading was reviewed. The big difference between the first language (L1) and the second language (L2) reading was the second language readers were not familiar with content schema or lack sociocultural knowledge to interpret the passage in the appropriate authentic way (Erler & Finkbeiner, 2007). Grabe (2009) stated that "there were no simple shortcuts to becoming a good L2 (second language) reader." Ten causes influence on learner's reading difficulties which were 1) lack of knowledge in the reading process, 2) unable to apply reading strategies for different reading purposes, 3) unable to interpret the structure of an argument while reading, 4) unable to assimilate the unfamiliar terms, 5) unable to perceive a text's rhetorical context, 6) unable to realize the purpose of the author, 7) unable to understand the cultural literacy of the text's author, 8) insufficient vocabulary, 9) unable to track on complex syntax and 10) unable to apply reading strategies to the varieties of academic discourse (Bean, 2011).

Koda (2007) stated that reading involved three primary operations: 1) linguistic knowledge in decoding, 2) linguistic knowledge in text-formation building, and 3) linguistic knowledge in reader-model building. Phonological awareness (PA) was a sub-skill of decoding, a vital factor in the second language (L2) reading.

Insufficient vocabulary was an essential difficulty in second language learning. Readers who read a foreign language always guess while they face unfamiliar words (Aebersold & Field, 1997). The social strategy could be used to solve this problem by asking someone who knew for addition formation (O'Malley, Chamot, Stewner-Manzanares, Kupper & Russo, 1985). Besides, prior knowledge plays a positive effect on reading comprehension. The readers who have gained prior knowledge about the topic reading can fill in the gaps when they cannot interpret some information in the text (Leeser, 2003). Apart from this cause, grammatical complexity or complex sentence presents reading problems for the second language readers (Heilman, Collins-Thompson, Callen & Eskenazi, 2007).

The length of the text was a factor that led to difficulty in second language reading. There was research investigating the participants' performances after reading a long passage (2,300 words) and short passage (300 words). The results showed that the participants who read the short passage outstanding performed than those who read a long passage (Newsom & Gaite, 1971).

In conclusion, difficulties in second language reading might interfere with this study's process, which might affect the study results. The language of the instruction in this study was English, the second language for all participants who were Thai students. Therefore, the texts used as the treatment materials and the word problem questions used to access the participants must be designed to match with their vocabulary glossaries, appropriate grammar structures, and the length of the text should not be long for Grade 6 students.

2.1.5 Cultural Differences and Second Language Reading

There was a positive relationship between culture familiarity with reading comprehension (Alptekin, 2006). There were several pieces of researches supporting the statement. For example, Steffensen and Joag-Dev (1984) investigated reading comprehension of the Indian students whose English was a second language (L2). The Indian students were assigned to read two passages about weddings written in English. One was about an American wedding. The other was about an Indian wedding. It found that the participants comprehend texts about their own cultures more accurately than others.

Carrel's (1987) investigated Muslim Arabs, and Catholic Hispanic students studied in an Intensive English Programme. Each student joined reading two texts, one with Muslim-oriented content and the other with Catholic-oriented content. It found that the participants gained better reading comprehension scores and could remember more on the passages that were familiar to their native cultures.

In summary, readers gained a higher reading comprehension level when familiar with the content (Erten & Razi, 2009). Thus, the texts used as the treatment and the questions of the word problems in this study tended to design to match which Thai culture and the participants' routines to delimitate the cultural differences.

2.1.6 Reading Motivation and Reading Comprehension

Reading motivation referred to the interest or desire to read for one's different reasons and purposes (Hermosa, 2002). The motivation was vital to bring up the potential of encouraging children to become good readers (Guthrie & Wigfield, 2000). Guthrie and Wigfield (2000) also stated the three components in reading motivation which was 1) intrinsic and extrinsic motivation, 2) competence and efficacy beliefs and 3) social motivation. There were many ways to establish reading motivation in children that needed teachers and parent cooperation. These included providing sufficient exciting reading materials, making reading environment stress-free and fun, providing feedback on their progress, and providing a great time to read suggested by Baker, Dreher, and Guthrie (2000).

In contrast, the research on reading adult English for Academic Purposes (EAP) showed a significant and positive relationship between reading motivation and reading proficiency (Jafari & Shokrpour, 2012). Thus, reading motivation in adult readers consisted of extrinsic and intrinsic factors (Komiyama, 2013). Reading motivation played an essential role in reading comprehension as pointed out by Ahmadi, Ismail and Abdullah (2013), the learners with higher motivation gained better scores in reading comprehension tests.

In conclusion, establishing readers' reading motivation was essential to promote their reading comprehension capability, which was necessary for this study. As a result, providing sufficient and friendly reading materials, stress-free environment, and encourage confidence in reading for the participants was necessary for this study.

2.1.7 Oral Reading Fluency VS Silent Reading Fluency in Reading Comprehension

Oral reading fluency was a vital indicator of reading comprehension (Wise et al., 2010). There was a positive relationship between reading comprehension and one's oral reading fluency (Walker, 2012). More fluent readers performed better in reading comprehension (Rasinski & Padak, 2001). There was no conclusion that oral reading fluency and silent reading fluency differently influenced one's reading comprehension (Hale et al., 2011; Armbruster & Wilkinson, 1991; McCallum, Sharp, Bell & George, 2004).

Hale et al. (2011) and McCallum et al. (2004) stated that reading silently could help readers perform better in reading comprehension because readers could read at their own pace or reread whenever they needed. In contrast, oral reading also positively influenced reading comprehension because readers were forced to pay more attention to every word and not skip over the words that they did not know the meanings.

In conclusion, oral reading influenced readers to gain more concentration during the reading which increased the cognitive ability to process while reading to perform better in reading comprehension (Hale et al., 2011; McCallum et al., 2004). The unclear how oral reading and silent reading impacted readers' reading comprehension were positively influenced by reading comprehension. For this reason, both oral reading and silent reading were applied to the treatment of this research to improve participants in reading comprehension.

2.2 Word Problem-solving skills in Mathematics

Students' achievement in Mathematics has become an increasing issue in Thailand (National Institute for Child and Family Development, 2013). Especially the word problems in Mathematics were one of the most challenging in Mathematics test (Forsten, 2004; Fuchs et al., 2009; Gersten, Jordan & Flojo, 2005). Solving word problems in Mathematics was a massive challenge for students of all ages (Zheng, Flynn

& Swanson, 2013). Owing to the Ordinary National Education Test (O-NET) low score in Mathematics every year has shown us the need to improve Thai students' mathematics (Phaichayonwichit, 2015).

Solving word problems in Mathematics was challenging because it required integrating conceptual and procedural knowledge, cognitive and metacognitive processes, and reading comprehension skills (Jitendra et al., 2015; Orosco, Swanson, O'Connor & Lisser, 2013). Besides, students were required to develop their reading comprehension skills, self-regulating, and self-monitoring abilities to use their ethical concepts when solving word problems in Mathematics (Gonsalves & Krawec, 2014). Students who lack these required skills always struggle in solving word problems (Jitendra et al., 2015).

Both literacy skill and numeracy skill were used to derive the correct answer to solve a word problem (Gonsalves & Krawec, 2014; Manzo, 1975). Fuches et al. (2009) pointed out the four skills required in solving word problems in Mathematics: 1) reading skill, 2) critical thinking skill, 3) computing skill, and 4) solving problem skill. To solve a word problem, it required students' abilities to use text to identify missing information, construct the number sentence, and solve the number sentence to find the answer or the missing information. There were four steps required to achieve in solving word problems stated by Polya (1945): 1) read the problem, 2) understand the problem, 3) solve the problem and 4) check the validity of the answer.

The following reviews were essential factors which might affect the participants' word problem-solving skills in Mathematics. The core curriculum used in teaching Mathematics for Grade 6 Thai students and the difficulties in solving word problems were discussed as follows:

2.2.1 Word Problem-solving skills in Mathematics According to the Basic Educational Core Curriculum (Ministry of Education, 2008; The Institute for the Promotion of Teaching Science and Technology, 2017)

There were four learning areas prescribed for Thai students to achieve in Mathematics subject as follows:

Strand 1 Number and Algebra: Understand the diversity of presenting numbers, systems of numbers, the operations of numbers, the properties of the operations and their application.

Strand 2 Measurement and Geometry: Understand and apply the basic of measurement; measure and estimate the size of things measured; analyze and apply the geometric shapes; the properties of the geometric shapes; the relationships between the geometric shapes and geometric theory.

Strand 3 Statistic and Probability: Understand the statistical methodology and use the knowledge in statistic to solve the problems.

Strand 4 Calculus: Understand limits, functions, and derivative of functions, and use the knowledge in calculus to solve the problems.

According to this study, it was only focused on investigating Grade 6 students, the only Strand 1-3 is necessary for Grade 6 Thai students. Strand 4 was not involved in this study because it was used for Grade 9-12 students.

Apart from achieving Strand 1-3 of the four learning areas, the Basic Education Core Curriculum has prescribed the Mathematics skills that students aimed to achieve: problem-solving skill, communication skill to transfer the meaning of Mathematics, connection skill, reasoning skill, and creative skill. The problem-solving skill was mainly skill students must acquire after learning Mathematics which was needed to improve in this study.

2.2.1.1 Mathematics Curriculum According to the Basic Educational Core Curriculum for Grade 6 Students (Ministry of Education, 2008; IPST, 2017)

Nine chapters must be taught to Grade 6 students which were 1) Factors, 2) Fractions and Operations of Fractions, 3) Decimals and Division of Decimals, 4) Quadrilaterals, 5) Triangles, 6) Circles, 7) Ratio and Scale, 8) Three-dimensional Geometric Shapes and 9) Statistics.

The instruction of the nine chapters could be rearranged by the teachers in each school that have to follow the Education Service Area policy in which a school was being in charge or by the principal of each school's policy.

The following information is the learning outcome and indicators which were needed to be achieved by Grade 6 students.

Table 2.2 The Learning Outcome and Indicators for Sixth Grade in Mathematics

Chapter 1: Factors
Learning outcome: Strand 1 – Number and Algebra
Indicators: M1.1 M1.1 Gr6/4: Find the greatest common factor of not more than 3 cardinal numbers. M1.1 Gr6/5: Find the least common multiple of not more than 3 cardinal numbers. M1.1 Gr6/6: Show method of finding answers to problems by using the greatest common factor and the least common multiple.

Chapter 2: Fractions and Operations of Fractions
Learning outcome: Strand 1 – Number and Algebra
Indicators: M1.1 M1.1 Gr6/1: Compare and arrange fractions and mixed numbers from different situations. M1.1 Gr6/7: Find the answer for mix addition, subtraction, multiplication, and division of fractions and mixed numbers. M1.1 Gr6/8: Show method of finding answers to 2-3 step problems of fractions and mixed numbers.

Table 2.2 The Learning Outcome and Indicators for Sixth Grade in Mathematics (Cont.)

Chapter 3: Decimals and Division of Decimals
Learning outcome: Strand 1 – Number and Algebra
Indicators: M1.1 M1.1 Gr6/9: Find the quotient of the decimal which the divisor and the quotient are the decimals not more than 3 places. M1.1 Gr6/10: Show the method of finding the answer to 3 steps addition, subtraction, multiplication, and division decimal problems.
Chapter 4: Quadrilaterals
Learning outcome: Strand 1 - Number and Algebra and Strand 2 – Measurement and Geometry
Indicators: M1.2 and M2.1 M1.2 Gr6/1: Show method of thinking and finding answers to problems involving patterns. M2.1 Gr6/2: Show the method of finding the answers to the problems involving the perimeters and the area of a polygon.
Chapter 5: Triangles
Learning outcome: Strand 2 – Measurement and Geometry
Indicators: M2.2 M2.2 Gr6/1: Classify a triangle by considering from its properties. M2.2 Gr6/2: Construct a triangle when given the length of each side the the size of the angle.
Chapter 6: Circles
Learning outcome: Strand 2 – Measurement and Geometry
Indicators: M2.1 M2.1 Gr6/3: Show the method of finding the answers to the problems involving the perimeter and the area of a circle.

In summary, Grade 6 students were required to solve mathematical word problems to achieve all the indicators indicated by the Ministry of Education. To improve students' ability to solve word problems was essential to the researcher as a Mathematics teacher.

Furthermore, the Mathematical lesson plans of Grade 6 students were attached as an additional instructional tool for this study according to the school grade 6 curriculum and requirements which applied from the Basic Educational Core Curriculum (Ministry of Education, 2008; IPST, 2017) (Lesson plans shown in Appendix A).

2.2.2 Difficulties in Word Problem-solving in Mathematics

Students with learning disabilities and Mathematical difficulties always had problems focusing, language, memory, motivation and impulsivity (Van Garderen, Thimas, Stormont & Lemket, 2013). Students who faced difficulties in solving Mathematical word problems generally were unable to understand the problems' language and were unable to solve the problems with complexity (Pfannenstiel, Bryant, D. P., Bryant, B. R. & Porterfield, 2015). Re, Pedron, Tressold, and Lucangeli (2014) pointed out that students' poor mathematics performance was related to their negative attitudes toward Mathematics.

The following information was about the reasons which might cause difficulties in solving word problems in Mathematics. The difficulties that might appear as boundaries in solving word problems consisted of language in word problems, reasoning ability, and students' working memory.

2.2.2.1 Language in Word Problem-solving in Mathematics

Mathematics concepts could be developed by learning Mathematics vocabulary. To select and apply strategies to solve word problems in Mathematics, students should read, comprehend the text and decode technical vocabulary in

Mathematics (Jitendra et al., 2015). The fundamental factor in solving word problems in Mathematics was understanding words, terms, and vocabulary found in the problems (Adams, 2003). Word problems in Mathematics combined with the language used in daily conversation and technical vocabulary in Mathematics (Orosco, 2014). Students' ability to understand and use two types of vocabulary in Mathematics: Math specific words and ambiguous (multiple-meaning words), could help in increasing students' proficiency in Mathematics (Pierce & Fountaine, 2009). Due to the complexity of Mathematics terms in word problems, learning technical vocabulary in Mathematics helped increase students' learning of Mathematics concepts (Freeman & Crawford, 2008).

There were three types of words in word problems in Mathematics defined by Beck et al. (2002) which were 1) basic words – found in daily life such as, clock, girl and buy, 2) intermediate words – found in the upper level of reading such as, admit, haunting and compare and 3) technical words – found in subject contents such as, addition, subtraction and fraction. Most of the word problems required students to comprehend type 1 (basic words) and 3 (technical words). Students were generally able to comprehend type 1 (basic words) (Beck, McKeown & Kucan, 2002). To comprehend words in type 3 (technical words) was one of the difficulties in solving word problems in Mathematics (Walker, 2012). For this reason, reading texts used as the treatment in this study consist of the type 3 words (technical words) to prepare participants to be ready to find the information missing of the word problems given.

Mathematics was an independent language which requires students to understand the symbols which showed Mathematics concept. To understand Mathematics taught in English, the students must understand the language rules of English. (Kester Phillips, Bardsley, Bach & Gibb-Brown, 2009). Mathematics had its own grammar rules and syntax structure like other languages which are difficult for students to learn (Capraro & Joffricon, 2006). To succeed in learning Mathematics, the students must be fluency in both the language used as media of the instruction and the language in Mathematics (Lager, 2006).

Vital English reading skill was required to learn Mathematics through word problems that English used as the instruction medium (Peeples, 2013). The relationship between reading and word problem-solving in Mathematics has noted since early kindergarten students started to apply the reading skill to basic problem-solving situations in Mathematics (Chard, Baker, Clarke & Jungjohann, 2008). By the time, some students' reading skill in comprehension had not developed by their ages as showed in failure when they were required to read texts to learn other subject contents (Harlaar, Kovas, Dale, Petrill & Plomin, 2012). This issue has become a common problem is Mathematics classrooms for many years, mainly because the students must apply their reading proficiency to solve word problems in Mathematics (Yan, Wiles, & Yu-Ying, 2008). Indeed, reading comprehension was an essential step in solving word problems in Mathematics (Scheiter, Gerjets, & Schuh, 2010).

In conclusion, to avoid facing the struggle of language in solving word problems in Mathematics, the students had to improve in reading comprehension of the language used as the medium of the instruction and the language in Mathematics.

2.2.2.2 Reasoning Ability in Word Problem-solving in Mathematics

Reasoning ability was a skill needed for all students to achieve word problem-solving in Mathematics (Peeples, 2013). Mathematical reasoning was defined as “purposeful inference, deduction, induction, and association in the areas of quantity and structure” (Thompson, 1996). Reasoning and problem-solving skills were needed skills for every person in learning not only Mathematics but including others and living one’s daily life efficiently (Kribs & Ruebel, 2008) which was the reason that Ministry of Education of Thailand has prescribed it as one of the five students characteristics must develop while learning Mathematics (IPST, 2017). Reasoning ability influenced Mathematical word problem-solving ability (Vilenius-Tuohimaa, Aunola & Nurmi, 2008).

In this study, reasoning ability was not the skill focus to improve. However, it could improve along with the group discussion time, which provided the instruction of the treatment to promote the participants' reading comprehension.

2.2.2.3 Working Memory in Word Problem-solving in Mathematics

Working memory was the way to temporarily store and retrieve the data that has been read or heard (Baddeley, 2002). Working memory was also defined as the individual's ability to process information to solve a complicated task (Smith, Sáez, & Doabler, 2016). Several researchers have investigated the relationship between the processes of working memory and word problem-solving. Several research pieces showed that deficit in working memory influenced poor Mathematics performance due to working memory helping in computational skills such as addition, subtraction, and multiplication (Bull, Espy, & Wiebe, 2008; Geary, Hoard, Byrd-Craven, Nugent & Numtee, 2007). Students with difficulties in solving word problems in Mathematics typically had problems with their working memory (Swanson, Lussier & Orosco, 2015). Also, students with poor working memory performance always had difficulties with complex tasks, such as word problems in Mathematics (Smith, Saez & Doabler, 2016).

Working memory played a vital role in solving word problems in Mathematics (Swanson et al., 2015). Welsh, Nix, Blair, Bierman, and Nelson (2010) studied if growth in working memory and attention control influenced prekindergarten to kindergarten students' reading, Mathematics, and language development. The study's result has shown the growth in working memory and attention control from prekindergarten to kindergarten positively influenced students' development in reading, Mathematics, and language.

Swanson et al. (2009) investigated Grade 1-3 students to determine if growth in word problem-solving in Mathematics related to growth in working memory. The result showed that "the capacity to store and process material in working memory significantly influenced a child's ability to solve a problem during early elementary

years regardless of individual differences in reading ability, computation skills, processing speed, and phonological processing."

To summarize, working memory was a significant factor that impacted reading comprehension and word problem-solving skills in Mathematics. In this study, the participants were required to practice their working memory ability by writing down the texts read in self-reflection.

2.3 Assessment Criteria and Statistical Analysis Used in this Research

The assessment was significant in evaluating teaching pedagogies, instructional materials, learning environments, and how a course was designed (National Institute of Education, 2014). To design an assessment for students to measure their authentic learning outcomes have been challenging tasks for teachers and educators for several years. Varied types of assessment were invented to serve different purposes of the teachers and educators.

In this study, there were two assessments used: mathematical word problem questions to measure the participants' word problem-solving skills and a test for tracking the participants' reading comprehension ability. Therefore, to create assessments in word problem-solving in Mathematics and reading comprehension were reviewed the following parts.

2.3.1 Assessment Criteria for Forming Pre-test and Post-test Questions

In this study, there were two sets of pre-test and post-test assessment for measuring participants' reading comprehension skill and word problem-solving skills in Mathematics. Creating a suitable assessment for quantitative research like this study was significant and needed to be concerned. When we discussed if the assessment was suitable, we always mentioned the validity and reliability of the assessment, which were discussed in this part.

Kelly (1927) raised the concept of validity, who pointed out that an assessment was valid if it measures what it claimed to measure. Validity was the most significant key for developing an actual scientific measurement and must be considered for those seeking good outcomes from assessment (Bond, 2003). Validity was the core of any form of assessment in trustworthy and accurate. Borsboom, Mellenbergh and Heerden (2004) stated that "… a test is valid for measuring an attribute if the attribute exists and variations in the attribute casually produce variation in the measurement". In this study, the categories of validity were divided into two main types, according to McLeod (2013) which were content-related validity and criterion-related validity.

Content-related validity was the area of measurement which must be designed to cover the content of interest. There were two sub-type of content-related validity which were face validity and construct validity. Face validity was the appearance of the test, which was suitable for the test. The test, which was the purpose was exact, was a test with high face validity (Nevo, 1985). Construct validity was formulated by Cronbach and Meehl (1955). Construct validity was the area of measurement which must be designed to relate to the underlying theoretical concepts.

Criterion-related validity was the measurement area that correlated with other variables that would expect them to correlate with. There were two sub-type of criterion-related validity which were concurrent validity and predictive validity.

Reliability was an assessment that can produce the same results if taken by the same test-taker under the same conditions (McMillan & Schumacher, 2006). Reliability reflected the consistency and replicability of an assessment (Neuman, 2003). There were two types of reliability: internal reliability and external reliability (McLeod, 2007). Internal reliability referred to the consistency of a test's results across items within the test. Furthermore, external reliability was the area of measurement that varies from one use to another.

In summary, the test in word problem-solving in Mathematics as a research tool of this research was needed for validity and reliability. The test must contain content

related to validity which needed to relate to the Basic Educational Core Curriculum for Grade 6 Students (Ministry of Education, 2008; IPST, 2017). The criteria-related validity meant the test was needed to design to relate to investigating reading comprehension ability. The validity of the 2 sets of pre-test and post-test questions of reading comprehension and word problem-solving skills in Mathematics was approved by using the Index of Item Objective Congruence (IOC) which were assessed by 3 professional lecturers in the education field.

To design an assessment, the first thing needed to be concerned was the purpose of the assessment. Reading comprehension assessment aimed to assess students' understanding of the texts they were reading, which required their cognitive abilities (Sabatini, Deane & O'Reilly, 2013). When it came to reading assessment, there were five types of the assessment according to the purpose of collecting information of students' reading skills stated by Grabe (2009) which were 1) assessment of reading proficiency (i.e., standardized test), 2) assessment of classroom learning, 3) assessment for support learning, 4) assessment of curricular effectiveness and 5) assessment for research purposes.

Flippo (2003) stated that there were two types of reading comprehension measuring: qualitative and quantitative data. The qualitative data are entirely informal assessments, such as cloze assessment which required students to fill in the blanks to show that they understood enough to provide the deleted word. Quantitative data tended to be in the form of formal assessments. An example of the quantitative data measuring was the standardized tests in multiple-choice, matching, and true-false questions.

In this study, the question of reading comprehension which was not the main assessment of this study was used to track the participants' progress on reading comprehension. The researcher used true-false questions to collect the data on the participants' reading comprehension due to treatment time limitation.

2.3.2 Statistical Analysis Used in this Research

This research was conducted as quantitative research to investigate reading comprehension usage to enhance word problem-solving skills in Mathematics and determine the relationship between reading comprehension skill and word problem-solving skills in Mathematics. Thus, the statistical analysis information was essential to design appropriate research methodology, find suitable sample size and use the acceptable statistical analysis methods.

2.3.2.1 Sample Size Determination

Due to this research conducted as a quantitative study, sample size determination was significant for planning an approvable study. To select the appropriate sample from the population was also crucial for an experimental study like this research. The adequate sample size related to the study's objectives must be done in the step of sample selection planning. This step was quite difficult because several factors were needed to be reviewed.

There were three criteria usually used to determine the appropriate sample size: 1) the level of precision (sampling error), 2) the level of confidence or risk (risk level) and 3) the degree of variability in the attributes (Miaoulis and Michener, 1976). The descriptions of the three levels are: 1) The level of precision (sampling error) was the range in which the actual value of the population estimated to be, 2) The confidence level (risk level) was the probability that if the test was repeated, the results obtained would be the same (Glen, 2019) and 3) the degree of variability referred to the distribution of attributes in the population.

There were several methods to determine the sample size: using published tables, applying formulas to calculate a sample size or using a sample size calculation software. To discuss the effect size in Chapter 5 of this study, G*Power software was chosen. G*Power was free of charge software which can help in

calculating sample size and others significant values, for example effect size, significance level (α) and power (1-β) (Faul et al., 2009).

2.3.2.2 Statistical Values Used in this Research

The information used to analyze the result of this research was the scores on pre-test and post-test of the participants' reading comprehension skills and word problem-solving skills in Mathematics. To compare the difference between pre-test and post-test scores in statistic analyzing, t-test was one of the most popular methods. T-test showed how significant the differences between groups are.

To analyze the relationship between two variables to check the hypotheses in this research, a correlation in the statistical analysis must be done. Correlation in the term of statistics referred to a bivariate analysis that measures the strength of association between two variables and the relationship's direction (Statistics Solutions, 2020). The value of the correlation coefficient was in the range of 1 to -1. The correlation coefficient value of ± 1 showed a strong relationship between the two variables. There were four types of correlations measuring Pearson r correlation, Spearman correlation, Kendall rank correlation and the Point-biserial correlation. The usage of each type of correlation depended on the characteristic of the raw data collected. In this study, Pearson correlation was used to find the relationship between reading comprehension and word problem-solving skills due to the interval scale's collected data.

Pearson correlation (r) was the most widely used statistical analysis to measure the relationship's degree in a straight-line relationship between each of the two variables. For the Pearson correlation (r), both variable values must distribute (a normal bell-shaped curve).

The modern requirement of quantitative research was to show the sample's 'effect size' and the statistical method used to analyze the collected data. The effect size was a quantitative statistical value of the magnitude of the experiment effect.

The larger the effect size, the more substantial the relationship between two variables (McLeod, 2019). In a quantitative study that needed to be analyzed the relation between two variables by using Pearson r correlation, the study's effect size should be shown to emphasize the bivariate relationship's strength.

2.4 Second Language Acquisition

2.4.1 Definition and Research Background

Second language acquisition (SLA) was defined as the process of people learning a second language after a first language has been already established (Sun, 2017). The process of second language acquisition was different from the first language acquisition, but the errors of learning the first language (L1) and the second language (L2) were quite similar (Dulay, Burt, and Krashen, 1982; Nemati & Taghizadeh, 2006). Second language learners who wanted to speak or write in the target language tend to rely on their first language structures. The second language learners developed inter-language skills by applying and using their first linguistic knowledge (Faerch & Kasper, 1987). There were problems in learning the second language if the learners apply their first language learning habits to their learning process (Nemati & Taghizadeh, 2006). If their structures of the first and the second language were different, there would be lots of errors that occur as an interference of the first language (L1) on the second language (L2) (Bhela, 1999).

2.4.2 Related Factors Affecting Second Language Acquisition

The interference of L1 on L2 can cause difficulties for learners in phonology, vocabulary, and grammar (Beardsmore, 1982; Bhela, 1999). Dualy et al. (1982) categorized the errors in the second language learning into three types as follows: 1) developmental errors – the errors which caused by the interference of the first language (L1), 2) ambiguous errors – the errors that caused by the interference of L1 and 3) unique errors – the errors which could not be categorized. Selinker (1983) stated two types of transfer in second language learning: positive and negative transfer. The

positive transfer was how L1 supports the process of acquisition of the second language. Otherwise, a negative transfer was how L1 interferes in the process of second language acquisition.

Macaro (2010) stated that there are two types of factors that influence the acquisition of a second language; internal and external factors. Internal factors were the individual factors for each learner, such as age, personality, intrinsic motivation, and cognition ability. External factors were the factors that influenced learners such as curriculum, instruction, culture, and extrinsic motivation.

2.4.3 English and Mathematics as a Second Language

Learning a language and Mathematics were closely related (Barwell, 2008). The language used to express Mathematics and Mathematics was also used to express a language. In this part, both Mathematics and English were defined as a second language for the participants of this study owing to the reasons which attached in the following parts.

Mathematics was described as a language because expression and communication required the uses of notations, symbols, terminology, conventions, and models (Setati, 2002). Besides, Adams (2003) stated that "Mathematics was a language that people used to communicate, solve problems, engage in recreation and create works of art and mechanical tools." As it shared the same characteristics of a language, Mathematics contained abstractions, symbols, rules of use, expressions, and translations.

Therefore, the characteristic of Mathematics was similar to English considerably as a type of language. The process of teaching and learning Mathematics and English were defined as a second language (Curtin, 2005).

Therefore, the characteristic of Mathematics was similar to English considerably as a type of language.

The participants who attended this study learned Mathematics in English as a second language. From the statements of Harrison (2014), 'language was the cement that allows us to build upon prior knowledge learning. If language was weak, so too was the ability to learn'. In a classroom in which a second language used as the medium of instruction, the second language acquisition was crucial for students to understand through language. Besides, the teachers generally had to diagnose and assess students' understanding by reading their writings as the researcher did in this study.

The mechanistic teaching approaches in Mathematics and English were significantly related, as shown in the RME theory of teaching Mathematics and TBI of a language lesson. RME theory was developed by Van den Heuvel-Panhuizen and Drijvers (2014). RME theory was designed to provide more opportunities for students to investigate and reinvent in a Mathematics classroom. The steps of the RME theory were problematization, construction, and reflection. While TBI was known as task-based instruction to guide how teaching methodologies in a language class should follow. TBI was developed by Griffiths and Parr (2001). The steps of TBI were pre-task phase (students think of problems and strategy to solve the problems), during-task phase (students try to solve the problem) and post-task phase (students reflect on the task).

From the similarity of teaching Mathematics and English language, there was a guideline step proposed by Moschkovich (2002) for bilingual or ESL learners to follow to be able to participate in a Mathematics class in which English was used as a second language. There were three steps to succeed in Mathematics class which were 1) acquiring vocabulary – students should acquire vocabulary which referred to mathematical dialogue and concept 2) constructing meanings – students should identify the precise meanings of the words seen to the mathematical meanings, and 3) participate in discourse – students should be able to solve the problems found in their daily mathematically.

In this study, the participants were Grade 6 Thai students who studied in the same school and stayed in the same study conditions of curriculum, instruction, and

teachers. All the participants in this study received the same treatment from the researcher. Owing to the instruction language in this study, English was the second language for the participants. For this reason, the participants were promoted both intrinsic and extrinsic motivation in the acquisition of English as a second language to reduce the boundary of English as a medium of instruction in this study. As well as enhance the students to think systematically and critically as keys to become successful in both English reading comprehension and mathematically word problem-solving.

2.5 The Research Site Profile

There were three topics relevant to this: the necessary information about the school, programmes, and curriculum used for instruction, and the results on the O-Net test of Grade 6, 9, and 12 students in the year 2017-2019.

2.5.1 About the Research Site

This private school was located in Donmuang, Bangkok. It was a Catholic school that provoked students to gain preferable characteristics in sharing love, politeness, honesty, and merciful. There were 150 teachers and approximately 2,500 students. The ratio of teachers to students was approximately 1:17. The following table showed the number of students from Kindergarten 2 to Grade 9 updated in November 2019.

2.5.2 Curricular and Programmes Provided

This school provided classes for pre-kindergarten to Grade 12 (Mathayomsuksa 6). The Basic Educational Core Curriculum B.C. 2550 revised edition (Ministry of Education, 2008; IPST, 2017) was used as the school's core curriculum. The school policy and management system were arranged according to the policy of Bangkok Archdiocese.

There were differences in the provided programmes for K. 2-Grade 9 and Grade 10-12. For the level of Kindergarten 2-Grade 9, there were three programmes provided: Intensive Programme (IP), Intensive English Programme (IEP) and Regular Programme, which would be discussed on the differences of each programme in the next part. For the level of Grade 10-12, three programmes were provided: Math-Science, Math-English and Math-Chinese, which was not focused on in this study.

Regular Programme was a basic programme which provided directly by the school. Students studied every subject (Math, Science, English, Thai, Social Studies, etc.) in the Thai language by the Thai teachers except the Chinese language by the Chinese teachers twice a week and English from Filipinos teachers one period a week.

Intensive Programme (IP) was a programme in which almost every subject was studied in Thai by Thai teachers except the English language. The English subject was taught by foreign teachers five periods a week.

Intensive English Programme (IEP) was a programme in which student study almost subject in Thai by Thai teachers except for Mathematics, Science, and English were taught in English. These three subjects were taught by Thai teachers who used English as a medium of instruction. The frequency of Mathematics, Science, and English was 1, 1, and 2 periods a week, respectively. Except for Grade 7 (Mathayomsuksa 1), the three subjects' frequency was three periods of each subject per week.

This private school constructed the instruction of IP and IEP programmes to the students. In this research, the participants were the students studying in IEP Programme. The researcher worked as a Mathematics teacher for the IEP programme and the language of the instruction in this research for the participants is in English.

2.5.3 School Subject Evaluation and O-NET Scores

The Ordinary National Educational Test (O-NET) was an assessment created by the National Institute of Educational Testing Service to assess Grade 6 (Prathomsuksa 6), Grade 9 (Mathayomsuksa 3), and Grade 12 (Mathayomsuksa 6) students in public and private schools in the contents of the basic subjects such as Mathematics, Science, English, and Thai.

The following table showed the average scores of O-NET test on Mathematics subject, comparing the score within Grade 6 students. In this part, the Mathematics scores on the O-NET test was shown because this study only focused on the word problem-solving skill in Mathematics.

Table 2.3 O-NET Mathematics average score of Grade 6 Thai students within Thailand and in a private school, Bangkok

Year	2016	2017	2018
Thailand[a]	40.47%	37.12%	37.50%

Source: NIETS, 2018

Table 2.4 showed that the average O-NET scores in Mathematics from all Grade 6 Thai students in 2016-2018 were below 50% of the full score. Even though the average score of the students in this school in Mathematics was higher than the average score of the overall Grade 6 students in Thailand, the score during 2016-2018 was unstable and decreased.

2.6 Related Literature and Previous Research Studies

This study investigated the usage of reading comprehension to enhance word problem-solving in Mathematics for Grade 6 students. The related research studies were the foundations of this study to determine if other reading comprehension factors might affect word problem-solving performance in Mathematics.

Most students had difficulties developing word problem-solving skills in Mathematics because of deficits in language and reading comprehension (Morningstar, Shogren, Lee & Born, 2015). A student's reading proficiency was an essential indicator of his/her mathematics achievement (Bohlmann & Pretorius, 2008; Capraro R., Capraro M. & Rurpley, 2012). Reading proficiency affected Mathematics performance (Rutherford-Becker & Vanderwood, 2009). Students with higher reading performance were found to perform better on Mathematics assessment than students with average and lower reading performance (Vilenius-Tuohimaa et al., 2008; Walker, Zhang & Surber, 2008). A group of college students was studied to determine why they were struggling with algebra (McGlaughlin, Knoop & Holiday, 2005).

Harlaar, et al. (2012) studied whether individual skills of Mathematics and reading comprehension were related or not. In the study, Harlaar and her research partners investigated the relationship from both phenotypic and genotypic levels. The participants of this research were approximately 5,000 12-year-old children in England. They found out that Mathematics skills and reading comprehension ability significantly related in both phenotypic and genetic level. They showed that there was an overlap in genetic level among reading and Mathematics skills. The genetic level overlap because these skills were based on executive function on information-processing or general cognitive abilities and working memory.

They were tested on working memory, Math fluency, reasoning, and reading comprehension, affecting mathematics performance. The result showed that working memory, Math fluency, reasoning, and reading comprehension affected Mathematic achievement. Reading Mathematics test items aloud might increase students' performance on Mathematics test even with the text considered too difficult for the students to read and comprehend (Bolt & Thurlow, 2007).

There was evidence that students who had the reading ability at grade level could perform better in learning Mathematics than the students who had difficulties in reading (Jordan, Hanich & Kaplan, 2003). Students with greater reading comprehension, extensive vocabulary, and high IQ were more proficient in mathematical word problems

(Swanson, 2006). Mathematics instruction is needed to apply reading comprehension strategies to enhance students' understanding of how to solve mathematical word problems. Reading comprehension could be included in Mathematics instruction by enhancing Mathematics teachers in asking the students to read aloud, helping in decoding when necessary, providing opportunities in vocabulary exploration, asking questions to activate the students' prior knowledge, and keeping on measuring their understanding (Carter & Dean, 2006). Reading comprehension was useful in picking out the information that matches to answer questions in Mathematical word problems (Cetintas, Si, Xin & Ron, 2010).

Achievement in Mathematics highly depended on literacy (Bohlmann & Pretorius, 2008). However, few studies were exploring the relationship between numeracy and literacy skills in Thailand. The conceptual complexity and problem-solving in Mathematics extensively required in the reasoning, critical thinking, computing, and reading comprehension.

Besides, Bohlmann & Pretorius (2008) pointed out that English reading was extensively supportive of mathematics achievement. Both English and Mathematics are universal languages (Kachru & Nelson, 2001; Smith, 2004); both contained rules and structures and required critical thinking to interpret and analyze them (Dekeyser, 2007). There were a few differences between English and Mathematics; the English language was more subjective using an emotive description. A 'sentence' might have different interpretations, while the language in Mathematics was more objective, and a 'sentence' might have only one interpretation (Leshem & Markovits, 2013).

A research by Jordan, Hanich, and Kaplan (2003) declared that reading abilities promote growth in Mathematics achievement, but Mathematics proficiencies did not affect reading achievement growth.

There were many research pieces on the difficulties of students who learn English as a second language (ESL) with solving mathematical word problems in English. Orosco et al., (2013) and Orosco (2014) found out that ESL students generally

face difficulties in solving mathematical word problems in English because of limited vocabulary and multiple steps processes.

2.7 Summary

In summary, this study aimed to find out the relationship between reading comprehension ability and word problem-solving skills in Mathematics and investigate reading comprehension usage to enhance word problem-solving skills of Grade 6 students in a private school, Bangkok. From the information reviewed in Chapter 2, reading comprehension and word problem-solving skills were significantly related in the same way. This study's treatment was created to promote the ability of participants reading comprehension, which might be affected by word problem-solving skills in Mathematics. Besides, reading comprehension ability relied on one's cognitive ability, metacognition, and working memory. Reading strategy could use to promote one's reading comprehension ability.

In this study, the Metacognitive Awareness of Reading Strategies Inventory (MARSI) developed by Mokhtari and Reichard (2002) was applied to construct this study's treatment in developing participants' reading comprehension. Besides, the word problem-solving questions in Mathematics for Grade 6 students as the research instruments were created according to the contents of the Basic Educational Core Curriculum for Grade 6 students by the Ministry of Education (2008) and IPST (2017).

Chapter 3

Research Methodology

This chapter presented the processes of how the data collected for the study. The chapter consisted of the research design, research site, research instruments, population and sample, data collection procedures, and lastly, it also has shown how the data were analyzed.

This study aimed to find out the relationship between reading comprehension skills and word problem-solving skills and assess the usage of reading comprehension on improving word problem-solving skills in Mathematics among Grade 6 students. The participants had to take the pretest and posttest in reading comprehension and mathematical word problem-solving skills before and after attending the online reading comprehension training programme for approximately eight weeks.

3.1 Research Design

In this study, the quantitative research method used to determine the relationship between reading comprehension skills and word problem-solving skills and assess the usage of reading comprehension on improving word problem-solving skills in Mathematics among Grade 6 students in a private school, Bangkok. The pretest and posttest scores in reading comprehension and mathematical word problem-solving skills were collected before and after the participants attending to the online training to improve reading comprehension ability. The validity and reliability of the research instruments were evaluated and approved by three university professors by using the Index of Item Objective Congruence (IOC) to examine whether the questions on pretest and posttest in both sets of reading comprehension test and word problem-solving in Mathematics test matched with the research objectives. The fundamental statistical

analysis used to sort out the collected data, such as mean average and standard deviation. The Paired Sample T-test used to examine the participants' reading comprehension and mathematical word problem-solving skills. The relationship between reading comprehension and word problem-solving skills was checked by a scatter plot and Pearson's correlation coefficient (*r*).

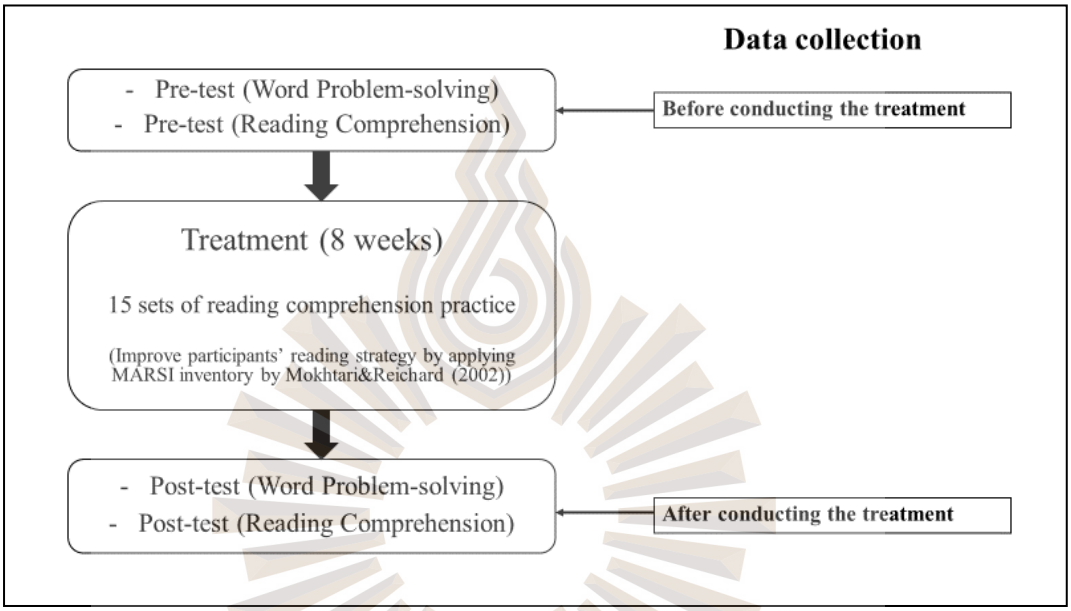


Figure 3.1 Illustration of the Conceptual Framework

Figure 3.1 showed that the participants of this research were 21 Grade 6 students from a private school, Bangkok. All the participants had to complete the pretest and posttest, both in reading comprehension and mathematical word problem-solving skills, before and after attending the online treatment for approximately eight weeks. The treatment of this research was designed to improve participants' reading strategy to enhance participants' reading comprehension.

This study was experimental research. Several variables might affect the results of the study. Thus, the related variables were shown in Fig 3.2 as follows:

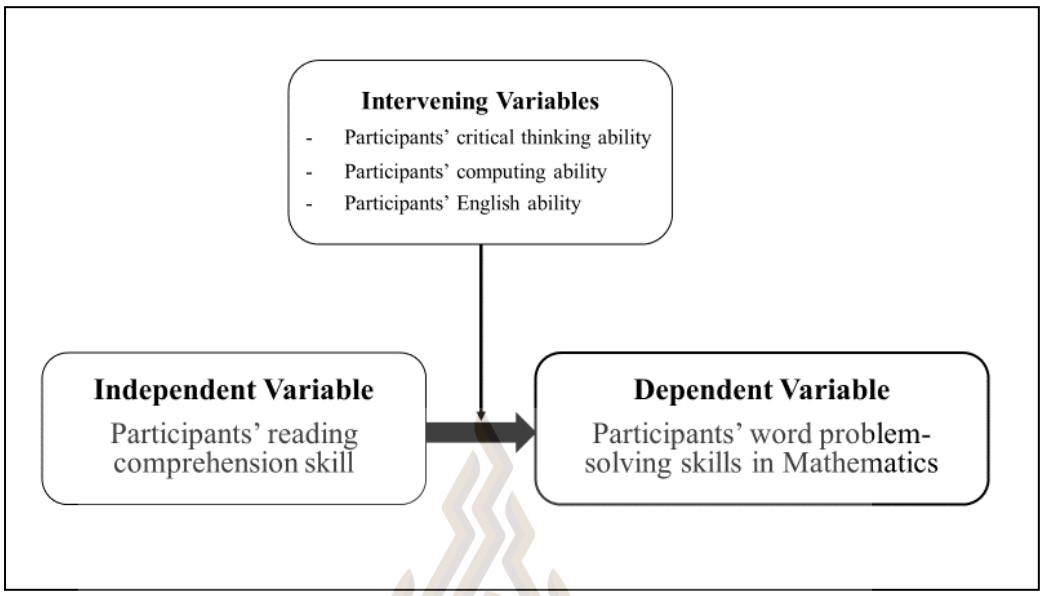


Figure 3.2 Illustration of the Variables Related to This Research

From Figure 3.2, the independent variable of this study was the usage of reading comprehension which was set as the treatment. The treatment was divided into 15 sections; each section took 40 minutes in total. Each program section of treatment consisted of 5 minutes of discussing the reading topic before reading, 10 minutes of reading silently, 10 minutes of practising reading aloud, 5 minutes of discussing the reading passage after reading, and 10 minutes of answering questions vocabulary, and writing short self-reflection. The treatment was designed by applying the Metacognitive Awareness of Reading Strategies Inventory (MARSI) created by Mokhtari and Reichard (2002) to track one's reading strategies.

3.2 Research Population and Sample

3.2.1 Population

This study's population was 66 Thai students from two Intensive English Programme classrooms, in Grade 6 in a private school, Bangkok, in the academic year 2020.

3.2.2 Number of Sample and Sample Selection Method

Therefore, the number of participants was limited to 66 students who were studying in IEP Programme classrooms. Simple random sampling was used to choose the participants randomly. The number of expected participants in this study was 21 students.

The expected number of the participants was calculated by using the statistical free software, G*Power 3.1, by setting the input parameters as follows:

Test family:	t tests
Statistical test:	Correlation: Point-biserial model
Tail(s):	Two
Effect size (ρ):	0.5
Significance level (α):	0.10
Power (1-β):	0.80

The parents or guardians of the participants must agree and sign the consent forms before their children attend the research programme.

3.3 Research Instruments

This study was quantitative and experimental research. The pretest and posttest scores in reading comprehension and word problem-solving in Mathematics skills of all the 21 participants were collected and analyzed. All participants had to take the pretest and posttest in the two mentioned skills before and after receiving the treatment. The treatment was designed to establish the participants' reading strategy as a critical factor in reading comprehension. The usage of reading comprehension was used as the treatment of this study. The treatment was divided into 15 sections; each section took 40 minutes in total. Each program section of treatment consisted of 5 minutes of discussing the reading topic before reading, 10 minutes of reading silently, 10 minutes of practicing reading aloud, 5 minutes of discussing the reading passage after reading, and 10 minutes of answering questions vocabulary and writing short self-reflection.

This research was conducted online due to the outbreak of Covid-19 in Thailand. The treatment was designed by applying the Metacognitive Awareness of Reading Strategies Inventory (MARSI) created by Mokhtari and Reichard (2002) to track one's reading strategies.

The research instruments used in this study were as follows.

1) Pretest and posttest of Mathematical word problems were:

Multiple choices (15 items) and showing the solution. (2 items) (Sample of the test shown in Appendix C)

1) Pretest and posttest of reading comprehension test were:

Multiple choice (10 items) and T/F questions (5 items) (Sample of the comprehension test shown in Appendix D)

The Index of Item-Objective Congruence (IOC) used to find validity. The research instruments were checked by three experts in the education field (see Appendix G). The value of the Index of Item-Objective Congruence (IOC) must be at least 0.75 to accept the validity of the research instruments (Rovinelli and Hambleton, 1977; Hambleton, 1978 cited in Turner and Carlson, 2003). The value of the Index of Item-Objective Congruence (IOC) of both research instruments were 0.76 (see Appendix G); thus, the instruments were acceptable.

3.4 Instructional Tool (Lesson Plans)

The Mathematical lesson plans of Grade 6 students was created as the addition of instructional tool for this study: according to the school grade 6 curriculum and requirements, which applied from the Basic Educational Core Curriculum (Ministry of Education, 2008; IPST, 2017) (Lesson plans showed in Appendix A).

3.5 Research Hypotheses

$H1_0$ There is no effect of the usage of reading comprehension on the improvement of word problem-solving skills in Mathematics.

$H1_a$ There is an effect of the usage of reading comprehension on the improvement of word problem-solving skills in Mathematics.

$H2_0$ There is no relationship between reading comprehension skill and word problem-solving skills in Mathematics.

$H2_a$ There is a relationship between reading comprehension skill and word problem-solving skills in Mathematics.

3.6 Data Collection Procedures

This study was conducted in the following steps.

1) Eight weekly lesson plans were used as the instructional tool.

2) All of the 21 participants were taken the pretest in reading comprehension and word problem-solving in Mathematics before attending the online reading comprehension training programme set as the treatment of this study.

3) The participants were divided into groups of 3-4 to attend to the 15 online sections of the usage of reading comprehension treatment. The frequency of the online training programme was twice a week. The approximate duration of the treatment was eight weeks.

4) After the 21 participants attended all the online reading comprehension training programme as the treatment of this study, they must complete the posttest in reading comprehension and mathematical word problem-solving skills. The scores were collected and analyzed by statistical method.

The pretest was given to the participants in May 2020, and posttest was given to the participants in July 2020. The scores were collected and analyzed using mean average, standard deviation, and Paired Sample T-test to compare the students' performances in reading comprehension and mathematical word problem-solving skills before and after receiving the treatment. The relationship between reading comprehension and word problem-solving skills in Mathematics was examined by finding the Pearson's correlation coefficient (*r*).

3.7 Data Analysis

The collected data were analyzed as follows:

1) The participants' performance on the pretest and posttest of reading comprehension skill and word problem-solving skills in Mathematics were compared by using the statistical methods as follows:

1.1) mean average

1.2) standard deviation

1.3) paired sample t-test

2) The simple scatter plots were used to examine whether there was a relationship between reading comprehension skill and word problem-solving skills in Mathematics in 'linear line' before finding the Pearson's correlation coefficient (*r*).

3) The Pearson's correlation coefficient (*r*) of the reading comprehension scores and mathematical word problem-solving scores were calculated by SPSS software.

To analyze the relationship between two variables to check the hypotheses in this research, a correlation in the statistical analysis must be done. Correlation in the term of statistics referred to a bivariate analysis that measures the strength of association between two variables and the relationship's direction (Statistics Solutions, 2020). The value of the correlation coefficient was in the range of 1 to -1. The correlation

coefficient value of ±1 showed a strong relationship between two variables. There were four types of correlations measuring: Pearson r correlation, Spearman correlation, Kendall rank correlation, and the Point-biserial correlation. The usage of each type of correlation depended on the characteristic of the raw data collected. In this study, Pearson's correlation coefficient (*r*) was used to find the relationship between reading comprehension and word problem-solving skills due to the interval scale's collected data. Pearson's r correlation was the most widely used statistical analysis to measure the degree of the relationship in a straight-line relationship between each of the two variables. For the Pearson's r correlation, both variable values must distribute (a normal bell-shaped curve).

3.8 Ethical Consideration

In order to conduct this study ethically, the data collection has proceeded the following steps:

3.8.1 Asking for permission from the participants' parents or guardians before conducting the study.

3.8.2 The participants' personal information and progress were collected and kept confidential.

3.8.3 Identity of each participant was kept anonymous by using the number system.

3.8.4 To avoid leaking of the participants' information, the collected information would be eliminated within 1-year after the publication of the research.

Chapter 4

Research Results

This study aimed to investigate the usage of reading comprehension to enhance word problem-solving skills in Mathematics and find out the relationship between reading comprehension skill and word problem-solving skills of Grade 6 students in a private school, Bangkok.

In Chapter 4, the quantitative results and analysis of the study presented in three sections. The first section presented the background information of the participants in this study. The second section provided the collected data and data analysis. The last section provided a discussion of the data analysis from the previous part to examine the study's hypotheses.

4.1 Descriptive Statistics

In this study, the participants were Grade 6 students in a private school, Bangkok, studying in the Intensive English Programme. The 21 participants were asked to attend the study by receiving the treatment on improving reading comprehension online twice a week for eight weeks. The participants also had to do the online pretest and posttest to examine their skills on word problem-solving and reading comprehension before and after receiving the treatment. This study was taken online due to reduce the risk of the outbreak of Covid-19 which was the critical period in the year 2020. Though the pandemic situation remained during the data collection, the researcher had good cooperation from the participants. In all the sample numbers, 21 sixth-grade students participated, 13 were female, and 8 were male, as shown in Table 4.1. The percentage of participants who were female and male were 61.91 and 38.09, respectively.

Table 4.1 The Number and Percentage of the Participants according to Gender

Gender	Numbers of the Participants	Percentage
Female	13	61.91
Male	8	38.09

All the participants were Thai and spoke Thai daily due to the Thai language was their mother tongue. The second language that they have studied is English. All of them have been studying in the Intensive English Programme since they were in Kindergarten level.

4.2 Data Collection and Analysis

In this study, 21 of Grade 6 students completed the pretest and posttest on word problem-solving skills and reading comprehension ability. The collected data and analysis presented in 3 sections. In the first section, the scores on mathematical word problem-solving skills presented and reviewed. In the second section, the scores on reading comprehension skill were explored. In the last section the pretest and posttest scores of both mathematical word problem-solving skills and reading comprehension skill were provided and statistically analyzed.

4.2.1 Word Problem-solving in Mathematics Scores and Analysis

The questions' scopes were related to the three topics that the participants were taught for the first two months of being Grade 6 students. The three topics were factors, fractions, and decimals. The pretest and posttest were designed to challenge the participants to solve 17 of word problem questions, which consisted of 15 multiple-choice questions and 2 long answer questions. Each of the multiple-choice questions valued 1 point. Each of the long answer questions equalled 2 points. Thus, the full score of both pretest and posttest was 20 points in total. The frequency distribution table showed in Table 4.2 below used to present the pretest and posttest raw scores of the 21 participants in mathematic word problem-solving skills.

Table 4.2 The Participants' Pretest and Posttest Raw Scores in Word Problem-solving in Mathematics Skills

Pretest		Posttest	
Score (20)	**Frequency**	**Score (20)**	**Frequency**
5.0	2	12.0	1
10.0	2	13.0	1
12.0	3	16.0	1
12.5	1	16.5	1
13.0	5	17.0	5
14.0	1	17.5	1
15.0	1	18.0	5
15.5	2	19.0	6
16.0	2		
16.5	1		
17.0	1		

From Table 4.2, the minimum and maximum of the pretest scores were 5.0 and 17.0, respectively. The median and mode of the pretest scores were 13.0. The mean of the pretest score was 12.81, with a standard deviation of 3.26. Comparing to the posttest score, the minimum and maximum scores were 12.0 and 19.0, respectively. The median of the posttest score was 18.0, and the mode of the posttest score was 19.0. The mean of the posttest score equals 17.35, with a standard deviation of 1.85.

To statistical examine whether the participants had improved in mathematical word problem-solving skills, a Paired-sample T-Test analysis was used to ensure the participants' progress.

Table 4.3 The Paired-Sample T-Test of the Pretest and Posttest on Word Problem-solving Skills in Mathematics

	Paired Differences					t	df	Sig. (2-tailed)
	Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
				Lower	Upper			
PreMath-PostMath	-4.5357	2.7887	.6085	-5.8051	-3.2663	-7.453	20	.001

The average scores in word problem-solving skills in Mathematics of all the 21 participants before and after receiving the treatment in developing reading comprehension ability were 12.81 and 17.35, respectively. The posttest score was higher than the pretest score by 4.54. From Table 4.3, T_{test} was -7.453, which was lower than the mean shown as -4.5357. This means there was an improvement in word problem-solving skills in Mathematics of the participants.

4.2.2 Reading Comprehension Scores and Analysis

This study's treatment consisted of 15 sections of reading comprehension activity arranged online during the outbreaks of Covid-19 for approximately eight weeks. This treatment was designed to improve the participants' reading comprehension skill to examine if there is any relationship to the improvement of mathematical word problem-solving skills, as mentioned as the hypothesis of this study.

The pretest and posttest of reading comprehension skill were designed to check the participants' progress on reading comprehension ability. The passage of the pretest and posttest was not in the topic related to Mathematics. Both word problem-solving skills and reading comprehension skill should be examined separately. Each of the tests consisted of one reading passage, 10 multiple choice questions and 5 true-false questions. The total score of the reading comprehension test was 15 points. Each of the raw scores was multiply by 4 and divided by 3 to prepare the collected scores to compare with the mathematical word problem-solving skills, which its total score was 20 points.

As shown in Table 4.4, the frequency distribution table presented the pretest and posttest scores of the 21 participants in reading comprehension skill.

Table 4.4 The Pretest and Posttest Scores in Reading Comprehension Skill

Pretest		**Posttest**	
Score (20)	**Frequency**	**Score (20)**	**Frequency**
less than 5	2	13.3	1
9.0	1	14.7	1
12.0	1	16.0	2
13.0	3	17.3	4
14.0	4	18.7	4
16.0	4	20	9
17.0	5		
18.0	1		

From Table 4.4, the minimum and maximum of the pretest scores were 4.0 and 18.7, respectively. The median and mode of the pretest scores were 14.7 and 17.0, respectively. The mean of the pretest score was 14.21, with a standard deviation of 3.85. The minimum and maximum of the posttest scores were 13.3 and 20.0, respectively. The median of the posttest score was 18.7, and the mode of the posttest score was 20.0. The mean posttest score was 18.29, with a standard deviation of 1.99.

To statistically examine whether the participants had improved in reading comprehension skill, ‘A Paired-sample T-Test’ analysis was used to assess the focused skill’s progress of the participants.

Table 4.5 The Paired-Sample T-Test of the Pretest and Posttest on Reading Comprehension Skills

	Paired Differences					t	df	Sig. (2-tailed)
	Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
				Lower	Upper			
PreRead-PostRead	-4.0714	3.5634	.7776	-5.6935	-2.4494	-5.236	20	.001

The average scores in reading comprehension skill of all the 21 participants before and after receiving the treatment in developing reading strategy were 14.21 and 18.29, respectively. The posttest score was higher than the pretest score by 4.07. From Table 4.5, T_{test} was -5.236, which was lower than the mean shown as -4.0714. This means there was an improvement in the reading comprehension skill of the participants.

4.2.3 Finding Relationship between Word Problem-solving in Mathematics Skills and Reading Comprehension Skill

According to this study's hypotheses, whether there was a relationship between reading comprehension skill and word problem-solving skills in Mathematics. The correlation was used to examine the association between the two variables. The relationship between two variables could be summarized in a single number called the 'correlation coefficient'. The correlation coefficient (*r*) is in the range of -1 to +1. If a correlation coefficient is close to 0, there is little or no relationship between the two variables. If a correlation coefficient close to +1 implies a positive relationship between the two variables, with increases in one of the variables being associated with increases in another variable. If a correlation coefficient close to -1, it means a negative relationship between the two variables, with increases in one of the variables being associated with a decrease in another variable.

The pretest and posttest scores were categorized as an interval scale. The commonly used correlation coefficient for interval scale level variables was 'Pearson's

correlation (*r*)'. Before finding a value of 'Pearson's correlation (*r*)', the scatter diagram must be used first. A scatter diagram showed two variables' values: the relation of the two variables along with the horizontal axis (X-axis) and the vertical axis (Y-axis). The purpose of drawing a scatter diagram before determining the correlation coefficient was defining the two variables' relationship. The scatter diagram of the two variables must show a linear line before indicating the correlation in statistical consideration.

Figure 4.1 and 4.2 below were the scatter diagrams of the pretest and posttest scores, respectively. The scatter diagrams were used to examine whether the pretest and posttest scores of the mathematical word problem-solving skills and reading comprehension skill related to linear lines.

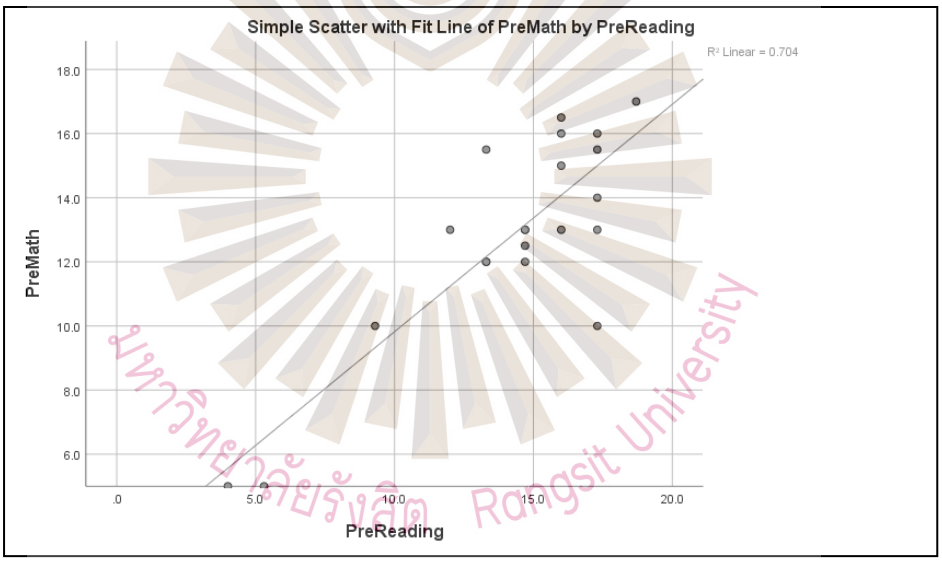


Figure 4.1 Scatter Diagram of the Pretest Scores on Word Problem-solving Skills and Reading Comprehension Skill

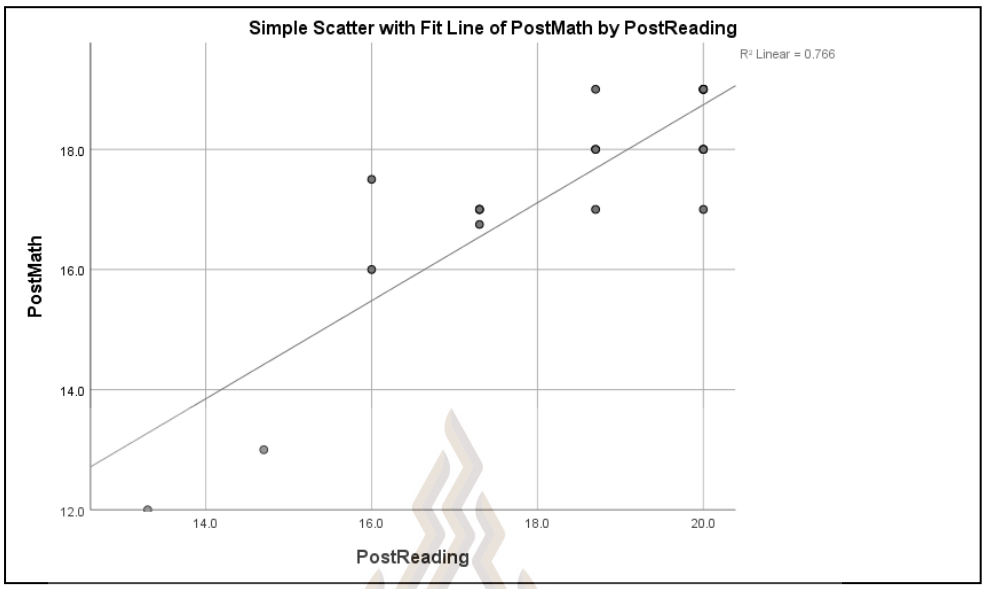


Figure 4.2 Scatter Diagram of the Posttest Scores on Word Problem-solving Skills and Reading Comprehension Skill

The scatter diagrams shown in Figure 4.1 and 4.2 have presented the relationships between word problem-solving in Mathematics skills and reading comprehension skill. The horizontal axis (X-axis) showed the score in reading comprehension skill. The vertical axis (Y-axis) showed the score in mathematical word problem-solving skills. Figure 4.1 presented the trend of the relationship between the two focus skills by comparing the pretest scores. Besides, Figure 4.2 presented the relationship trend of the two skills by comparing the posttest scores. As the results, both scatter diagrams of the pretest scores and posttest scores have shown the relationship between the two focus skills in the linear lines.

Pearson's correlation coefficient (*r*) shows in the range between -1 to 1. The closer the coefficient is to 1, the stronger the correlation between the variables (Gay&Airasian, 2003). Pearson's correlation coefficients were calculated in SPSS to determine if there was a relationship between word problem-solving skills in Mathematics and reading comprehension skill. The pretest and posttest scores on mathematical word problem-solving skills and reading comprehension skill were used to measure the Pearson's correlation coefficients. The Pearson's correlation coefficient (*r*) of the pretest and posttest to examine whether there was a relationship between the

word problem-solving in Mathematics skills and reading comprehension skill are shown in Table 4.6 and 4.7, respectively.

Table 4.6 The Pearson's Correlation Coefficient of the Relationship between Word Problem-solving Skills and Reading Comprehension Skill of the Pretest

Correlations

		PreMath	PreReading
PreMath	Pearson Correlation	1	.839**
	Sig. (2-tailed)		.001
	n	21	21
PreReading	Pearson Correlation	.839**	1
	Sig. (2-tailed)	.001	
	n	21	21

** Correlation is significant at the 0.01 level (2-tailed).

Table 4.7 The Pearson's Correlation Coefficient of the Relationship between Word Problem-solving Skills and Reading Comprehension Skill of the Posttest

Correlations

		PostMath	PostReading
PostMath	Pearson Correlation	1	.875**
	Sig. (2-tailed)		.001
	n	21	21
PostReading	Pearson Correlation	.875**	1
	Sig. (2-tailed)	.001	
	n	21	21

** Correlation is significant at the 0.01 level (2-tailed).

The Pearson's correlation coefficients (*r*) shown in Table 4.6-4.7 presented the relationship between mathematical word problem-solving and reading comprehension skills. The Pearson's correlation coefficients (*r*) of pretest and posttest were 0.839 and 0.875, respectively. Due to the size of the correlation were in the range of 0.70-0.90, the Pearson's correlation coefficient (*r*) found could be interpreted that there was 'high positive correlation' between the two mentioned variables. The coefficient of determination (r^2) of the pretest and posttest of the focused skills was 0.70 which presented that reading comprehension skill score could be used to predict the mathematical word problem-solving skills score by 70%.

The results showed a strong positive relationship between the word problem-solving skills in Mathematics and reading comprehension skill. This meant that there would positively affect a person's reading comprehension skill if there were improved mathematical word problem-solving skills. Like if there were an improvement in a person's reading comprehension skill, there would positively affect one's word problem-solving in Mathematics.

Effect size is the magnitude of the difference between groups (Sullivar G. M., 2012). The effect size is the principal value shown in a quantitative study in the sections of abstract and result. To design a well-organized experiment, the effect size should be determined before starting the research to avoid a statistical error (Type II or β) and determine the number of subjects or the study participants to examine whether it will be sufficient to ensure that the study has acceptable. In this research, the predicted effect size was used to calculate an appropriate number of participants before conducting the research experiment. Using the effect size to calculate the draft number of population and participants of experimental research which conducted with humans by using the complex treatment and the quality of the treatment was focused like clinical research or educational research like this study, due to the number of the participants should not be in a large number like research in data collection or statistical research.

Effect size can be calculated by both using statistical formula and ready-made software. There are several formulas to calculate the effect size depending upon the type of comparisons under study. In this research, the researcher has chosen the software called 'G*Power' to calculate the effect size of the study. At the significance level (α) of 0.05 and the power of the test (1-β) equals 0.95, the effect size of the study of all the 21 participants is 0.6386. According to Ferguson (2012), the range of the effect size are ±0.2 (small), ±0.5 (medium) and ±0.8 (large). Thus, the effect size of this study at 0.6386 was classified as 'medium'.

4.2.4 Additional Finding

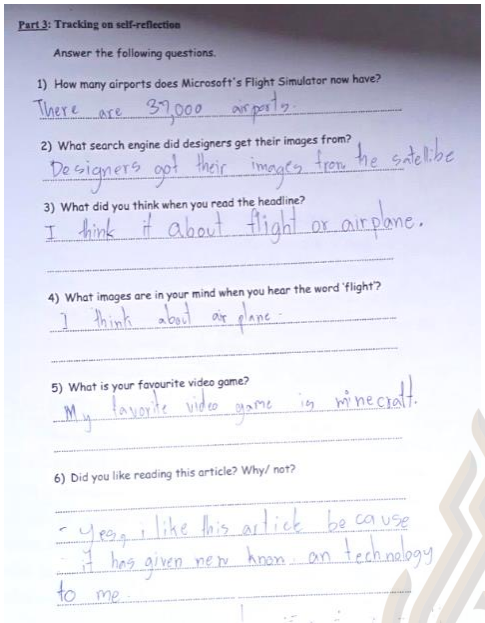
Due to Thai students who are in Grade 6, 9 and 12 have to test the national test called 'O-Net' and the results of the test in Mathematics of every single year have shown the average scores which were very low as shown in Chapter 1 and 2, the researcher was a Mathematics teacher of Grade 6 students in a private school in Bangkok noticed this issue and would like to find a solution to improve the students' scores. The national test pattern, O-Net, in Mathematics subject, each item was designed in a long paragraph and in the pattern of word problems that could examine Thai students' ability to apply Mathematics in their daily life.

Word problems were always written in the form of paragraph which contained large among of words both in daily words and technical words in Mathematics. Some students who were good at computation could not perform well in solving a word problem because it required students' reading comprehension skills. This study was inspired by the previous study results that a student's reading proficiency was an important indicator of his/her achievement in Mathematics (Bohlmann & Pretorius, 2008; Capraro R., Capraro M. & Rupley, 2012). Thus, this study was designed to improve the participants reading comprehension skills to perform better in mathematical word problem-solving skills.

The treatment to improve the participants' reading comprehension of this study was designed by group activity divided into 15 sections. Each section of the treatment

required the participants to attend for 40 minutes, and it took approximately 8 weeks to complete all the sections of the treatment. All the 21 participants were divided into six groups which contained 3-4 participants for each group. At first, the activity was planned as a face-to-face activity to let the participants and the instructor communicated to exchange their thoughts and experiences. Unfortunately, this study was affected by the outbreak of Covid-19, which has required people to keep social distance to prevent the virus's spreading. For this reason, the treatment had to be conducted online by the video conferencing software, Zoom, instead.

The treatment aimed to improve the participants' reading comprehension skill. The Metacognitive Awareness of Reading Strategies Inventory invented by Mokhtari & Reichard (2012) was adapted to use as strategies of the treatment to improve the mentioned skill. Within the 40 minutes of each section of the treatment, the participants were induced to think and discuss what did they know about the topic of the passage before reading to help them understand what they were going to read. They were guided to read slowly but carefully to be sure that they understood what they were reading, they were allowed to ask for help if they did not understand any words of the passage, and after reading, they were asked to discuss what they read with others and the instructor to check their understanding. At the end of every section, the participants were given worksheets with lists of questions that would help them summarize and reflect on their thoughts on the passage. These worksheets were not required to send, but the participants could send them if they wanted to get some feedback or share their thoughts with the instructor by their writings. In the following part, there were examples of the reflection worksheets shown as evidence of the participants' improvement in reading comprehension skill and their writings.



Part 3: Tracking on self-reflection

Answer the following questions.

1) How many airports does Microsoft's Flight Simulator now have?
There are 37,000 airports.

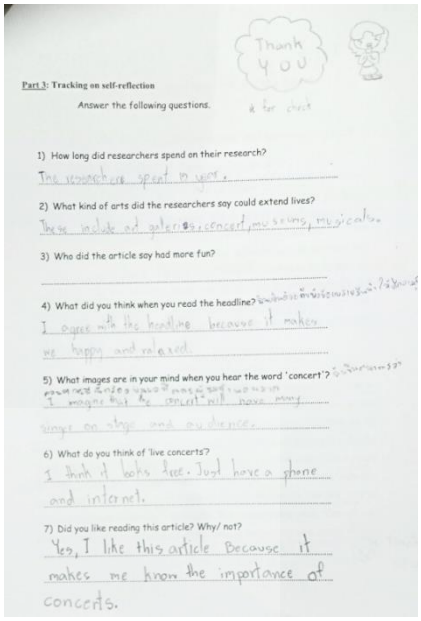
2) What search engine did designers get their images from?
Designers got their images from the satellite

3) What did you think when you read the headline?
I think it about flight or airplane.

4) What images are in your mind when you hear the word 'flight'?
I think about air plane.

5) What is your favourite video game?
My favorite video game is minecraft.

6) Did you like reading this article? Why/ not?
- Yes, I like this article because it has given new knowledge on technology to me.



Part 3: Tracking on self-reflection

Answer the following questions.

1) How long did researchers spend on their research?
The research are spent in year.

2) What kind of arts did the researchers say could extend lives?
These include art galleries, concert, museums, musical etc.

3) Who did the article say had more fun?

4) What did you think when you read the headline?
I agree with the headline because it makes me happy and relaxed.

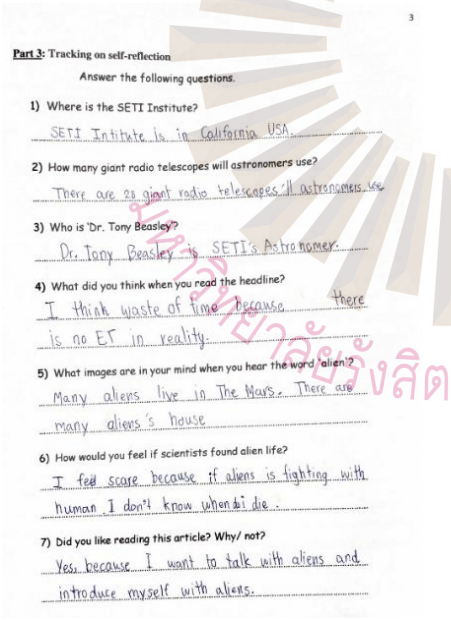
5) What images are in your mind when you hear the word 'concert'?
I imagine that the concert will have many singer on stage and audiences.

6) What do you think of 'live concerts'?
I think it looks free. Just have a phone and internet.

7) Did you like reading this article? Why/ not?
Yes, I like this article because it makes me know the importance of concerts.

Section 3 Section 13

Figure 4.3 The Reflection Worksheets of Participant No.04



Part 3: Tracking on self-reflection

Answer the following questions.

1) Where is the SETI Institute?
SETI Institute is in California USA.

2) How many giant radio telescopes will astronomers use?
There are 28 giant radio telescopes'll astronomers use

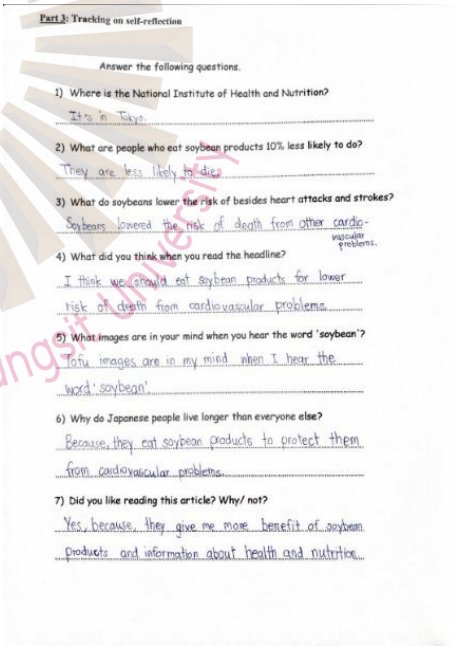
3) Who is 'Dr. Tony Beasley'?
Dr. Tony Beasley is SETI's Astronomers.

4) What did you think when you read the headline?
I think waste of time because there is no ET in reality.

5) What images are in your mind when you hear the word 'alien'?
Many aliens live in The Mars. There are many aliens's house

6) How would you feel if scientists found alien life?
I feel scare because if aliens is fighting with human I don't know when I die.

7) Did you like reading this article? Why/ not?
Yes, because I want to talk with aliens and introduce myself with aliens.



Part 3: Tracking on self-reflection

Answer the following questions.

1) Where is the National Institute of Health and Nutrition?
It's in Tokyo.

2) What are people who eat soybean products 10% less likely to do?
They are less likely to die.

3) What do soybeans lower the risk of besides heart attacks and strokes?
Soybeans lowered the risk of death from other cardiovascular problems.

4) What did you think when you read the headline?
I think we should eat soybean products for lower risk of death from cardiovascular problems.

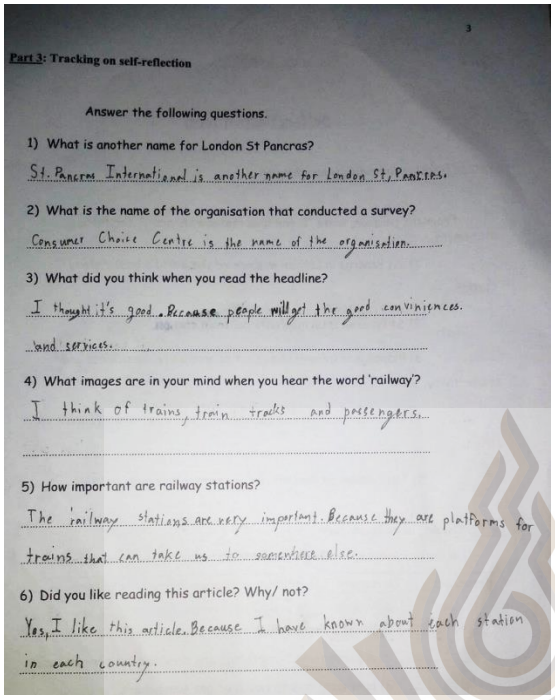
5) What images are in your mind when you hear the word 'soybean'?
Tofu images are in my mind when I hear the word 'soybean'.

6) Why do Japanese people live longer than everyone else?
Because they eat soybean products to protect them from cardiovascular problems.

7) Did you like reading this article? Why/ not?
Yes, because, they give me more benefit of soybean products and information about health and nutrition.

Section 5 Section 9

Figure 4.4 The Reflection Worksheets of Participant No.06



Part 3: Tracking on self-reflection

Answer the following questions.

1) What is another name for London St Pancras?

St. Pancras International is another name for London St. Pancras.

2) What is the name of the organisation that conducted a survey?

Consumer Choice Centre is the name of the organisation.

3) What did you think when you read the headline?

I thought it's good. Because people will get the good conviniences.

and services.

4) What images are in your mind when you hear the word 'railway'?

I think of trains, train tracks and passengers.

5) How important are railway stations?

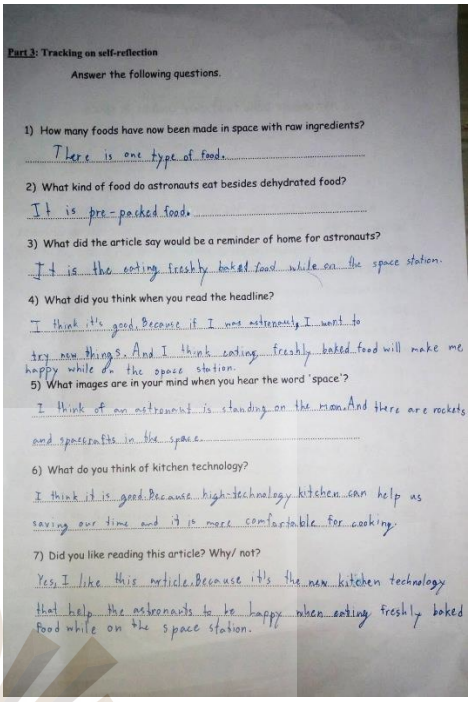
The railway stations are very important. Because they are platforms for

trains that can take us to somewhere else.

6) Did you like reading this article? Why/ not?

Yes, I like this article. Because I have known about each station

in each country.



Part 3: Tracking on self-reflection

Answer the following questions.

1) How many foods have now been made in space with raw ingredients?

There is one type of food.

2) What kind of food do astronauts eat besides dehydrated food?

It is pre-packed food.

3) What did the article say would be a reminder of home for astronauts?

It is the eating freshly baked food while on the space station.

4) What did you think when you read the headline?

I think it's good. Because if I was astronomy I want to

try new things. And I think eating freshly baked food will make me

happy while in the space station.

5) What images are in your mind when you hear the word 'space'?

I think of an astronaut is standing on the moon. And there are rockets

and spacecrafts in the space.

6) What do you think of kitchen technology?

I think it is good. Because high-technology kitchen can help us

saving our time and it is more comfortable for cooking.

7) Did you like reading this article? Why/ not?

Yes, I like this article. Because it's the new kitchen technology

that help the astronauts to be happy when eating freshly baked

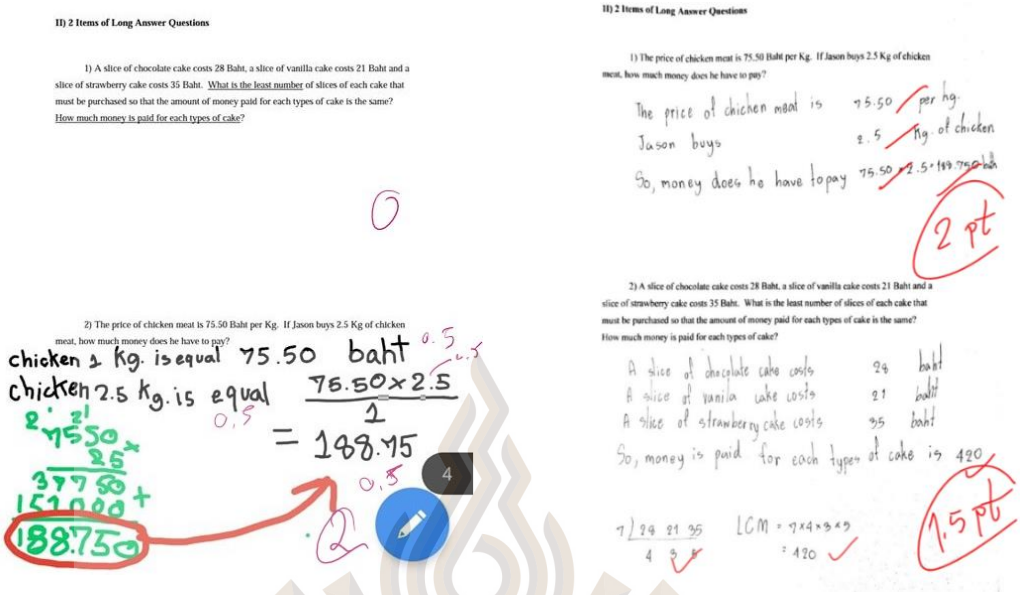
food while on the space station.

Section 4 Section 10

Figure 4.5 The Reflection Worksheets of Participant No.21

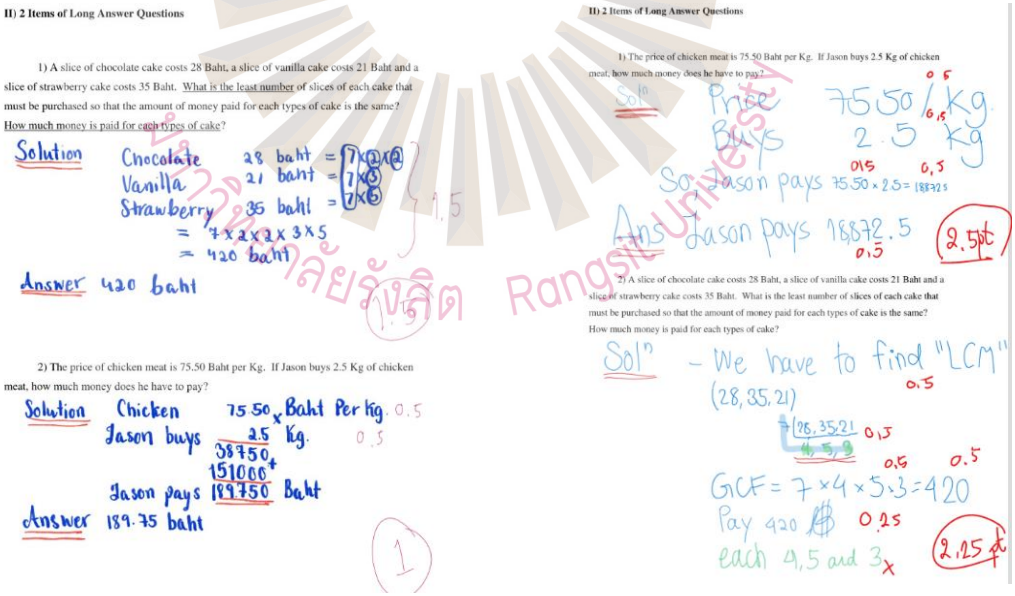
As shown in Figure 4.3-4.5, the improvements of the participants' reading comprehension skills presented by their writings. For section 1-7, apart from the discussion about the text read, the participants were guided on how to express their thought by writing. After section 8, the participants could express their thoughts through discussion and writing freely with help upon their requests. The reflection worksheets showed that the participants had improved their ability to collect the needed information, give reasons, arrange each circumstance's orders, and choose vocabularies to express their thoughts through writing. These abilities were essential to solving mathematical word problems.

The following part presented clear evidence of how the treatment has improved the participants' word problem-solving skills in Mathematics. The document was collected from the posttest in solving mathematical word problems. One part of the test was that the participants had to solve the word problems given by showing their solutions, which; the participants had to express their solutions by applying their understandings in Mathematics with their explanation writing ability.



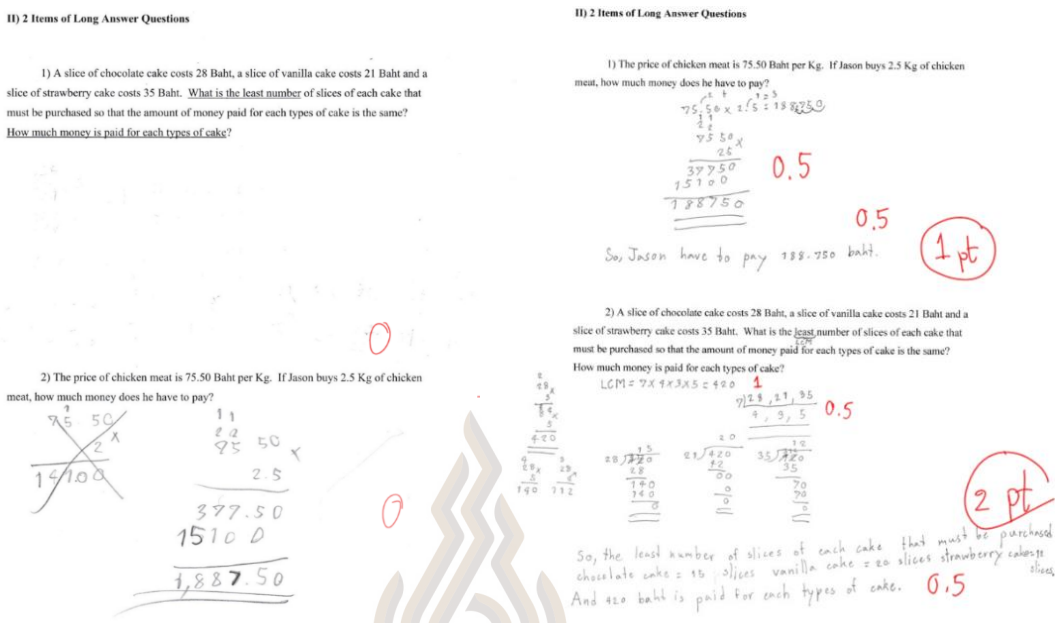
Pretest Posttest

Figure 4.6 Pretest and Posttest Results of the Participants No. 04 on Word Problem-Solving in Mathematics in Long Answer Questions Part



Pretest Posttest

Figure 4.7 Pretest and Posttest Results of the Participants No. 06 on Word Problem-Solving in Mathematics in Long Answer Questions Part



Pretest Posttest

Figure 4.8 Pretest and Posttest Results of the Participants No. 21 on Word Problem-Solving in Mathematics in Long Answer Questions Part

As shown in Figure 4.8-4.10, the participants could perform better in solving word problems in Mathematics. The participants' abilities to capture important information from the problems, arrange the order of events, give reasons, and express their thoughts by writing had improved to a satisfying level.

Figure 4.6-4.8 presented the qualitative data of the relationship of the improvement on word problem-solving skills in Mathematics and reading comprehension skill. To solve a mathematical word problem and comprehend a passage required the ability to capture important information, relate the text read to background knowledge, arrange the events in order, and express the thinking process or thoughts by giving reasons in steps. These abilities were the product of working memory.

4.3 Summary

This study was planned to examine if improving reading comprehension performance would affect the participants' ability to solve word problems in Mathematics. The treatment of this study was applied from the Metacognitive Awareness of Reading Strategies Inventory invented by Mokhtari & Reichard (2012). The treatment was taken online due to the outbreak of Covid-19. The pretest and posttest in mathematical word problem-solving skills and reading comprehension skills were collected before and after giving the participants the treatment.

In this chapter, the results of the study were analyzed, as well as additional document analysis. According to this research, the hypothesis was to examine if there was a relationship between word problem-solving skills in Mathematics and reading comprehension. The pretest and posttest scores in both mathematical word problem-solving skills and reading comprehension were analyzed by finding the Pearson's correlation coefficient as an index to examine if there is a relationship between the two mentioned skills. The Pearson's correlation coefficient of the pretest and posttest were 0.839 and 0.875, which indicated that there was a high positive correlation between the word problem-solving skills in Mathematics and reading comprehension skills. The coefficient of determination (r^2) was 0.70.

Chapter 5

Conclusion, Discussion and Recommendations

The preceding chapter presented the collected data and the analysis of quantitative data. Chapter 5 presents conclusion of the study, discussion of findings, limitations, implications for practice, and recommendations for further study.

5.1 Conclusion of the Study

Reading comprehension was one of the skills required for solving word problems in Mathematics. Reading comprehension could be developed by establishing one's reading strategies. The Metacognitive Awareness of Reading Strategies Inventory (MARSI) invented by Mokhtari & Reichard (2002) was applied to use as the treatment of this research to enhance the participants' ability in reading comprehension.

The objectives of this study were to assess the usage of reading comprehension on improving word problem-solving skills in Mathematics and find out the relationship of the reading comprehension skill and word problem-solving skills in Mathematics of Grade 6 students in a private school, Bangkok. After receiving the consents from the participant's parents or guardians, all the 21 participants had to take the pretest and posttest before and after receiving the treatment. There were two sets of the pretest and posttest: reading comprehension and word problem-solving skills in Mathematics. The treatment consisted of 15 sections; each section was approximately 40 minutes long. The treatment was conducted online in 2 sections for a week due to prevent the outbreak of Covid-19. The participants were divided into a group of 3-4 to ensure that each participant would receive a chance to show his/her opinions while joining and to get complete feedback from friends and the instructor.

This study was experimental quantitative research. The study was designed to examine the following research hypotheses:

$H1_0$ There is no effect of the usage of reading comprehension on the improvement of word problem-solving skills in Mathematics.

$H1_a$ There is an effect of the usage of reading comprehension on the improvement of word problem-solving skills in Mathematics.

$H2_0$ There is no relationship between reading comprehension skill and word problem-solving skills in Mathematics.

$H2_a$ There is a relationship between reading comprehension skill and word problem-solving skills in Mathematics.

To examine the improvement of the reading comprehension skill and word problem-solving in Mathematics skills, the pretest and posttest scores of each skill were statistical analyzed by the Pair Sample T-Test. To examine whether there was a relationship between reading comprehension skill and word problem-solving skills, the Pearson's Correlation Coefficient (*r*) was calculated. The statistical analysis results have shown that there was the improvement on both reading comprehension skill and mathematical word problem-solving skills. The Pearson Correlation Coefficient (*r*) on the relationship of the pretest and posttest of the focused skills were 0.839 and 0.875, respectively, which showed that there was 'high positive correlation' between reading comprehension skill and word problem-solving in Mathematics skills. The coefficient of determination (r^2) of the pretest and posttest of the focused skills was 0.70, which presented that reading comprehension skill score could predict the mathematical word problem-solving skills score by 70%.

5.2 Discussion of the Findings

This study was established to examine the two objectives. The results of the study were discussed as follows.

Objective 1

To assess the usage of reading comprehension on improving of word problem-solving skills in Mathematics of Grade 6 students in a private school, Bangkok.

After data analysis was completed and the hypothesis was tasted, the findings indicated a strong result that there was an improvement of the posttest scores comparing to the pretest scores in both reading comprehension skill and word problem-solving in Mathematics skills when examined by the Paired Sample T-test. The usage of reading comprehension was set as the treatment of this study to investigate the improvement of the participants' mathematical word problem-solving skills.

Objective 2

To find out the relationship of the reading comprehension skill and word problem-solving skills in Mathematics of Grade 6 students in a private school, Bangkok.

In Chapter 4, the simple scatter plot was used to examine the relationship between the 2-focused skills before finding the Pearson's Correlation Coefficient (r). The simple scatter plots of the reading comprehension skill scores and word problem-solving scores in Mathematics showed the tradeline trend in a linear line. The Pearson's Correlation Coefficient results showed that the relationship of reading comprehension skill and word problem-solving skills in Mathematics was ranged in 'high positive correlation' at the coefficient of determination (r^2) was 0.70.

Achievement in Mathematics highly depended on literacy (Bohlmann & Pretorius, 2008). However, few studies were exploring the relationship between numeracy and literacy skills in Thailand. The conceptual complexity and problem-solving in Mathematics extensively required in reasoning, critical thinking, computing, and reading comprehension.

Besides, Bohlmann & Pretorius (2008) pointed out that English reading was extensively supportive of mathematics achievement. Both English and Mathematics are universal languages (Kachru & Nelson, 2001; Making Mathematics Count, 2004); both

contained rules and structures and required critical thinking to interpret and analyze them (Dekeyser, 2007). There were a few differences between English and Mathematics; the English language was more subjective using an emotive description. A ‘sentence’ might have different interpretations, while the language in Mathematics was more objective, and a ‘sentence’ might have only one interpretation (Leshem & Markovits, 2013).

Readers with higher motivation gained better reading comprehension tests; owning to it was an important factor in reading comprehension (Ahmadi, Ismail, & Abdullah, 2013). Guthrie and Wigfield (2000) stated the three components in reading motivation which was 1) intrinsic and extrinsic motivation, 2) competence and efficacy beliefs, and 3) social motivation. To maintain and keep promoting the participants in reading motivation, the treatment was designed to set up the stress-free and friendly environment for the participants. The participants who applied to attend this study could resign without any conditions throughout the training programme, and they could choose the time to attend the training programme from the providing choices. The training programme was set to contain only 3-4 participants for each round to establish a friendly environment between the participants and the instructor to share their thoughts, suggestions and provide feedbacks in each section.

The ‘reading strategy’ used as the treatment of the study was also designed to enhance the participant’s working memory as a significant factor in information processing used in reading comprehension, learning, and problem-solving skills (Haberlant, 1999). There was a large amount of study which show the importance of working memory, which was the significant link in reading comprehension ability and word problem-solving skills in Mathematics (Bolt & Thurlow, 2007; Bull, Espy, & Wiebe, 2008; Geary, Hoard, Byrd-Craven, Nugent & Numtee, 2007; Smith, Saez & Doabler, 2016; Swanson, Jerman & Zheng, 2009, 2015; Welsh, Nix, Blair, Bierman & Nelson, 2010).

Working memory is a significant skill in academic achievement. Children who show low achievement at reading comprehension or at solving word problems in

Mathematics were poor working memory to recall vital information to solve a task (De Beni, Palladino, Pazzaglia, & Cornoldi, 1998; Passolunghi, Cornoldi, & De Liberto, 1999). Good working memory provides children with good mathematics and reading performances, which are important since the first few primary schooling years (Bull, Espy, & Weibe, 2008). Children with poor working memory may fail in completing learning activities (Gathercole & Alloway, 2006).

5.3 Limitations

This study had several limitations because it was conducted during the outbreak of Covid-19; the pandemic virus was uncontrollable from December 2019 until now. This made people must keep social distancing and replace face-to-face activities with online activities.

This study required participants who could communicate in English and get used to studying by using English as a medium of instruction due to the instruction of the treatment is in English. Therefore, the researcher used this criterion to qualify the participants. Furthermore, the treatment required participants' free time online during the outbreak of Covid-19. Owing conducted the research during the crisis time of pandemic and unfamiliar online training, the number of the population and sample was limited.

5.4 Implications for Practice

Numeracy and literacy skills are vital for one's wellbeing. Thus, teachers and schools' administrators are feeling pressure to meet the needs of parents and society. Students have to spend more time to take classes both inside and outside the school to perform well in an academic test. Parents have to spend lots of money to ensure that their children would receive the best education opportunity, which could enhance their children numeracy and literacy skills.

Numeracy and literacy skills could be measured by a test in reading comprehension and word problem-solving in Mathematics which was investigated in this study. This study offers evidence that working memory is an essential factor that affects reading comprehension, mathematical word problem-solving and learning activities. Besides, there is a high positive correlation between reading comprehension and mathematical word problem-solving skills. This means a reading activity which induced children to develop their working memory could also help children to gain reading comprehension skill and word problem-solving skills at the same time.

This study points out the importance of reading activity which is not required several budget and equipment. The researcher suggests that parents, teachers, and schools' administrators should provide children with the quality time and environment that support children to spend their time in stress-free reading environments full of feedback and support from parents and teachers.

5.5 Recommendations for Further Study

As mentioned in the previous part, there were limitations in this study, which might affect the study's result. The recommendations for further study are as follows;

This study was conducted by collecting data from a small group of participants from a private school in Bangkok, and the data collection process was taken for approximately eight weeks. The power of this research topic might be increased if the sample size and the time of conducting the research could be expanded. The diversity of participants' schools and environment also should be added for further study.

This study was conducted during the unstable and critical time from the spreading of Covid-19, which positively affect the methods of conducting research and data collection. The research was conducted online to ensure that all the participants would be safe from contacting the virus during the time of conducting the research. An online educational connection was new to primary students, which affected the participants in sharing their thoughts which were important in improving their reading comprehension strategy. For further research, face-to-face activity should be used to reduce discussion restrictions and give feedback steps.

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Appendix

Appendix A

Lesson Plans

LEARNING OF MATHEMATICS 6 (Grade 6)

Chapter 1: Factors

Time: **4 Hours**

1. Main concept

This chapters are covered in 5 contents: factors, prime numbers and prime factors, factorization, the greatest common factors (GCF) and the least common multiple (LCM). Factor is the whole number that can divide another whole number without remainder. Prime number is number that has only 2 factors which are 1 and itself. Prime factor is the factor that is a prime number. GCF is the greatest whole number that can divide two or more numbers without having remainder. LCM is the least whole number that is a multiple of each two or more numbers.

2. Learning outcomes and indicators

2.1 Learning outcomes

Learning Area of Mathematics						
Strand 1 Number and Algebra			Strand 2 Measurement and Geometry		Strand 3 Statistic and Probability	
M1.1	M1.2	M1.3	M2.1	M2.2	M3.1	M3.2
✓						

Standard M1.1	Understand the diversity of presenting numbers, system of numbers, the operations of numbers, the properties of the operations and their application.

2.2 Indicators

M1.1 Gr6/4	Find the greatest common factors of not more than 3 cardinal numbers.
M1.1 Gr6/5	Find the least common multiple of not more than 3 cardinal numbers.
M1.1 Gr6/6	Show method of finding answers to problems by using the greatest common factor and the least common multiple.

3. Learning objectives

Students will be able to:

1) Find factors of a whole number.

2) Find prime factors of a whole number.

3) Show solution in factorization in multiplication method and short division method.

4) Find GCF and LCM of not more than 3 cardinal numbers.

4. Learning areas

1) Factors

2) Prime numbers and prime factors

3) Factorization

4) GCF and LCM

5. Learners' Key Competencies

Communication Capacity	Thinking Capacity	Problem-solving capacity	Capacity for Applying Life Skills	Capacity for Technological Application
	✓	✓	✓	

6. Desirable Characteristics

Love of nation, religion, and king	Honesty and integrity	Self-discipline	Avidity for learning	Observance of Sufficiency Economy	Dedication / commitment to work	Cherishing Thai-ness	Public mind-ness
	✓	✓	✓		✓		✓

7. Assessment and Evaluation

Procedures	Tools	Criteria
Assignment	Exercise 1.1 Page 3 Exercise 1.2.1 Page 5 Exercise 1.2.2 Page 6 Exercise 1.3.1 Page 8 Exercise 1.3.2 Page 9 Exercise 1.4 Page 12	Completed and Pass: 60 percent

Procedures	Tools	Criteria
	Exercise 1.5 Page 14	
Worksheet	-	Pass: 60 percent
Task completion	Observing Form	Pass: Receive “Satisfactory” level
Group assignment observance	Observing Form	Pass: Receive “Satisfactory” level

Criteria of assessment

1) Students co-operate during the instructional process, having interacted with teachers and friends’ comments. Pass criteria is not less than 60 per cent.

2) Work assigned by teachers, including the correctness, completion, and tidiness of the work. Pass criteria is not less than 60 percent.

8. Learning Media

8.1 Learning materials

1) Textbook Mathematics 6 (Grade 6)

2) Flashcards / Flash words

3) Worksheet

8.2 Learning resources

-

9. Lesson Management

Hours	Topics
1	Factors
2	Prime numbers and prime factors
3	Factorization
4	GCF and LCM

LEARNING OF MATHEMATICS 6 (Grade 6)

Chapter 2:

Fractions and Operations of Fractions

Time: **2 Hours**

1. Main concept

This chapters are covered in 2 contents: comparing fractions and operations of fractions. A fraction is combined by numerator and denominator. To compare two fractions with different denominators, equalize denominator must done first before comparing. Addition and subtraction of fractions are also required to equalize denominators before adding or subtracting numerators. Multiplication of fractions can be done by multiply numerator by numerator and multiply denominator by denominator. Division of fractions can be done by swop numerator and denominator of divisor before operating by the same pattern as multiplication of fractions.

2. Learning outcomes and indicators

2.1 Learning outcomes

Learning Area of Mathematics						
Strand 1 Number and Algebra			Strand 2 Measurement and Geometry		Strand 3 Statistic and Probability	
M1.1	M1.2	M1.3	M2.1	M2.2	M3.1	M3.2
✓						

Standard M1.1	Understand the diversity of presenting numbers, system of numbers, the operations of numbers, the properties of the operations and their application.

2.2 Indicators

M1.1 Gr6/1	Compare and arrange fractions and mixed numbers from different situations.
M1.1 Gr6/7	Find the answer for mix addition, subtraction, multiplication and division of fractions and mixed numbers.
M1.1 Gr6/8	Show the method of finding the answers to 2-3 step problems of fractions and mixed numbers.

3. Learning objectives

Students will be able to:

1) Compare and arrange fractions.

2) Find the answers of operations of fractions.

4. Learning areas

1) Comparing Fractions

2) Operations of Fractions

5. Learners' Key Competencies

Communication Capacity	Thinking Capacity	Problem-solving capacity	Capacity for Applying Life Skills	Capacity for Technological Application
	✓	✓	✓	

6. Desirable Characteristics

Love of nation, religion, and king	Honesty and integrity	Self-discipline	Avidity for learning	Observance of Sufficiency Economy	Dedication / commitment to work	Cherishing Thai-ness	Public mind-ness
	✓	✓	✓		✓		✓

7. Assessment and Evaluation

Procedures	Tools	Criteria
Assignment	Exercise 2.1 Page 19 Exercise 2.2 Page 21 Exercise 2.3 Page 23	Pass: 60 percent
Task completion	Observing Form	Pass: Receive "Satisfactory" level
Group assignment observance	Observing Form	Pass: Receive "Satisfactory" level

Criteria of assessment

1) Students co-operate during the instructional process, having interacted with teachers and friends' comments. Pass criteria is not less than 60 per cent.

2) Work assigned by teachers, including the correctness, completion, and tidiness of the work. Pass criteria is not less than 60 per cent.

8. Learning Media

8.1 Learning materials

1) Textbook Mathematics 6 (Grade 6)

2) PowerPoint Presentation Slide

8.2 Learning resources

-

9. Lesson Management

Hours	Topics
1	Comparing Fractions
2	Operations of Fractions

LEARNING OF MATHEMATICS 6 (Grade 6)

Chapter 3:

Decimals and Division of Decimals

Time: **2 Hours**

1. Main concept

This chapter are covered with 3 contents: converting between fractions and decimals, rounding decimals and division of decimals. A decimal is a form of number that write with a decimal point. Decimals can be changed to fractions. And fractions also can be changed to decimals. Converting decimals into fractions to decimals and rounding decimals are supportive knowledge in division of decimals. Division of decimals can be done by two methods which are long division and converting decimals into fractions. The appropriate method can be used by checking the characteristics of problems.

2. Learning outcomes and indicators

2.1 Learning outcomes

Learning Area of Mathematics						
Strand 1 Number and Algebra			Strand 2 Measurement and Geometry		Strand 3 Statistic and Probability	
M1.1	M1.2	M1.3	M2.1	M2.2	M3.1	M3.2
✓						

Standard M1.1	Understand the diversity of presenting numbers, system of numbers, the operations of numbers, the properties of the operations and their application.

2.2 Indicators

M1.1 Gr6/9	Find the quotient of the decimal which the divisor and the quotient are the decimals not more than 3 places.
M1.1 Gr6/10	Show the method of finding the answer to 3 steps addition, subtraction, multiplication and division decimal problems.

3. Learning objectives

Students will be able to:

1) Convert decimals to fractions and fractions to decimals.

2) Round decimals into the places given.

3) Find the quotient of division of decimals.

4. Learning areas

1) Rounding decimals

2) Converting decimals to fractions and fractions to decimals

3) Division of decimals

5. Learners' Key Competencies

Communication Capacity	Thinking Capacity	Problem-solving capacity	Capacity for Applying Life Skills	Capacity for Technological Application
	✓	✓	✓	

6. Desirable Characteristics

Love of nation, religion, and king	Honesty and integrity	Self-discipline	Avidity for learning	Observance of Sufficiency Economy	Dedication / commitment to work	Cherishing Thai-ness	Public mind-ness
	✓	✓	✓		✓		✓

7. Assessment and Evaluation

Procedures	Tools	Criteria
Assignment	Exercise 3.2 Page 29 Exercise 3.3 Page 31	Pass: 60 percent
Task completion	Observing Form	Pass: Receive "Satisfactory" level
Group assignment observance	Observing Form	Pass: Receive "Satisfactory" level

Criteria of assessment

1) Students co-operate during the instructional process, having interacted with teachers and friends' comments. Pass criteria is not less than 60 percent.

2) Work assigned by teachers, including the correctness, completion, and tidiness of the work. Pass criteria is not less than 60 percent.

8. Learning Media

8.1 Learning materials

1) Textbook Mathematics 6 (Grade 6)

2) PowerPoint Presentation Slide

8.2 Learning resources

-

9. Lesson Management

Hours	Topics
1	Rounding Decimals
2	Converting Decimals to Fractions and Fractions to Decimals
3	Division of Decimals

Appendix B

Example of Reading Passages for the Treatment

Set 1

Men start washing hands because of coronavirus

Adapted from: https://breakingnewsenglish.com (2020)

The spread of the COVID-19, coronavirus, has made more men wash their hands more often, especially after going to the toilet. A recent survey of 2,000 men in the UK found that 32 percent of them did not wash their hands after using the toilet. However, social media reports that more men are washing their hands in public toilets since the outbreak of COVID-19. People on Twitter wrote that a month ago, it was unusual to see a man using the sinks in a public toilet. Since the outbreak, more men have been washing their hands in public toilets. Dan McCoy, a writer from New York, said: "For once, there are lines in men's restrooms as coronavirus makes men wash their hands for the first time."

Governments around the world have stressed the importance of regular handwashing. This is not just after using the bathroom but also throughout the day. Doctors say regular handwashing is the best way to stop the spread of the coronavirus. Health authorities in the UK and USA have told people to wash their hands for at least 20 seconds each time - or the time it takes to sing "Happy Birthday" twice. A caller into a UK radio station spoke about the first time he realised men were washing their hands. It was when he stopped at the toilets on a highway. He said: "There were eight sinks and men were washing their hands in all of them." He also said the men were spending a long time carefully washing their hands.

Set 2

Parents angry as COVID-19 shuts schools for a month

Adapted from: https://breakingnewsenglish.com (2020)

Japan and Hong Kong have closed their elementary, junior-high and high schools until April. Governments say they want to protect children from the COVID-19 coronavirus. Schools in Japan will remain closed until April the 8th, which is the start of the new school year. Children in Hong Kong will return to school on April the 20th at the earliest. Parents are now worried about the school closures. Working parents have to think about how to care for younger children. Grandparents will look after many children while their parents go to work. However, many children have no grandparents or extended family who live nearby. Parents may have to pay for expensive childcare fees.

Japan's Prime Minister Shinzo Abe shut the country's schools after a meeting of Japan's anti-virus task force. He said the next two weeks are critical to control the spread of COVID-19. He wants to "stem the risk of many children and teachers becoming infected through gathering for long hours every day". The government said it would urge public services and private companies to make it easier for people to take time off work to look after their children. An angry mother said: "I wonder if the government thinks it is OK to leave children at home alone for long hours." She asked: "What's the point of closing schools if parents are still commuting in packed trains in which passengers may have COVID-19?"

Set 3

Microsoft Flight Simulator includes all world airports

Adapted from: https://breakingnewsenglish.com (2020)

The Microsoft airplane game Flight Simulator has been upgraded to include every airport in the world. This means gamers will have a choice of over 37,000 airports to take off from and land at. The upgrade has added over 13,000 new airports to the previous version of the game, which included 24,000 airports. The game includes international hubs like New York's JFK and London Heathrow. It also includes tiny airports like rural, grassy landing strips and runways that are in the middle of deserts or on the top of mountains. The 37,000 airports in Flight Simulator have been manually designed to look like the real airports. Designers used satellite images and Bing Maps to do this.

The graphics are also much better in the latest release of Flight Simulator. The designers put a lot of work and effort into increasing the level of detail you see. Gamers will see windsocks blowing in the wind and service vehicles driving around the roads next to the runways. The markings on the runways in the game are the same as those on the real runways. Lead game designer Sven Mestas said: "To reach a new level, we needed a new approach. We decided to innovate by editing airports from real satellite pictures. This technique involves editing each airport manually. This means we paid particular attention to detail to bring every airport a step closer to reality."

Set 4

London St. Pancras best railway station in Europe

Adapted from: https://breakingnewsenglish.com (2020)

A railway station in London has been named as the best station in Europe for passengers. The station is London St. Pancras, which is also called St. Pancras International. It is an international station because the Eurostar trains to France, Belgium and Holland start there. St Pancras was chosen as the best railway station in Europe by the Consumer Choice Centre. This organisation asks rail passengers every year about their opinions on different stations in Europe. Passengers answer questions on a survey about accessibility, cleanliness, connectivity, friendliness of staff, and the number of platforms. There is also a question about the number of days station staff went on strike throughout the year.

St. Pancras was the only UK station in the top ten. Zurich Central Station was number two and Leipzig Central Station came in third. Five of the top ten stations were in Germany. They were Berlin, Frankfurt, Hamburg, Leipzig and Munich. A spokesman from the Consumer Choice Centre commented on the beauty of St. Pancras, which was built in a gothic style and opened in 1868. The spokesman said: "London St Pancras does not just look like a station from another world, it also leads this index as Europe's best railway station." He added: "High points were awarded to the stations that offered great destinations around the continent and also had a healthy mix of shops, restaurants and conveniences."

Set 5

Criminals have smaller brain size, says study

Adapted from: https://breakingnewsenglish.com (2020)

A new study has found that antisocial people are more likely to have smaller areas of their brain. Researchers said criminals' brains had a different structure to the brains of people who followed the law. The study is published in the journal "Lancet Psychiatry". Researchers used data from 672 people born in 1972-73. They looked at records of the people's antisocial behaviour between the ages of seven and 26. At the age of 45, the researchers scanned the people's brains. Eighty of the people had a history of criminal and antisocial behaviour from being early teenagers. Researchers found that the areas of the brain linked to emotions, motivation and behaviour control were smaller in the long-term criminals' brains.

Professor Terrie Moffitt, a co-author of the research, said the research could help doctors understand what is behind long-term antisocial behaviour. She said the antisocial people in the study may have behaved badly because of their brain structure. She said: "They are actually operating under some [disability] at the level of the brain." She added that because of this, we needed to care for these people in a kinder way. Lead author Dr. Christina Carlisi said: "Differences in brain structure might make it difficult for people to develop social skills. This may prevent them from engaging in antisocial behaviour. These people could benefit from more support throughout their lives."

Set 1 Nickname: …… Date: ……/……/……

Self-reflection form

Part 1: Tracking on reading comprehension

From the passage, write '**T**' for **true** statements and '**F**' for **false** statement.

…… 1) A survey found that 2,000 men didn't wash their hands in public toilets.

…… 2) More men have been washing their hands since the virus outbreak.

…… 3) Twitter users said it used to be unusual to see men at sinks in toilets.

…… 4) A writer said he now sees lines at men's restrooms.

…… 5) The article said all governments said handwashing was important.

Part 2: Gaining more vocabulary

Fill in the blanks with the given words according to their definitions.

survey	sink	public	restroom	regular

…… 1) a toilet in a public building

…… 2) an investigation of the opinions or experience of a group of people, based on a series of questions

…… 3) the place where you wash your hands or wash the dishes (it usually has hot-water and cold-water taps)

…… 4) of or about all people

…… 5) done or happening often

Part 3: Tracking on self-reflection

Please try to answer the following questions.

1) How many men were there in a recent survey?
2) What percentage of men in the survey did not wash their hands?
3) Where were the reports on men now washing their hands more often?
4) What did you think when you read the headline?
5) What images are in your mind when you hear the word 'virus'?
6) How important is it to wash your hands?
7) Did you like reading this article? Why/ not?

Set 2 Nickname: …… Date: ……/……/……

Self-reflection form

Part 1: Tracking on reading comprehension

From the passage, write '**T**' for **true** statements and '**F**' for **false** statement.

…… 1) Japan, Hong Kong and China have closed their high schools.
…… 2) Schools in Hong Kong will stay closed until April the 20th at the earliest.
…… 3) Parents are not at all worried about the school closures.
…… 4) Japan has said childcare will be free in March for working parents.
…… 5) Japan wants companies to help workers who have children.

Part 2: Gaining more vocabulary

Fill in the blanks with the given words according to their definitions.

Elementary school	protect	remain	return	closure

…… 1) keep safe from harmful people or things
…… 2) the action of shutting something for a long time, or forever (like a shop, school, road, etc.)
…… 3) Go back to a place or person.
…… 4) Stay as it is.
…… 5) a place where children aged between five and ten go to learn and make friends

Part 3: Tracking on self-reflection

Please try to answer the following questions.

1) How many countries have closed schools?
2) What did the article say parents are now worried about?
3) What might parents have to pay?
4) What did you think when you read the headline?
5) What do you know about COVID-19?
6) What should we do to reduce the risk of catching the virus?
7) Did you like reading this article? Why/ not?

Set 3 Nickname: …… Date: ……/……/……

Self-reflection form

Part 1: Tracking on reading comprehension

From the passage, write '**T**' for **true** statements and '**F**' for **false** statement.

…… 1) Gamers will be able to simulate landing at more than 37,000 airports.

…… 2) Microsoft has more than doubled the number of airports in the game.

…… 3) The new game does not include landing strips or desert runways.

…… 4) Designers used Google Maps to create the graphics for the airports.

…… 5) The game's runway markings are the same as in real-life runways.

Part 2: Gaining more vocabulary

Fill in the blanks with the given words according to their definitions.

upgraded	take off	land	previous	manually

…… 1) the one before

…… 2) the action of an airplane, helicopter or rocket moving from the ground into the air

…… 3) by hand rather than automatically

…… 4) increasing the level of something by making it better or by adding to it

…… 5) The action of an airplane, helicopter or rocket moving from the air onto the ground

Part 3: Tracking on self-reflection

Answer the following questions.

1) How many airports does Microsoft's Flight Simulator now have?
2) What search engine did designers get their images from?
3) What did you think when you read the headline?
4) What images are in your mind when you hear the word 'flight'?
5) What is your favourite video game?
6) Did you like reading this article? Why/ not?

Set 4 Nickname: …… Date: ……/……/……

Self-reflection form

Part 1: Tracking on reading comprehension

From the passage, write '**T**' for **true** statements and '**F**' for **false** statement.

…… 1) St. Pancras in London was named the world's best railway station.

…… 2) St. Pancras is an international train station.

…… 3) Passengers were asked about accessibility, cleanliness and connectivity.

…… 4) A survey question was about how many days rail staff went on strike.

…… 5) The London St. Pancras railway station was built in 1868.

Part 2: Gaining more vocabulary

Fill in the blanks with the given words according to their definitions.

passenger	consumer	opinion	accessibility	platform

…… 1) What someone thinks about something.

…… 2) A person who buys things and services for personal use.

…… 3) How easy it is to reach or get somewhere.

…… 4) the long part of a railway station where people wait to get on a train or step onto to get off a train

…… 5) a traveler on a bus, train, boat or in a car, airplane, etc. but not the driver, pilot, or crew

Part 3: Tracking on self-reflection

Answer the following questions.

1) What is another name for London St. Pancras?
2) What is the name of the organisation that conducted a survey?
3) What did you think when you read the headline?
4) What images are in your mind when you hear the word 'railway'?
5) How important are railway stations?
6) Did you like reading this article? Why/ not?

Set 5 Nickname: …… Date: ……/……/……

Self-reflection form

Part 1: Tracking on reading comprehension

From the passage, write '**T**' for **true** statements and '**F**' for **false** statement.

…… 1) The article said antisocial people have smaller areas of the brain.

…… 2) A part of the brain for people who follow the law is larger than that in criminals.

…… 3) Researchers looked at the brains of 6,720 people.

…… 4) Eight hundred people in the research were antisocial as teenagers.

…… 5) An author said the research could help doctors.

Part 2: Gaining more vocabulary

Fill in the blanks with the given words according to their definitions.

antisocial	data	motivation	co-author	benefit

…… 1) facts and statistics collected together for reference or analysis

…… 2) acting in a way that breaks laws or go against accepted ways of behaviour

…… 3) the reason or reasons for acting or behaving in a particular way

…… 4) a person who wrote a book, essay, article, etc. with another person or people

…… 5) an advantage or profit gained from something

Part 3: Tracking on self-reflection

Answer the following questions.

1) What do the brains of antisocial people have that is different?
2) What is "Lancet Psychiatry"?
3) How many of the people in a test were antisocial as teenagers?
4) What did you think when you read the headline?
5) What images are in your mind when you hear the word 'brain'?
6) What do you think of your brain?
7) Did you like reading this article? Why/ not?

Appendix C

Pre-test and Post-test Questions: Word Problem-solving Skills

Appendix C

Pre-test Questions: Word Problem-solving Skills in Mathematics

I) 15 Items of Multiple-Choice Questions

1) Which of the following numbers has 21 as a factor?

A) 43 B) 83

C) 63 D) 103

2) Which of the following is a common factor of 17 and 51?

A) 3 B) 17

C) 19 D) 23

3) Which of the following sets of numbers have a common factor of 7?

A) 12, 28, 34 B) 14, 30, 47

C) 16, 29, 35 D) 21, 49, 84

4) The lengths of three pieces of wood are 12 metres, 18 metres and 30 metres. If we want to equally cut them, what is the longest length of wood that we can possibly get?

A) 2 metres B) 4 metres

C) 6 metres D) 8 metres

5) There are 8 apples, 20 mangoes and 24 oranges. We put them equally into some bags. Each bag is required to contain all types of fruit. What is the greatest number of bags that we need?

A) 2 bags B) 4 bags

C) 6 bags D) 8 bags

6) Which of the following is **NOT** equivalent to $\frac{3}{7}$?

A) $\frac{6}{14}$ B) $\frac{11}{28}$

C) $\frac{9}{21}$ D) $\frac{15}{35}$

7) Which of the following fractions are arranged in descending order?

A) $\frac{1}{2}, \frac{5}{8}, \frac{2}{3}$ B) $\frac{5}{9}, \frac{3}{5}, \frac{4}{7}$

C) $\frac{3}{4}, \frac{4}{6}, \frac{3}{5}$ D) $\frac{1}{3}, \frac{5}{6}, \frac{2}{3}$

8) Which of the following fractions is in its simplest form?

A) $\frac{3}{6}$ B) $\frac{13}{17}$

C) $\frac{6}{10}$ D) $\frac{14}{21}$

Use the given statement to answer questions 9 and 10.

Ferida has 42 stamps. Julie takes $\frac{1}{3}$ of them and Ella takes $\frac{1}{7}$ of them.

9) How many stamps does Julie have?

A) 12 B) 14

C) 16 D) 18

10) What is the total number of stamps taken by Julie and Ella?

A) 14 B) 16

C) 18 D) 20

11) Tisha collects money for 3 days. She collects 132.50 baht on the first day, 121.25 baht on the second day, and 130.50 baht on the third day. How much money does she have after 3 days?

A) 380.25 baht B) 383.25 baht

C) 383.50 baht D) 384.25 baht

12) Jackie collects one 50 satang coin per day. If he collects it for 60 days, how much money will he have?

A) 3 baht B) 13 baht

C) 30 baht D) 300 baht

13) A construction company bought 0.238 tons of gravel and 0.535 tons of sand. How many tons of material did the company buy altogether?

A) 0.293 tons B) 0.297 tons

C) 0.763 tons D) 0.773 tons

14) A carpenter bought a piece of wood that was 1.88 meters long. He sawed 0.569 meters off. How long is the piece of wood now?

A) 1.311 meters B) 1.321 meters

C) 1.331 meters D) 1.341 meters

15) Ken's car uses 148.50 liters of petrol a month. How many liters of petrol does his car use in a year?

A) 1,780 liters B) 1,781 liters

C) 1,782 liters D) 1,783 liters

II) 2 Items of Long Answer Questions

1) A slice of chocolate cake costs 28 Baht, a slice of vanilla cake costs 21 Baht and a slice of strawberry cake costs 35 Baht. What is the least number of slices of each cake that must be purchased so that the amount of money paid for each types of cake is the same? How much money is paid for each type of cake?

2) The price of chicken meat is 75.50 Baht per Kg. If Jason buys 2.5 Kg of chicken meat, how much money does he have to pay?

Appendix C

Pre-test Questions: Word Problem-solving Skills in Mathematics

Keys

PART I

1) C	6) B	11) D
2) B	7) C	12) C
3) D	8) B	13) D
4) C	9) B	14) A
5) B	10) D	15) C

PART II

1) A slice of chocolate cake costs 28 Baht, a slice of vanilla cake costs 21 Baht and a slice of strawberry cake costs 35 Baht. What is the least number of slices of each cake that must be purchased so that the amount of money paid for each types of cake is the same? How much money is paid for each type of cake?

- We have to find LCM of 28, 21 and 35. (0.5 pt)
- LCM(28, 21, 35) = 7 × 4 × 3 × 5 = 420 (1 pt.)
So, we have to spend 420 Baht for each type of cake.
And we can get 420 ÷ 28 = 15 slices of chocolate cake
420 ÷ 21 = 20 slices of vanilla cake
420 ÷ 35 = 12 slices of strawberry cake.

7 | 28, 21, 35
4, 3, 5 (0.5 pt)
(0.5 pt)
(0.5 pt)

2) The price of chicken meat is 75.50 Baht per Kg. If Jason buys 2.5 Kg of chicken meat, how much money does he have to pay? (0.5 pt)

Number Sentence : 75.50 × 2.5 = □
- The price of chicken meat is 75.50 Baht / kg. (0.5 pt)
- Jason buys 2.5 kg. (0.5 pt)

So, He has to pay = 75.50 × 2.5 = 188.75 Baht (0.5 pt)
(0.5 pt)

Appendix C

Post-test Questions: Word Problem-solving Skills in Mathematics

I) 15 Items of Multiple-Choice Questions

1) Which of the following fractions is in its simplest form?

A) $\frac{3}{6}$ B) $\frac{13}{17}$

C) $\frac{6}{10}$ D) $\frac{14}{21}$

2) There are 8 apples, 20 mangoes and 24 oranges. We put them equally into some bags. Each bag is required to contain all types of fruit. What is the greatest number of bags that we need?

A) 2 bags B) 4 bags

C) 6 bags D) 8 bags

3) Which of the following sets of numbers have a common factor of 7?

A) 12, 28, 34 B) 14, 30, 47

C) 16, 29, 35 D) 21, 49, 84

Use the given statement to answer questions 4 and 5.

Ferida has 42 stamps. Julie takes $\frac{1}{3}$ of them and Ella takes $\frac{1}{7}$ of them.

4) How many stamps does Julie have?

A) 12 B) 14

C) 16 D) 18

5) What is the total number of stamps taken by Julie and Ella?

A) 14 B) 16

C) 18 D) 20

6) Which of the following is **NOT** equivalent to $\frac{3}{7}$?

A) $\frac{6}{14}$ B) $\frac{11}{28}$

C) $\frac{9}{21}$ D) $\frac{15}{35}$

7) The lengths of three pieces of wood are 12 metres, 18 metres and 30 metres. If we want to equally cut them, what is the longest length of wood that we can possibly get?

A) 2 metres B) 4 metres

C) 6 metres D) 8 metres

8) Tisha collects money for 3 days. She collects 132.50 baht on the first day, 121.25 baht on the second day, and 130.50 baht on the third day. How much money does she have after 3 days?

A) 380.25 baht B) 383.25 baht

C) 383.50 baht D) 384.25 baht

9) Which of the following fractions are arranged in descending order?

A) $\frac{1}{2}, \frac{5}{8}, \frac{2}{3}$ B) $\frac{5}{9}, \frac{3}{5}, \frac{4}{7}$

C) $\frac{3}{4}, \frac{4}{6}, \frac{3}{5}$ D) $\frac{1}{3}, \frac{5}{6}, \frac{2}{3}$

10) Which of the following numbers has 21 as a factor?

A) 43 B) 83

C) 63 D) 103

11) Jackie collects one 50 satang coin per day. If he collects it for 60 days, how much money will he have?

A) 3 baht B) 30 baht

C) 300 baht D) 3,000 baht

12) Which of the following is a common factor of 17 and 51?

A) 3 B) 17

C) 19 D) 23

13) A construction company bought 0.238 tons of gravel and 0.535 tons of sand. How many tons of material did the company buy altogether?

A) 0.293 tons B) 0.297 tons

C) 0.763 tons D) 0.773 tons

14) Ken's car uses 148.50 liters of petrol a month. How many liters of petrol does his car use in a year?

A) 1,780 liters B) 1,781 liters

C) 1,782 liters D) 1,783 liters

15) A carpenter bought a piece of wood that was 1.88 meters long. He sawed 0.569 meters off. How long is the piece of wood now?

A) 1.311 meters B) 1.321 meters

C) 1.331 meters D) 1.341 meters

II) 2 Items of Long Answer Questions

1) The price of chicken meat is 75.50 Baht per Kg. If Jason buys 2.5 Kg of chicken meat, how much money does he have to pay?

2) A slice of chocolate cake costs 28 Baht, a slice of vanilla cake costs 21 Baht and a slice of strawberry cake costs 35 Baht. What is the least number of slices of each cake that must be purchased so that the amount of money paid for each type of cake is the same? How much money is paid for each type of cake?

Appendix C

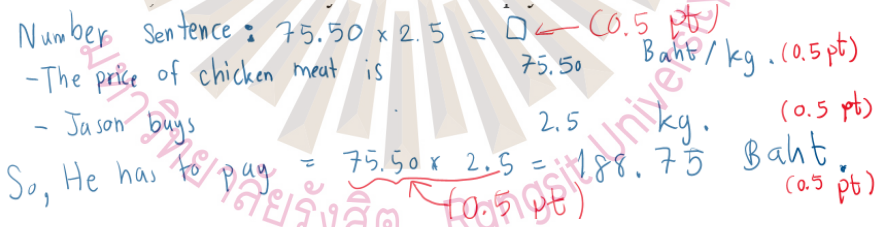
Post-test Questions: Word Problem-solving Skills in Mathematics

PART I

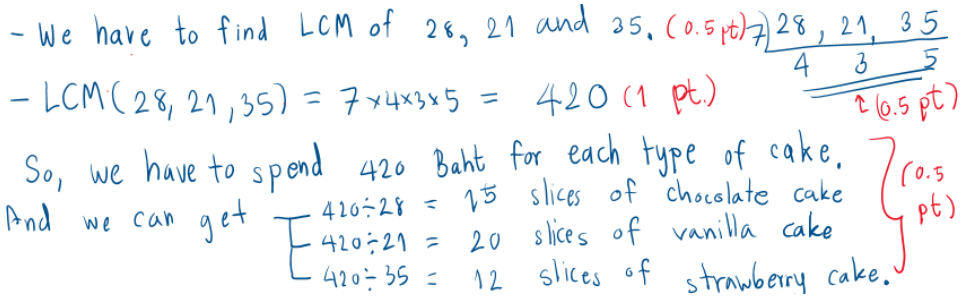
1) B	6) B	11) B
2) B	7) C	12) B
3) D	8) D	13) D
4) B	9) C	14) C
5) D	10) C	15) A

PART II

1) The price of chicken meat is 75.50 Baht per Kg. If Jason buys 2.5 Kg of chicken meat, how much money does he have to pay?



2) A slice of chocolate cake costs 28 Baht, a slice of vanilla cake costs 21 Baht and a slice of strawberry cake costs 35 Baht. What is the least number of slices of each cake that must be purchased so that the amount of money paid for each types of cake is the same? How much money is paid for each type of cake?



Appendix D

Pre-test and Post-test Questions: Reading Comprehension Ability

Appendix D

Pre-test Questions: Reading Comprehension Ability

I) Reading Passage

Scientists find out why dogs' noses are cold

Source: https://breakingnewsenglish.com

Researchers believe they have solved one of science's greatest mysteries. They think they have found out why a dog's nose is cold. Scientists from universities in Sweden and Hungary have posited that dogs' noses are constantly cold because they act as "ultra-sensitive heat detectors". Canines can sense the temperature of something before they touch it. They added that dogs use their noses to detect tiny changes in temperature, such as when possible predators or prey are nearby. Humans generally only know something is hot after touching it, often with painful consequences. It was common belief that the only reason dogs' noses are cold is to control and regulate their own body temperature.

The researchers conducted experiments on sixteen dogs that had to detect the temperature of different objects in a room. The objects had different temperatures that humans could only differentiate by touching them. The scientists said that the brain activity in the dogs showed that they could discern which objects were warmer than others. Anna Balint, lead author of the study, said: "Dogs are able to sense the thermal radiation coming from warm bodies or weak thermal radiation, and they can change their behaviour according to this signal." Another scientist said scientists should now re-evaluate how predators hunt. Many may use heat-sensing abilities to track or sense their prey.

II) 10 Multiple Choice Questions

Choose the best answers after reading the passage given.

1) What did the researchers say they might have solved?
   a) a formula
   b) one of science's greatest mysteries
   c) a quiz
   d) a puzzle
2) Where are the scientists from?
   a) a kennel
   b) a canine university
   c) a dog food company
   d) Sweden and Hungary
3) What did the researchers say dogs use their nose to detect?
   a) the temperature of gardens
   b) hot and cold water taps
   c) tiny changes in temperature
   d) fire
4) How do humans find out if something is hot?
   a) They touch it.
   b) They sense it.
   c) They use the internet.
   d) They use a thermometer.
5) What did people think dogs regulated with their noses?
   a) their ears
   b) their body temperature
   c) how much they pant
   d) how much they sleep
6) How many different dogs did researchers use in their experiments?
   a) 16
   b) 20
   c) 36
   d) 60
7) What activity allowed dogs to discern the different warmth in objects?
   a) running
   b) chasing stick
   c) brain activity
   d) sleeping
8) Who is Anna Balint?
   a) lead researcher
   b) a pet owner
   c) a dog expert
   d) a nose doctor

9) What can dogs sense coming from warm bodies?

a) smell
b) fleas
c) hair
d) thermal radiation

10) What might other predators use to track or sense their prey?

a) their paws
b) their eyes
c) heat-sensing abilities
d) nerve endings

III) 5 T/F Questions

Identify whether each statement given is true or false after reading the passage given. If it is TRUE, fill in 'T' in the blank. If it is FALSE, fill in 'F' in the blank.

…… 1) Scientists said they finally solved science's greatest mystery.

…… 2) Dogs can sense the temperature of something with their noses.

…… 3) Researchers did tests on the noses of sixty dogs.

…… 4) Humans also use their noses to sense the temperature of something.

…… 5) The researchers said we should re-evaluate how other predators hunt.

Appendix D

Pre-test Questions: Reading Comprehension Ability

Keys

Part: Multiple Choice Questions

1) b
2) d
3) c
4) a
5) b
6) a
7) c
8) a
9) d
10) c

Part: T/F Questions

1) T 2) T 3) F 4) F 5) T

Appendix D

Post-test Questions: Reading Comprehension Ability

I) Reading Passage

Scientists find out why dogs' noses are cold

Source: https://breakingnewsenglish.com

Researchers believe they have solved one of science's greatest mysteries. They think they have found out why a dog's nose is cold. Scientists from universities in Sweden and Hungary have posited that dogs' noses are constantly cold because they act as "ultra-sensitive heat detectors". Canines can sense the temperature of something before they touch it. They added that dogs use their noses to detect tiny changes in temperature, such as when possible predators or prey are nearby. Humans generally only know something is hot after touching it, often with painful consequences. It was common belief that the only reason dogs' noses are cold is to control and regulate their own body temperature.

The researchers conducted experiments on sixteen dogs that had to detect the temperature of different objects in a room. The objects had different temperatures that humans could only differentiate by touching them. The scientists said that the brain activity in the dogs showed that they could discern which objects were warmer than others. Anna Balint, lead author of the study, said: "Dogs are able to sense the thermal radiation coming from warm bodies or weak thermal radiation, and they can change their behaviour according to this signal." Another scientist said scientists should now re-evaluate how predators hunt. Many may use heat-sensing abilities to track or sense their prey.

II) 10 Multiple Choice Questions

Choose the best answers after reading the passage given.

1) What did the researchers say they might have solved?
   a) a formula
   b) one of science's greatest mysteries
   c) a quiz
   d) a puzzle
2) Where are the scientists from?
   a) a kennel
   b) a canine university
   c) a dog food company
   d) Sweden and Hungary
3) What did the researchers say dogs use their nose to detect?
   a) the temperature of gardens
   b) hot and cold water taps
   c) tiny changes in temperature
   d) fire
4) How do humans find out if something is hot?
   a) They touch it.
   b) They sense it.
   c) They use the internet.
   d) They use a thermometer.
5) What did people think dogs regulated with their noses?
   a) their ears
   b) their body temperature
   c) how much they pant
   d) how much they sleep
6) How many different dogs did researchers use in their experiments?
   a) 16
   b) 20
   c) 36
   d) 60
7) Who is Anna Balint?
   a) lead researcher
   b) a pet owner
   c) a dog expert
   d) a nose doctor
8) What activity allowed dogs to discern the different warmth in objects?
   a) running
   b) chasing stick
   c) brain activity
   d) sleeping

9) What might other predators use to track or sense their prey?

a) their paws
b) their eyes
c) heat-sensing abilities
d) nerve endings

10) What can dogs sense coming from warm bodies?

a) smell
b) fleas
c) hair
d) thermal radiation

III) 5 T/F Questions

Identify whether each statement given is true or false after reading the passage given. If it is TRUE, fill in 'T' in the blank. If it is FALSE, fill in 'F' in the blank.

…… 1) Scientists said they finally solved science's greatest mystery.

…… 2) Dogs can sense the temperature of something with their noses.

…… 3) Humans also use their noses to sense the temperature of something.

…… 4) Researchers did tests on the noses of sixty dogs.

…… 5) The researchers said we should re-evaluate how other predators hunt.

Appendix D

Post-test Questions: Reading Comprehension Ability

Keys

Part: Multiple Choice Questions

1) b
2) d
3) c
4) a
5) b
6) a
7) a
8) c
9) c
10) d

Part: T/F Questions

1) T 2) T 3) F 4) F 5) T

Appendix E

Index of Item-Objective Congruence (IOC) Form for Word Problem-solving in Mathematics Pretest and Posttest

INDEX OF ITEM-OBJECTIVE CONGRUENCE (IOC) FORM

"USAGE OF READING COMPREHENSION TO ENHANCE WORD PROBLEM-SOLVING SKILLS IN MATHEMATICS OF GRADE 6 STUDENTS: A PRIVATE SCHOOL, BANGKOK"

by PREYANAN SUPONTAWANIT

Objectives: The list of question is consisted of 15 multiple-choice questions and 2 open-ended word problems. It is used to investigate the improvement of the participants' word problem-solving skills before and after receiving the treatment. The objectives of this study are: (1) to investigate the usage of reading comprehension to enhance word problem-solving skills in Mathematics and (2) to find out the relationship between reading comprehension skill and word problem-solving skills of Grade 6 students in a private school, Bangkok. The participants in this study are 21 Grade 6 students who are studying in the Intensive English Programme (IEP) in a private school, Bangkok.

The list of Question: Word Problem-solving Skills				
The expert is requested to examine each item of the research instrument for its content validity.		Expert's Review		
	Questions	Agree	Not sure	Disagree
		+1	0	-1
1	Which of the following numbers has 21 as a factor? A) 43 B) 83 C) 63 D) 103			
2	Which of the following is a common factor of 17 and 51? A) 3 B) 17 C) 19 D) 23			
3	Which of the following sets of numbers have a common factor of 7? A) 12, 28, 34 B) 14, 30, 47 C) 16, 29, 35 D) 21, 49, 84			
4	The lengths of three pieces of wood are 12 metres, 18 metres and 30 metres. If we want to equally cut them, what is the longest length of wood that we can possibly get? A) 2 metres B) 4 metres C) 6 metres D) 8 metres			
5	There are 8 apples, 20 mangoes and 24 oranges. We put them equally into some bags. Each bag is required to contain all types of fruit. What is the greatest number of bags that we need? A) 2 bags B) 4 bags C) 6 bags D) 8 bags			

The list of Question: Word Problem-solving Skills				
The expert is requested to examine each item of the research instrument for its content validity.		Expert's Review		
	Questions	Agree	Not sure	Disagree
		+1	0	-1
6	Which of the following is **NOT** equivalent to $\frac{3}{7}$? A) $\frac{6}{14}$ B) $\frac{11}{28}$ C) $\frac{9}{21}$ D) $\frac{15}{35}$			
7	Which of the following fractions are arranged in descending order? A) $\frac{1}{2}, \frac{5}{8}, \frac{2}{3}$ B) $\frac{5}{9}, \frac{3}{5}, \frac{4}{7}$ C) $\frac{3}{4}, \frac{4}{6}, \frac{3}{5}$ D) $\frac{1}{3}, \frac{5}{6}, \frac{2}{3}$			
8	Which of the following fractions is in its simplest form? A) $\frac{3}{6}$ B) $\frac{13}{17}$ C) $\frac{6}{10}$ D) $\frac{14}{21}$			

The list of Question: Word Problem-solving Skills				
The expert is requested to examine each item of the research instrument for its content validity.		Expert's Review		
	Questions	Agree	Not sure	Disagree
		+1	0	-1
	Use the given statement to answer questions 9 and 10. **Ferida has 42 stamps. Julie takes $\frac{1}{3}$ of them and Ella takes $\frac{1}{7}$ of them.**			
9	How many stamps does Julie have? A) 12 B) 14 C) 16 D) 18			
10	What is the total number of stamps taken by Julie and Ella? A) 14 B) 16 C) 18 D) 20			
11	Tisha collects money for 3 days. She collects 132.50 baht on the first day, 121.25 baht on the second day, and 130.50 baht on the third day. How much money does she have after 3 days? A) 380.25 baht B) 383.25 baht C) 383.50 baht D) 384.25 baht			
12	Jackie collects one 50 satang coin per day. If he collects it for 60 days, how much money will he have? A) 3 baht B) 13 baht C) 30 baht D) 300 baht			
13	A construction company bought 0.238 tons of gravel and 0.535 tons of sand. How many tons of material did the company buy altogether? A) 0.293 tons B) 0.297 tons C) 0.763 tons D) 0.773 tons			

The list of Question: Word Problem-solving Skills				
The expert is requested to examine each item of the research instrument for its content validity.		Expert's Review		
	Questions	Agree	Not sure	Disagree
		+1	0	-1
14	A carpenter bought a piece of wood that was 1.88 meters long. He sawed 0.569 meters off. How long is the piece of wood now? A) 1.311 meters B) 1.321 meters C) 1.331 meters D) 1.341 meters			
15	Ken's car uses 148.50 liters of petrol a month. How many liters of petrol does his car use in a year? A) 1,780 liters B) 1,781 liters C) 1,782 liters D) 1,783 liters			
16	A slice of chocolate cake costs 28 Baht, a slice of vanilla cake costs 21 Baht and a slice of strawberry cake costs 35 Baht. What is the least number of slices of each cake that must be purchased so that the amount of money paid for each types of cake is the same? How much money is paid for each type of cake?			
17	The price of chicken meat is 75.50 Baht per Kg. If Jason buys 2.5 Kg of chicken meat, how much money does he have to pay?			

Appendix F

Index of Item-Objective Congruence (IOC) Form for Reading Comprehension Pretest and Posttest

INDEX OF ITEM-OBJECTIVE CONGRUENCE (IOC) FORM

"USAGE OF READING COMPREHENSION TO ENHANCE WORD PROBLEM-SOLVING SKILLS IN MATHEMATICS OF GRADE 6 STUDENTS: A PRIVATE SCHOOL, BANGKOK"

by PREYANAN SUPONTAWANIT

Objectives: The list of question is consisted of 10 multiple-choice questions and 5 true/false questions and it is used to investigate the improvement of the participants' reading comprehension skill before and after receiving the treatment. The objectives of this study are: (1) to investigate the usage of reading comprehension to enhance word problem-solving skills in Mathematics and (2) to find out the relationship between reading comprehension skill and word problem-solving skills of Grade 6 students in a private school, Bangkok. The participants in this study are 21 Grade 6 students who are studying in the Intensive English Programme (IEP) in a private school, Bangkok.

Reading Passage

Scientists find out why dogs' noses are cold

Source: https://breakingnewsenglish.com

Researchers believe they have solved one of science's greatest mysteries. They think they have found out why a dog's nose is cold. Scientists from universities in Sweden and Hungary have posited that dogs' noses are constantly cold because they act as "ultra-sensitive heat detectors". Canines can sense the temperature of something before they touch it. They added that dogs use their noses to detect tiny changes in temperature, such as when possible predators or prey are nearby. Humans generally only know something is hot after touching it, often with painful consequences. It was common belief that the only reason dogs' noses are cold is to control and regulate their own body temperature.

The researchers conducted experiments on sixteen dogs that had to detect the temperature of different objects in a room. The objects had different temperatures that humans could only differentiate by touching them. The scientists said that the brain activity in the dogs showed that they could discern which objects were warmer than others. Anna Balint, lead author of the study, said: "Dogs are able to sense the thermal radiation coming from warm bodies or weak thermal radiation, and they can change their behaviour according to this signal." Another scientist said scientists should now re-evaluate how predators hunt. Many may use heat-sensing abilities to track or sense their prey.

The list of Question: Word Problem-solving Skills				
The expert is requested to examine each item of the research instrument for its content validity.		Expert's Review		
	Questions	Agree	Not sure	Disagree
		+1	0	-1
1	What did the researchers say they might have solved? a) a formula b) one of science's greatest mysteries c) a quiz d) a puzzle			
2	Where are the scientists from? a) a kennel b) a canine university c) a dog food company d) Sweden and Hungary			
3	What did the researchers say dogs use their nose to detect? a) the temperature of gardens b) hot and cold water taps c) tiny changes in temperature d) fire			
4	How do humans find out if something is hot? a) They touch it. b) They sense it. c) They use the internet. d) They use a thermometer.			
5	What did people think dogs regulated with their noses? a) their ears b) their body temperature c) how much they pant d) how much they sleep			
6	How many different dogs did researchers use in their experiments? a) 16 b) 20 c) 36 d) 60			
7	What activity allowed dogs to discern the different warmth in objects? a) running b) chasing stick c) brain activity d) sleeping			

The list of Question: Word Problem-solving Skills				
The expert is requested to examine each item of the research instrument for its content validity.		Expert's Review		
	Questions	Agree	Not sure	Disagree
		+1	0	-1
8	Who is Anna Balint? a) lead researcher b) a pet owner c) a dog expert d) a nose doctor			
9	What can dogs sense coming from warm bodies? a) smell b) fleas c) hair d) thermal radiation			
10	What might other predators use to track or sense their prey? a) their paws b) their eyes c) heat-sensing abilities d) nerve endings			
	Identify whether each statement given is true or false after reading the passage given. If it is TRUE, fill in 'T' in the blank. If it is FALSE, fill in 'F' in the blank.			
11	Scientists said they finally solved science's greatest mystery.			
12	Dogs can sense the temperature of something with their noses.			
13	Researchers did tests on the noses of sixty dogs.			
14	Humans also use their noses to sense the temperature of something.			
15	The researchers said we should re-evaluate how other predators hunt.			

Appendix G

Item-Objective Congruence (IOC) Summary of the Three Experts

Appendix G

Item-Objective Congruence (IOC) Summary of the Three Experts

Instrument	Rating by Experts			IOC Average	Remarks
	Expert 1 (+1),(0),(-1)	Expert 2 (+1),(0),(-1)	Expert 3 (+1),(0),(-1)		
Test: Word Problem-solving in Mathematics	+1	+1	0.3	0.76	Accepted
Test: Reading Comprehension	+1	0.9	0.4	0.76	Accepted

Appendix H

Name List of Experts

Appendix H

Name List of Experts

No.	Name	Position Title	Institutes
1	Dr. Kunlayarat Lormanenoprat	Lecturer	Rangsit University, Thailand
2	Dr. Chatchaya Perathoranich	Lecturer	Rangsit University, Thailand
3	Dr. Juladis Khanthap	Lecturer	Rangsit University, Thailand

Biography

Name	Preyanan Supontawanit
Date of Birth	20 October 1992
Place of Birth	Bangkok, Thailand
Education Background	Kasetsart University
	Bachelor of Biotechnology, B.S. 2015
Address	Bangkok, Thailand
Email Address	fern_preyanan@hotmail.co.th
Work Position	Online tutor